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The Global Nuclear Balance

A Quantitative and Arms Control Analysis

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Part One

Overall Nuclear Force Levels

The Nuclear Dimension – Part One

Country	Sea-Based	Land Based	Air Force
US	18 SSBM/432 SLBM (+1/16 Poseidon C-3	550 Missiles Total	208 Active. 315 START accountable
(33,500 nuclear weapons)*	tubes in ex-SSBN)	50 Peacekeeper MX	2/20 B-2A
	10 SSBN-734 with up to 24 Trident D-5 (240 SLBM)	500 Minuteman III	5/92 B-52H with up to 20 ALCM (AGM-86) each (57 combat ready)
	8 SSBN-726 with up 24 Trident C-4 (192 SLBM)		8/91 B-1B
Russia	17 SSBN/280 SLBM	740 ICBM/3,380 Whd.	74 Hvy Bomber (Start Accountable)
		180 SS-18 (RS-20 74 START-accountable Mostly Mod4/5 w/	
	3 Typhoon with 20 SS-N-20 each (60)	10 MIRV	74 Tu-95H6 with AS-15 ALCM
(62,500 nuclear weapons)*		140 SS-19 (RS-18)	15 Tu-160
	6 Delta IV with 16 SS-N-23 each (96)	Mostly Mod 3, 6 MIRV	
		24 SS-27 Topol M2	7 Tu-95 & 1 Tu-160 test
	7 Delta III with 16 SS-N-18 each (112)	with 20 entering service	aircraft.
		36 SS-24 (RS22) with	117 Tu-22M/MR (more in storage)
	1 Delta I with 12 SS-N-8 each (12)	10 MIRV 36 Rail in Russia	
	In addition, 10 SSBN and 156 missiles remain START accountable: 2 Typhoon/40 SS-N-20 1 Delta IV/16 SS-N-23 4 Delta III/64 SS-N-18 3 Delta I/36 SS-N-8	360 SS-25 (RS-12M) single warhead mobile (360) & silo launch (10) in Russia 36 SH-11 Galosh & 64 SH-08 Gazelle	
	6 Oscar II SSGN/ 24 SS-N-19		
	8 Akula SSN/ SS-N-21 1 Sierra SSN/ SS-N-21 1 Yankee SSN/SS-N-21 5 Victor III SSN/SS-N-15		

* Without nuclear warhead or weapons.

The Nuclear Dimension – Part Two

Country	Sea-Based	Land Based	Air Force
France	4 SSBN/64 SLBM	None	3/60 Mirage-2000N (ASM P)
(1,400 nuclear weapons)*	2 L'Inflexible with 16 M-4?TN-70 or 71 each		28 Super Etendard AMSP plus 16 in storage
	2 Le Triomphant with 16 M-45/TN-75 each		
United Kingdom	4 SSBN/58 SLBM		None None
(1,100 nuclear weapons)*	4 Vanguard SSBN with up to 16 Trident D-5 each and maximum of 48 warheads per boat. (Each missile can be MIRV'd to 12 warheads, But some had only 1. Total is less than 200 operational warheads.		
China	1 Xia SSBN with 12 CSS-N-3 (J-1)	20+ CSS-4 (DF-5) MIRV ICBM	Up to 126 H-6, Some nuclear capable.
(500-1,300 nuclear weapons)*	1 Romeo SSGN?	20+ CSS-3 (DF-4) ICBM	200+ H-5?
		60-80 CSS-2 (DF-3 IRBM 50+ CSS-5 DF-21 IRBM	
		25L/200M DF-15 CSS-6/M-9 SRBM (600 km)	
		25 DF-11 CSS-7/M-11 SRBM (120-300 KM)	

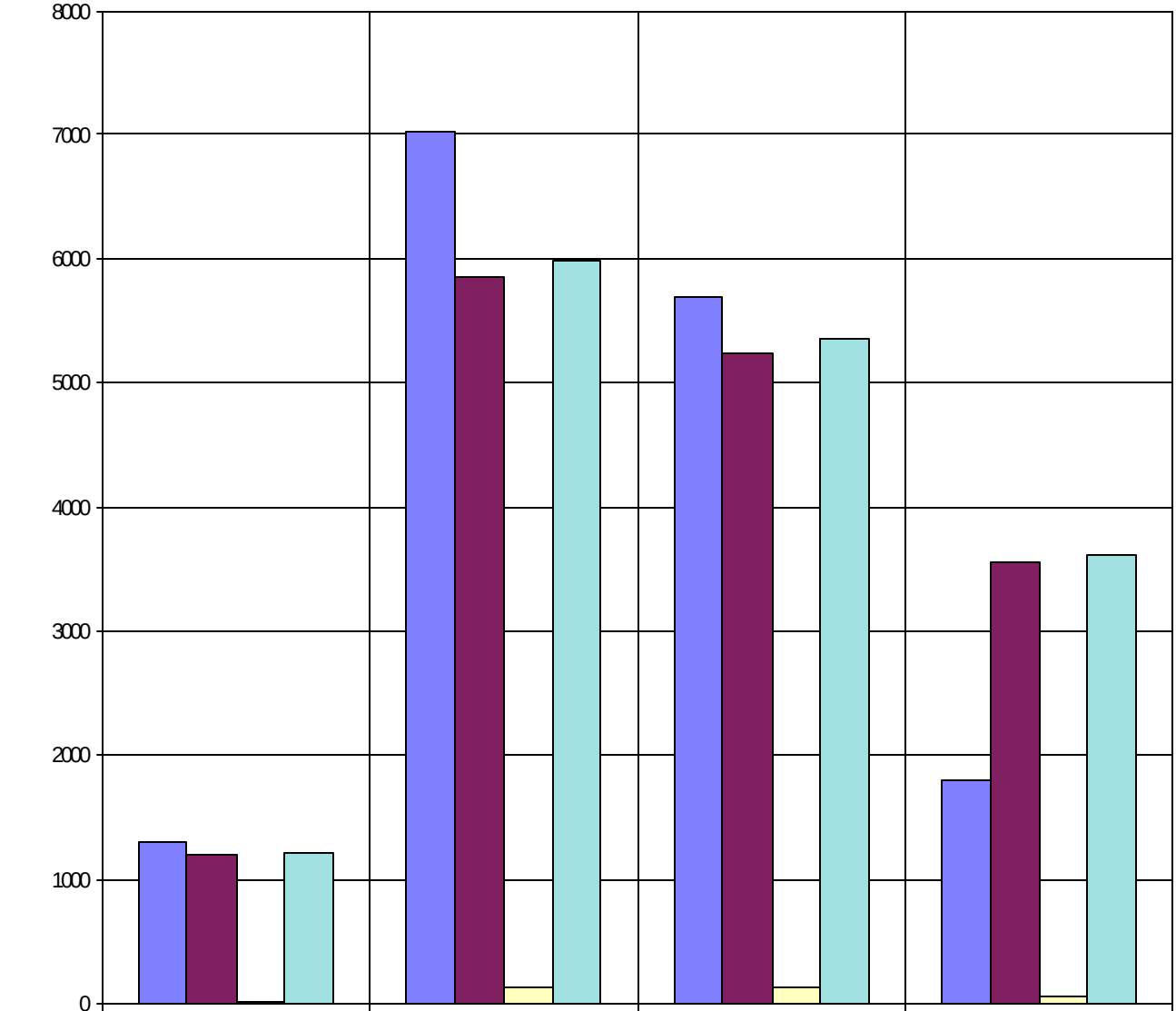
* Estimate by Sergei Rogov
Source: Adapted by Anthony H. Cordesman from the IISS, Military Balance, 2001-2002.

Part Two

US, FSU, and Russian Force Levels

US, Russian, and Ukrainian Strategic Nuclear Forces Declared for Start I

(Declarations as of July 31, 2001)

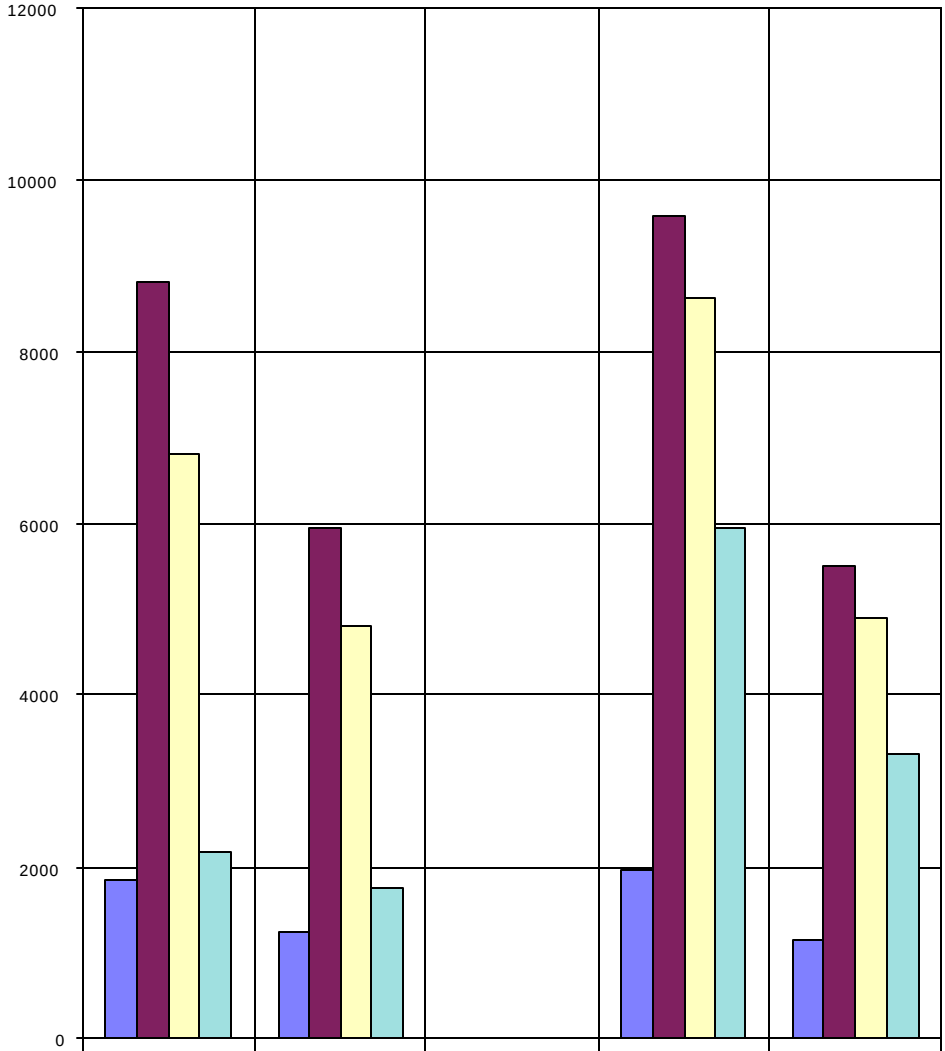


	Deployed ICBMs, SLBMs, Heavy Bombers and Associated Launchers	Warheads Attributed to Deployed ICBMs, SLBMs, and Heavy Bombers	Warheads Attributed to Deployed ICBMs and SLBMs	Throw-weight of Deployed ICBMs and SLBMS (MT)
US	1299	7013	5695	1,795.20
Russia	1198	5858	5232	3,563.60
Ukraine	13	130	130	52.65
Total FSU	1211	5988	5362	3,616.25

Source: Adapted by Anthony H. Cordesman from data provided by US State Department on July 31, 2001. Belarus and Kazakhstan report zero in every category. All data reflect START counting rules.

US and Russian Strategic Nuclear Forces
At the Completion of Start I

(US State Department estimate as of December 5, 2001)

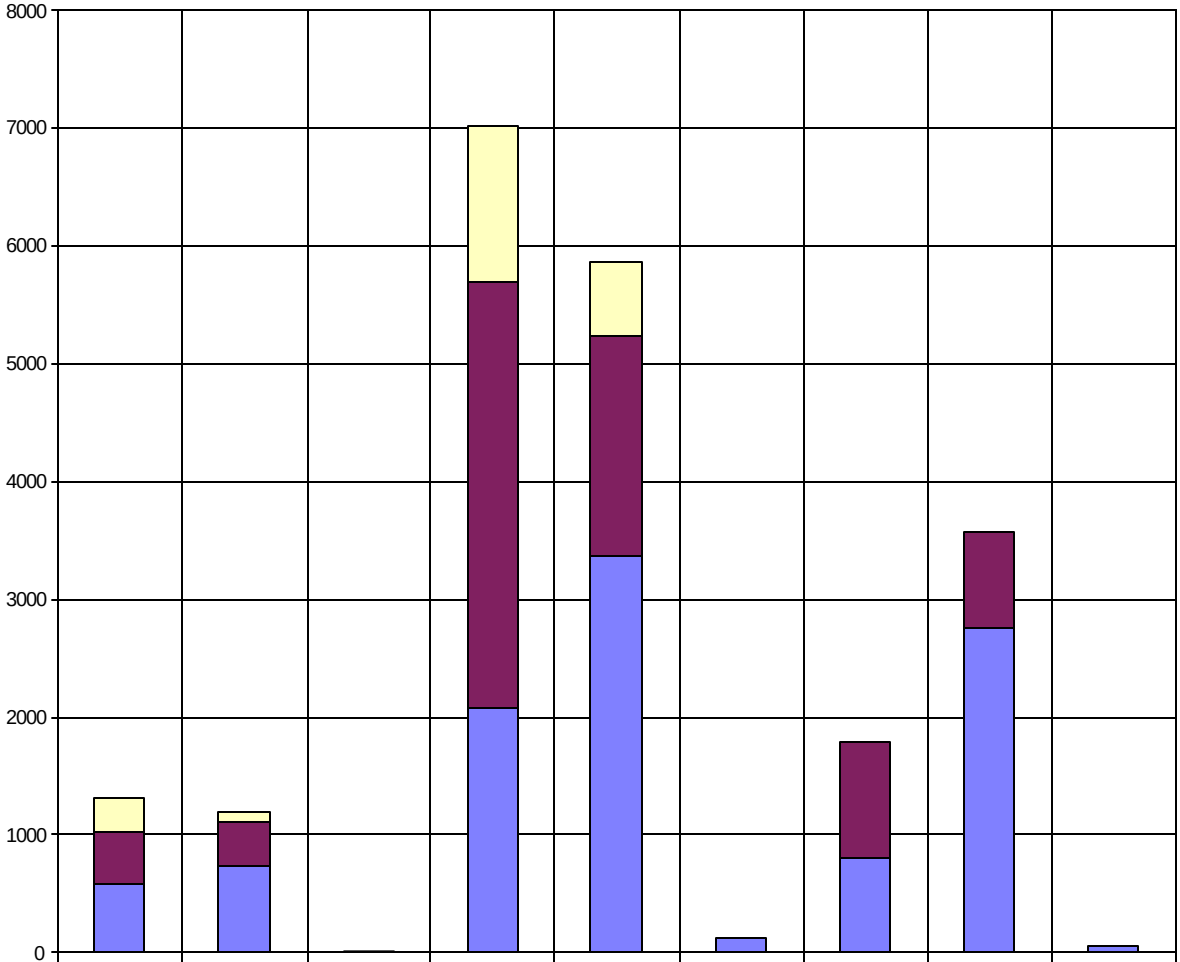


	US 12-5-94	US 12-5-01	.	FSU 12-5-95	FSU 12-5-01
Deployed ICBMs, SLBMs, Heavy Bombers and Associated Launchers	1838	1238		1956	1140
Warheads Attributed to Deployed ICBMs, SLBMs, and Heavy Bombers	8824	5949		9568	5520
Warheads Attributed to Deployed ICBMs and SLBMs	6793	4821		8638	4900
Throw-weight of Deployed ICBMs and SLBMS (MT)	2176.5	1732.5		5930.4	3320

Source: Adapted by Anthony H. Cordesman from data provided by US State Department on July 31, 2001. Belarus and Kazakhstan report zero in every category. All data reflect START counting rules.

The US, Russian, and Ukrainian Strategic Nuclear Triad Declared for Start I

(Declarations as of July 31, 2001)

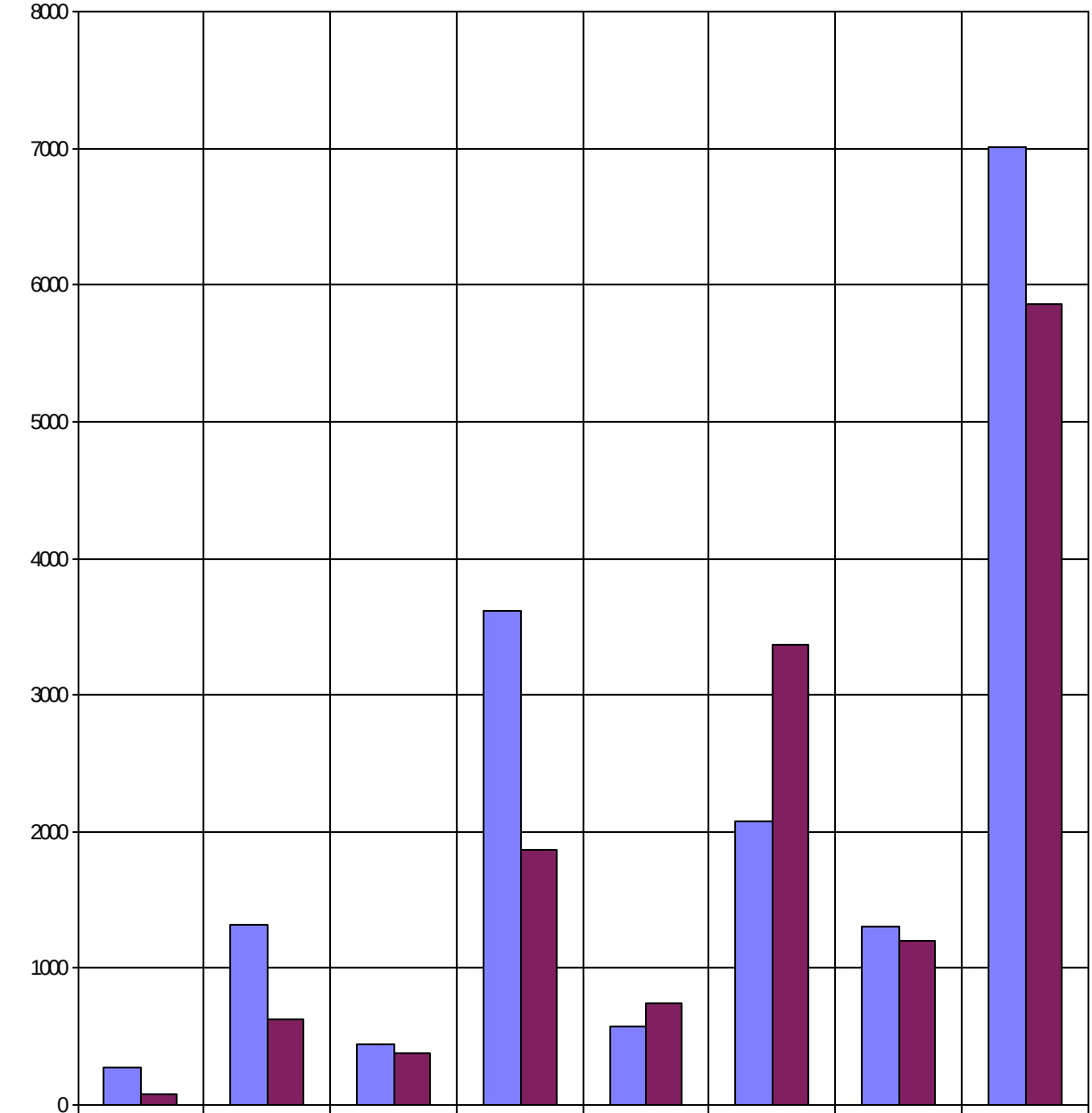


	US Launchers & Bombers	Russian Launchers and Bombers	Ukrainian Launchers and Bombers	US Warheads	Russian Warheads	Ukrainian Warheads	US Throw Weight	Russian Throw weight	Ukrainian Throw Weight
Bombers	274	80	0	1318	626	0			
SLBMs	448	376	0	3616	1868	0	992	819.4	
ICBMs	577	742	13	2079	3364	130	803.2	2744.2	52.65

Source: Adapted by Anthony H. Cordesman from data provided by US State Department, Bureau of Arms Control on July 31, 2001. Belarus and Kazakhstan report zero in every category.

US and Russian Deployed Strategic Nuclear Forces

(Declarations as of July 31, 2001)

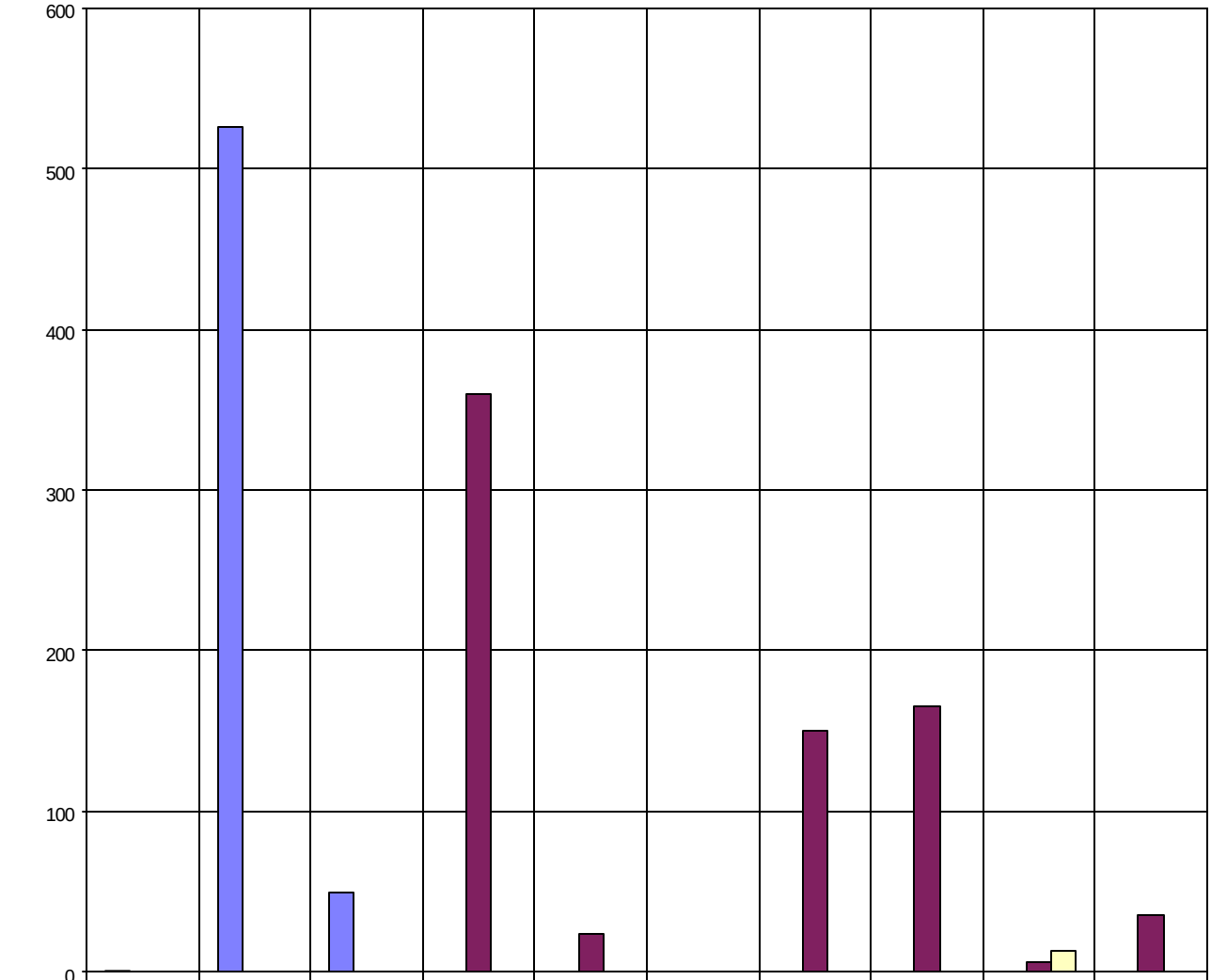


	Bombers	Bomber Warheads	SLBMs	SLBM Warheads	ICBMs	ICBM Warheads	Total Delivery	Total Warheads
US	274	1318	448	3616	577	2079	1299	7003
Russia	80	626	376	1868	742	3364	1198	5858

Source: Adapted by Anthony H. Cordesman from data provided by US State Department, Bureau of Arms Control on July 31, 2001. Belarus and Kazakhstan report zero in every category.

Declared US, Russian, and Ukrainian ICBMs

(Declarations as of July 31, 2001)



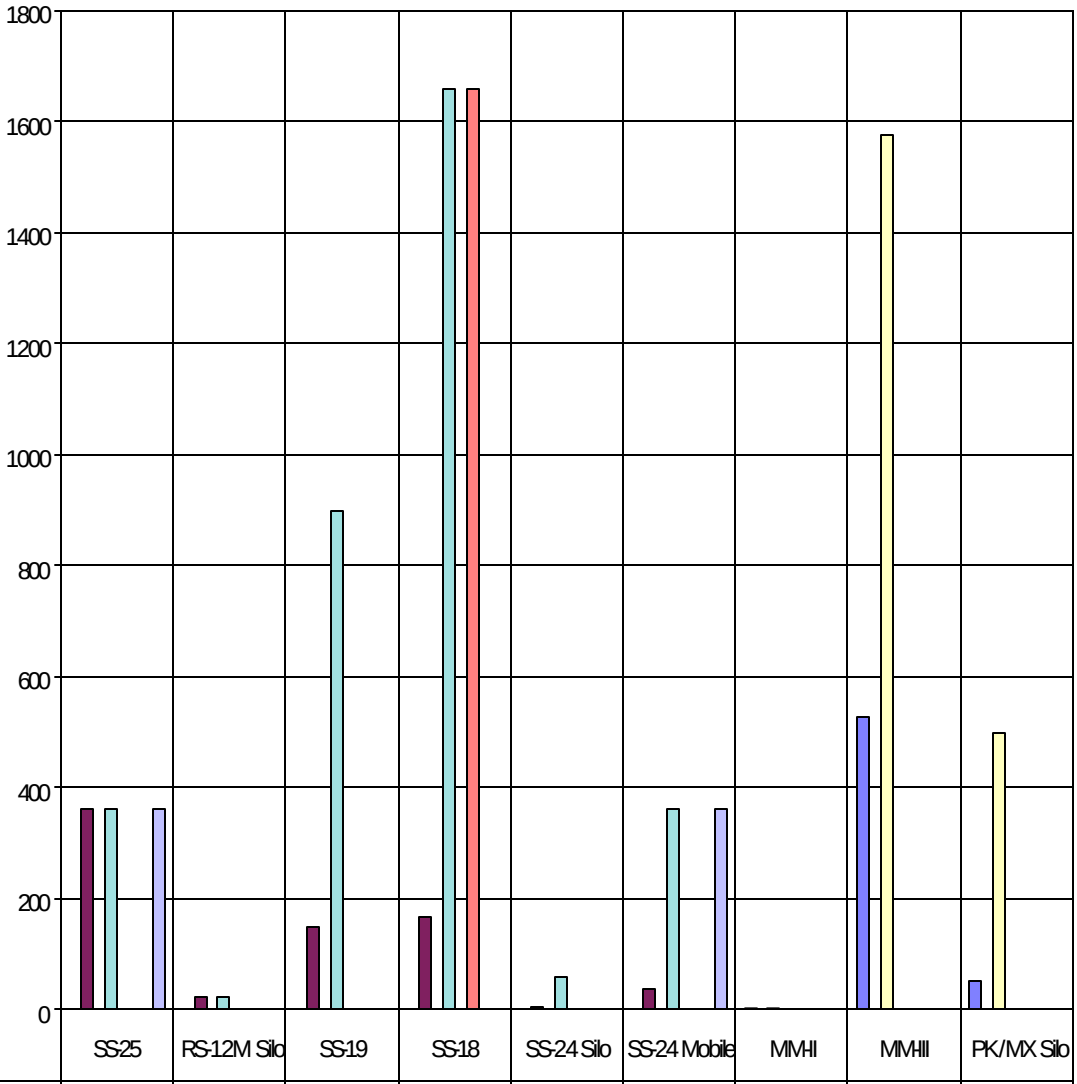
	MM-II Missiles	MM-III Missiles	MX Silo	SS-25	RS-12M	SS-17	SS-19	SS-18	SS-24 Silo	SS-24 Rail
US	1	526	50							
Russia				360	24	0	150	166	6	36
Ukraine									13	

Throw weight (MT)										
US	0.80	604.9	197.50	-	-	-	-	-	-	
Russia	-	-	-	432.0	28.80	0	652.5	1460.80	24.30	145.80
Ukraine	-	-	-	-	-	-	-	-	52.65	-

Source: Adapted by Anthony H. Cordesman from data provided by US State Department, Bureau of Arms Control on July 31, 2001. Belarus and Kazakhstan report zero in every category.

US and Russian Deployed Total and Heavy ICBM Missiles

(Declarations as of July 31, 2001)

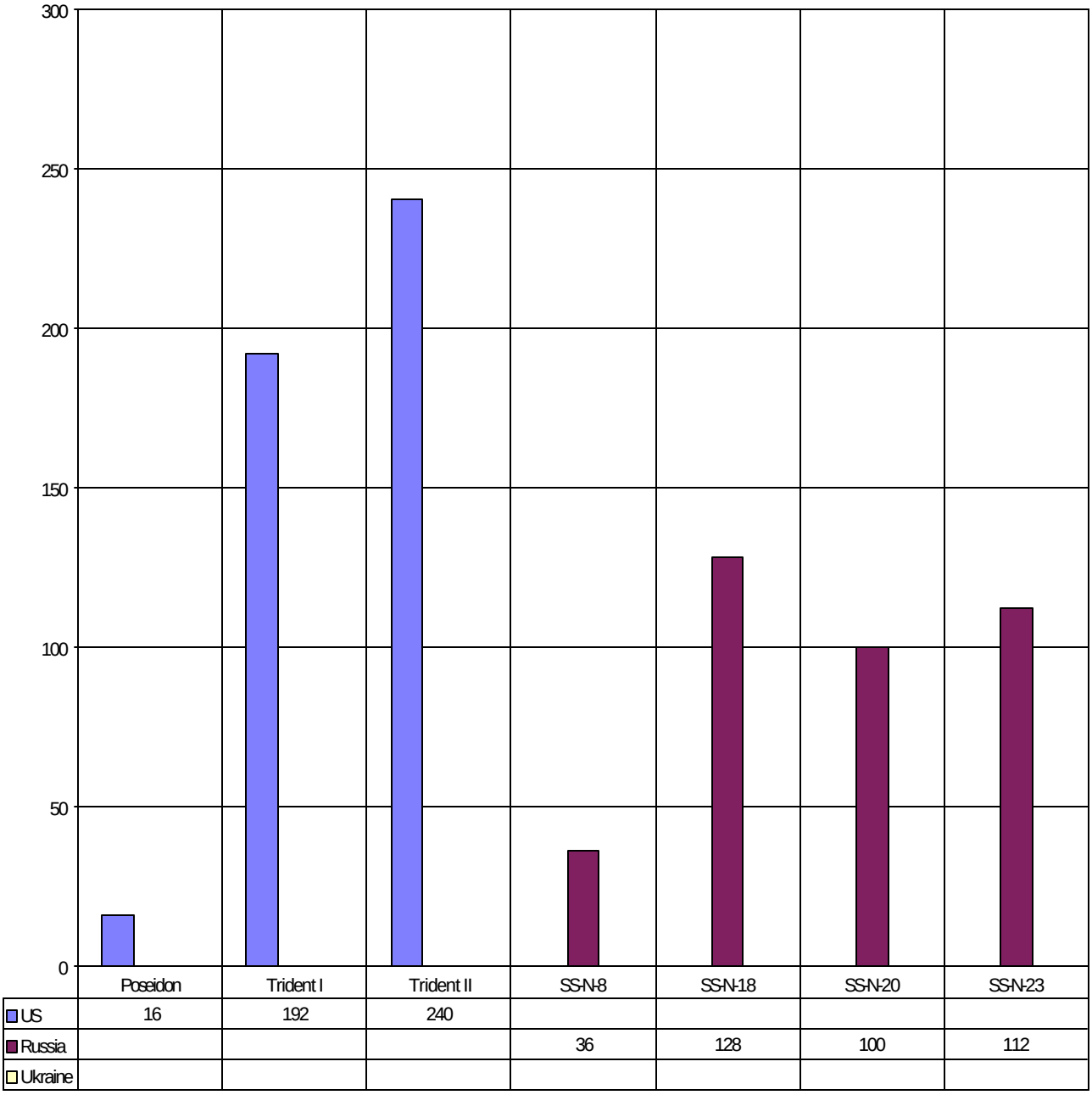


	SS-25	RS-12M Silo	SS-19	SS-18	SS-24 Silo	SS-24 Mobile	MM-II	MM-III	PK/MX Silo
US Missiles							1	526	50
Russia Missiles	360	24	150	166	6	36			
US Warheads							1	1578	500
Russia Warheads	360	24	900	1660	60	360			
US Heavy ICBM Warheads							-	-	-
Russia Heavy ICBM Warheads	-	-	-	1660	-	-			
US Mobile ICBM Warheads							-	-	-
Russia Mobile ICBM Warheads	360	-	-	-	-	360			

Source: Adapted by Anthony H. Cordesman from data provided by US State Department, Bureau of Arms Control on July 31, 2001. Belarus and Kazakhstan report zero in every category.

US, Russian, and Ukrainian SLBMs Declared for Start I

(Declarations as of July 31, 2001)



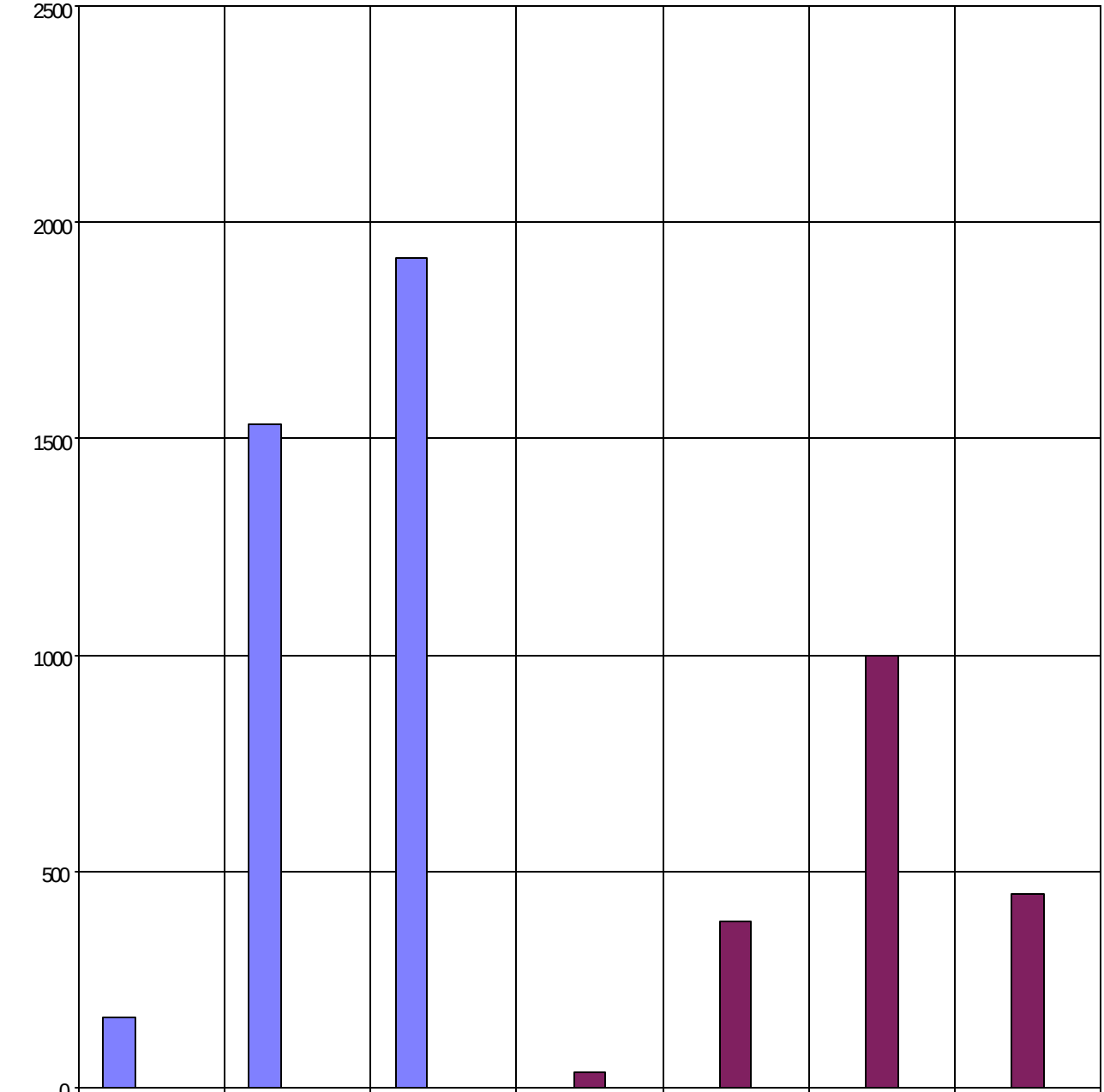
Throw weight (MT)

US	32.00	288.0	672.00	-	-	-	-
Russia	-	-	-	39.60	211.20	120.00	313.60
Ukraine	-	-	-	-	-	-	-

Source: Adapted by Anthony H. Cordesman from data provided by US State Department, Bureau of Arms Control on July 31, 2001. Belarus and Kazakhstan report zero in every category.

US, Russian, and Ukrainian SLBM Warheads Declared for Start I

(Declarations as of July 31, 2001)

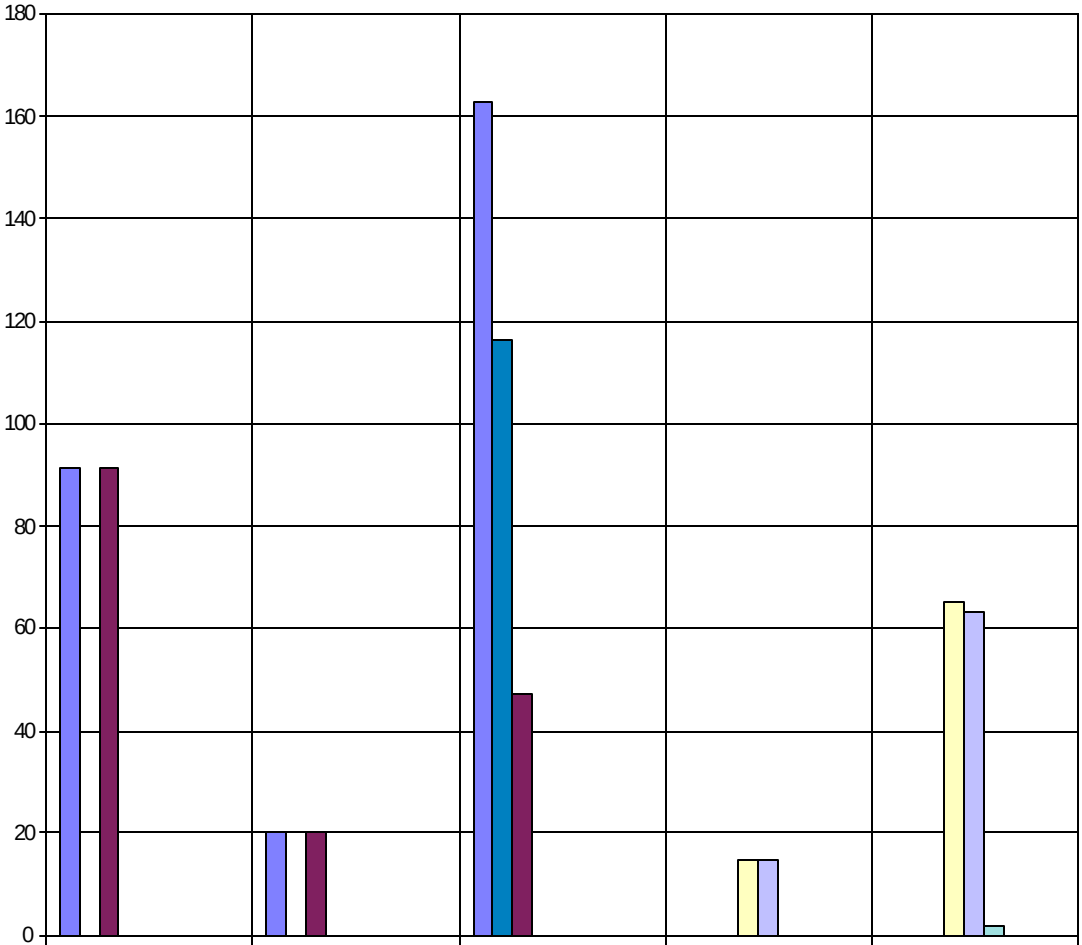


	Poseidon	Trident I	Trident II	SS-N-8	SS-N-18	SS-N-20	SS-N-23
US	160	1536	1920				
Russia				36	384	1000	448
Ukraine							

Source: Adapted by Anthony H. Cordesman from data provided by US State Department, Bureau of Arms Control on July 31, 2001. Belarus and Kazakhstan report zero in every category.

US, Russian, and Ukrainian Bombers Declared for Start I

(Declarations as of July 31,2001)

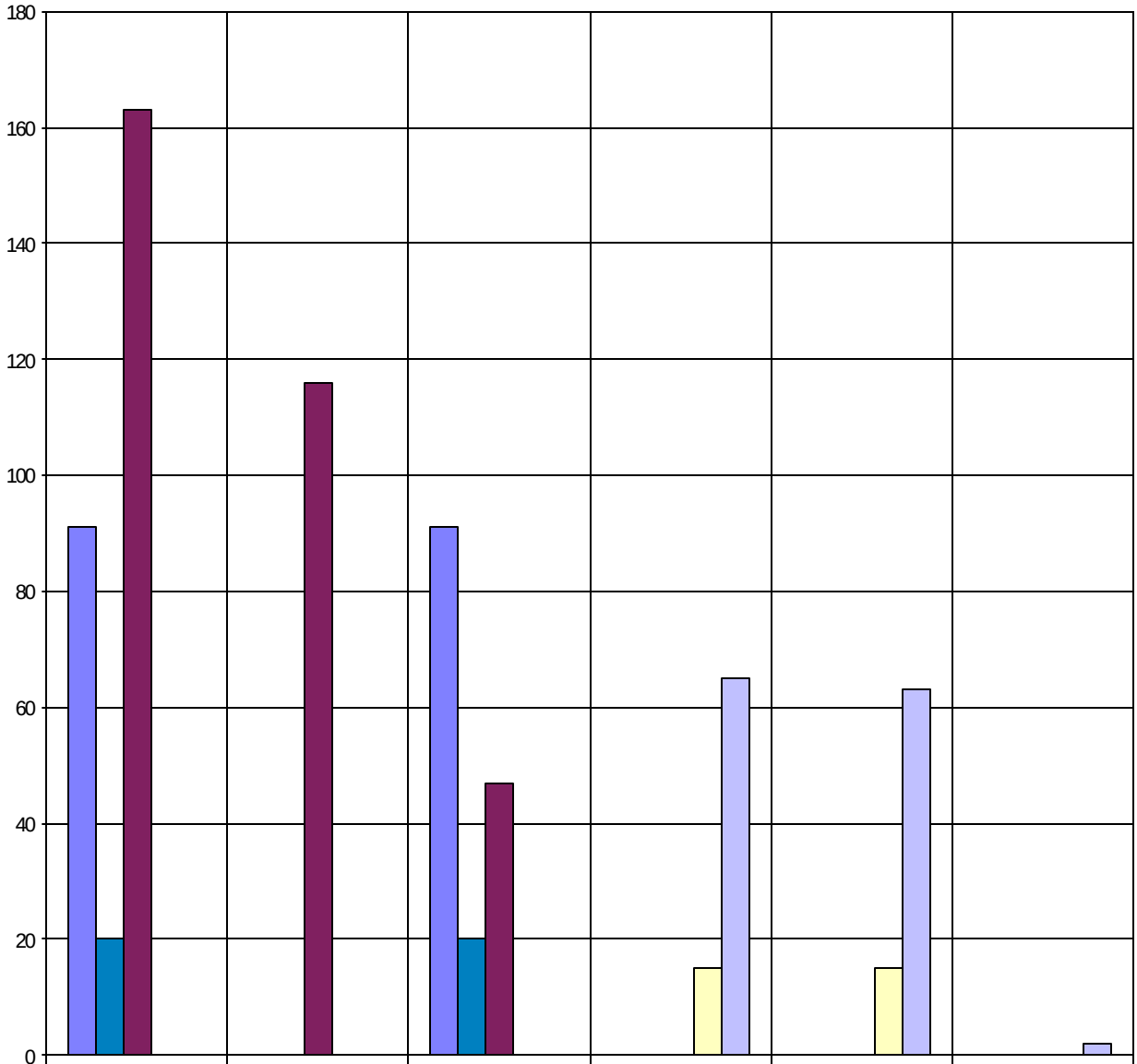


	B-1	B-2	B-52	Blackjack	Bear
US	91	20	163	0	0
(ALCM-Equipped)	0	0	116	0	0
(Non-ALCM Nuclear)	91	20	47	0	0
Russia	0	0	0	15	65
(ALCM-Equipped)	0	0	0	15	63
(Non-ALCM Nuclear)	0	0	0		2
Ukraine	0	0	0	0	0
(ALCM-Equipped)	0	0	0	0	0
(Non-ALCM Nuclear)	0	0	0	0	0

Source: Adapted by Anthony H. Cordesman from data provided by US State Department, Bureau of Arms Control on July 31, 2001. Belarus and Kazakhstan report zero in every category.

US and Russian Bombers Declared for Start I

(Declarations as of July 31,2001)

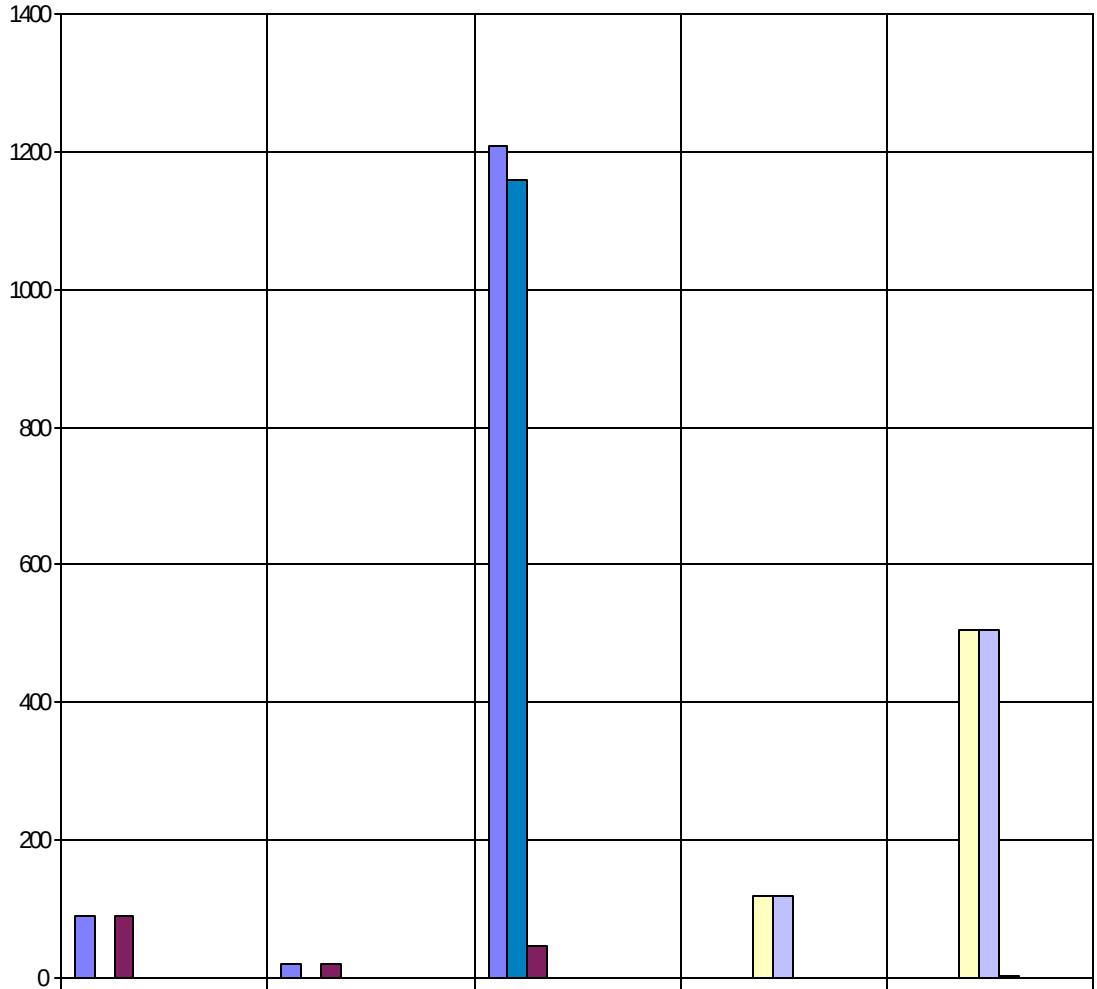


	US	(ALCM-Equipped)	(Non-ALCM Nuclear)	Russia	(ALCM-Equipped)	(Non-ALCM Nuclear)
B-1	91	0	91	0	0	0
B-2	20	0	20	0	0	0
B-52	163	116	47	0	0	0
Blackjack	0	0	0	15	15	
Bear	0	0	0	65	63	2

Source: Adapted by Anthony H. Cordesman from data provided by US State Department, Bureau of Arms Control on July 31, 2001. Belarus and Kazakhstan report zero in every category.

US, Russian, and Ukrainian Bomber Warheads Declared for Start I

(Declarations as of July 31,2001)



	B-1	B-2	B-52	Blackjack	Bear
US	91	20	1207	0	0
(ALCM-Equipped)	0	0	1160	0	0
(Non-ALCM Nuclear)	91	20	47	0	0
Russia	0	0	0	120	506
(ALCM-Equipped)	0	0	0	120	504
(Non-ALCM Nuclear)	0	0	0		2
Ukraine	0	0	0	0	0
(ALCM-Equipped)	0	0	0	0	0
(Non-ALCM Nuclear)	0	0	0	0	0

Source: Adapted by Anthony H. Cordesman from data provided by US State Department, Bureau of Arms Control on July 31, 2001. Belarus and Kazakhstan report zero in every category.

The True Nature of US and Russian Nuclear Arms Reductions

The reporting of START accountable warheads has led to serious confusion between START accountable warheads and actual warheads.

The attached table provides a rough estimate of the immense difference between START accountable and actual warheads put together with the informal aid of one of the US weapons labs. Please note that no detailed accounting is made of theater nuclear weapons, which are not the subject of START reductions, or total weapons assemblies and fissile material holdings which would include many more potential weapons than are counted as deployed.

	Total			NSNF	Strategic			
Country	Inventory	Reserve	Deployed	Deployed	Deployed	START I	START II	Day to Day
Russia	Up to 20,000	Approx.10,000	9,200	3,600	5,600	6,094	6,366	2,000-3,000
United States	10,820	*2,000	8,820	1,670	7,150	7,295	7,534	2,000-3,000

* The Department of Energy also holds 12,000 intact plutonium “pits” from nuclear warheads, and between 5,000-6,000 “canned subassemblies”, this being the secondary stage of a two stage nuclear weapon.

Part Three

US Nuclear Force Trends

US Strategic Nuclear Force Goals Under START

,	FY 1990	FY 2000	START I	START II (December 5, 2001)	START II (December 31, 2007)
ICBMs		1,000	550	550	500
Attributed Warheads on ICBMs		2,450	2,000	Not over 2,000	500
SLBMs		568a	432b	Not over 432	336
Attributed Warheads on SLBMs		4,864a	3,456b	Not over 3,456	Not over 1,750
Ballistic Missile Submarines[d]		31a	18b	Not over 18	14
Attributed Warheads on Ballistic Missiles		7,314[a]	5,456[b]	Not over 4,900	Not over 2,250
Heavy Bombers[d]		324	113[c]	97[c]	97[c]

a Excludes five decommissioned submarines (and their associated missiles and warheads) that were still START accountable.
b Excludes two Benjamin Franklin–class (Poseidon missile) (SSBNs) converted for Special Operations Forces that are still START accountable.
c Excludes 93 B–1s that are devoted entirely to conventional missions. B–1s are still accountable as a nuclear bomber under START I, but would not be accountable under START II.
d Specific systems numbers are not mandated by treaty. Force structure results from allocation of resources and mission requirements.
Since establishment of the Cooperative Threat Reduction (CTR) program in 1991, the United States has been assisting Russia, Ukraine, Belarus, and Kazakhstan in implementing nuclear force reductions required under the START I Treaty. In anticipation of further reductions mandated by the START II Treaty and in potential support of a negotiated START III Treaty, the United States is starting to discuss additional CTR projects with Russia.
Note :The START I Treaty entered into force on December 5, 1994. The United States and Belarus, Kazakhstan, the Russian Federation, and Ukraine, the four successor states that continued to be bound by the rights and obligations of the former Soviet Union under START, are working to achieve the final phase of nuclear force reductions mandated by that treaty by December 2001. The Treaty on Further Reduction and Limitation of Strategic Offensive Arms (START II), approved by the U.S. Senate in January 1996, has not yet entered into force because the Russian Federation has yet to ratify the treaty. START II calls for reductions in aggregate force levels, conversion or elimination of multiple–warhead intercontinental ballistic missile (ICBM) launchers, elimination of heavy ICBMs, and a limit on deployed submarine–launched ballistic missile (SLBM) warheads. It will eliminate the most destabilizing strategic nuclear systems—multiple warhead ICBMs—and will reduce deployed strategic nuclear warheads by about two-thirds from Cold War levels. The original START II Treaty called for the parties to complete the final reduction phase no later than January 1, 2003.
At their March 1997 meeting in Helsinki, President Clinton and Russian President Yeltsin issued a joint statement establishing parameters for future reductions in nuclear forces beyond START II. In this statement, the Presidents agreed to an overall limit of 2,000–2,500 deployed strategic warheads for a future START III Treaty.
They also agreed to extend the deadline for elimination of strategic nuclear delivery vehicles under START II to December 31, 2007, but stipulated that systems to be eliminated under START II must be deactivated by December 31, 2003, subject to START II entering into force, by removing their nuclear warheads or other joint agreed steps. The Presidents further agreed that negotiations would begin on a START III Treaty immediately after Russian ratification of START II.
These agreements were formalized in a Joint Agreed Statement and a Protocol to the treaty in New York in September 1997, extending the time period for full implementation of START II until December 31, 2007. In addition, letters were signed and exchanged recording the Helsinki Summit commitment to deactivate, by December 31, 2003, the U.S. and Russian strategic nuclear delivery vehicles that under START II will be eliminated. START II entry into force will require approval by the Russian parliament and ratification by both parties of the Protocol to the START II Treaty and its associated Joint Agreed Statement.
At the G–8 summit held in Cologne, Germany, in June 1999, Presidents Clinton and Yeltsin again agreed that both governments would do everything in their power to facilitate the ratification of START II, and further agreed that discussions on START III and the Anti–Ballistic Missile (ABM) Treaty would begin in late summer 1999.

Source: William Cohen, Annual Report to the President and the Congress, Department of Defense, Washington, February, 1999, February 2000, and January 2001.

Planned Shifts in the US Strategic Force Posture

US Nuclear Offensive Force Plans as of January 2001

FORCE STRUCTURE AND CAPABILITIES

Until START II enters into force, the United States is protecting options to maintain a strategic nuclear arsenal at essentially START I levels. If START II is implemented as amended by the Helsinki Summit letters, accountable warheads will be reduced by the end of 2007 to a level of 3,000 to 3,500, of which no more than 1,750 may be carried on SLBMs. Strategic nuclear delivery vehicles that will be eliminated under START II will be deactivated by December 31, 2003, providing the benefits of a reduced force structure four years prior to the agreed 2007 date for full elimination.

READINESS

Selected elements of U.S. strategic forces maintain the highest state of readiness to perform their strategic deterrence mission. And while these forces can respond promptly to aggression if necessary, they can only be used with proper authorization from the National Command Authorities. A credible and effective nuclear deterrent requires proper support for all of its components: attack platforms, other weapons systems, command and control elements, the nuclear weapons stockpile, research and development capabilities, the supporting industrial base, and well trained, highly motivated people.

U.S. ICBMs and SLBMs on day-to-day alert are not targeted against any specific country. The missiles, however, can be assigned targets on short notice. The United States maintains two full crews for each SSBN, with about two-thirds of operational SSBNs routinely at sea. At least one and often two U.S. SSBNs are undergoing long-term overhauls at any given time and are not available for immediate use.

All 550 ICBMs, with the exception of a few undergoing routine maintenance, are maintained on a continuous day-to-day alert. The bomber force is no longer maintained on day-to-day alert, although it can be returned to alert status within a few days if necessary. No nuclear weapons can be executed except by direction of the President. This has been a longstanding U.S. policy and remains so.

NUCLEAR MISSION MANAGEMENT

The Department relies upon the Nuclear Mission Management Plan (NMMP) to provide an integrated approach for the support of the nuclear mission. The NMMP provides the policy backdrop for the maintenance of the nation's nuclear forces, describes their integrated architecture as it exists today, and summarizes the efforts of the Services and defense agencies to sustain and modernize a credible deterrent. A concise, comprehensive reference on DoD programs supporting the nuclear deterrent, the NMMP is a valuable tool for decision making in the Department.

STOCKPILE STEWARDSHIP

The President declared that maintenance of a safe and reliable nuclear weapon stockpile is a supreme national interest of the United States. The Department of Energy's Stockpile Stewardship Program (SSP) is the United States' primary means of ensuring the safety and reliability of its nuclear deterrent, absent nuclear testing. The SSP develops new tools to supplant nuclear explosive testing as the means to sustain the confidence obtained in the past from nuclear explosive testing. There was high confidence in the enduring stockpile when the United States entered into a nuclear testing moratorium in 1992. Since that time, the SSP, principally its surveillance program, has uncovered problems including those associated with aging. Through the SSP, an understanding of those problems has been developed, coupled with programs to address them. The SSP still faces challenges; but as long as it continues to get the resources it needs, it will keep pace with the complex problems likely to be encountered in the future to resolve a safety or reliability issue relating to a warhead critical to the U.S. deterrent. Should annual certification reveal a problem that can only be resolved by nuclear explosive testing, the Secretaries of Defense and Energy will inform the President and Congress of the need to resume nuclear testing.

FUNDING AND MODERNIZATION

Funding for strategic nuclear forces—ICBMs, SLBMs, and nuclear bombers—has significantly declined in recent years, as has the fraction of the total defense budget that is devoted to nuclear forces. A few modernization programs for strategic forces are currently under way: B-2 modifications, primarily for conventional missions; D-5 SLBM life extension activities and procurement; conversion of four SSBNs from the C-4 to the D-5 missile systems; and Minuteman III life extension activities. With most nuclear modernization efforts complete, programs to sustain nuclear forces and their readiness now account for most strategic nuclear funding.

LAND-BASED INTERCONTINENTAL BALLISTIC MISSILES

At the end of FY 2000, the United States had 500 Minuteman III ICBMs and 50 Peacekeeper missiles. If START II enters into force, the United States will modify all Minuteman III missiles to carry only one warhead and will retire all Peacekeeper missiles.

In this transition, DoD will redeploy the Mark 21 reentry vehicle (RV), currently deployed on Peacekeeper, on a portion of the single RV Minuteman force. Mark 21 RVs contain features that further enhance nuclear detonation safety and reduce the risk of plutonium dispersal in the unlikely event of a fire or other mishap.

The United States is not developing or producing any new ICBMs. This makes it difficult to sustain the industrial base needed to maintain and modify strategic ballistic missiles. To maintain the Minuteman ICBM system and to preserve key industrial technologies needed to sustain ICBMs and SLBMs, the Department plans to replace guidance and propulsion systems, as well as to preserve a core of expertise in the areas of reentry vehicle and guidance system technology. Further, the Air Force is exploring plans for a replacement to the Minuteman III around 2020.

SEA-BASED BALLISTIC MISSILES

The Ballistic-Missile Submarine (SSBN) fleet has reached its planned total of 18 Ohio-class submarines. The first eight Ohio-class submarines each carry 24 Trident I (C-4) missiles; the final ten are each equipped with 24 Trident II (D-5) missiles.

The SSBN fleet's survivability and effectiveness are enhanced through the D-5 missile's improved range, payload, and accuracy. The Future Year Defense Plan (FYDP) provides for continued procurement of D-5 missiles to support the conversion of four SSBNs from the C-4 to the D-5 missile system. Backfits during regularly scheduled ship depot maintenance periods began in 2000.

The United States will retain 14 SSBNs armed with D-5s, while the four oldest Ohio-class SSBNs will be eliminated or converted. D-5 missiles aboard the 14 boats, capable of carrying eight warheads a piece, will be downloaded consistent with START II limits. The FYDP also supports Navy planning for a life extension to the D-5 SLBM to match missile life to the recently extended Trident submarine service life of 44 years.

HEAVY BOMBERS

The U.S. bomber force consists of 93 B-1s, 94 B-52s (includes 18 attrition/reserve aircraft), and 21 B-2s. Operational B-2s, all deployed from Whiteman AFB, Missouri, are Block 30 configuration aircraft. B-2 and B-52 bombers can be used for either nuclear or conventional missions. The B-1 force is dedicated to, and has been equipped exclusively for, conventional operations.

THEATER NUCLEAR FORCES

As reaffirmed by NATO in its April 1999 Strategic Concept, theater nuclear forces, in the form of dual-capable aircraft, in the United States and NATO are an essential political and military link between the European and North American members of the Alliance. They also contribute to the spectrum of response options to deter aggression. The United States will continue to maintain these weapons in NATO, but at levels significantly below Cold War levels. All naval theater nuclear weapons are in storage. Nuclear weapons capability on surface ships has been eliminated, but the capability to deploy Tomahawk Land Attack Missiles armed with a nuclear weapon on submarines has been maintained.

Source: Adapted by Anthony H. Cordesman from Secretary of Defense William Cohen, Annual Report to the President and the Congress, FY2001, Washington, Department of Defense, 2001, Chapter 6.

The US Nuclear Policy Review – January 2002: Key Quotes

In a letter to Congress, Defense Secretary Donald Rumsfeld set down the case for the changes: "We have concluded that a strategic posture that relies solely on offensive nuclear forces is inappropriate for deterring the potential adversaries we will face in the 21st century," Rumsfeld wrote. "Terrorists or rogue states armed with weapons of mass destruction will likely test America's security commitments to its allies and friends. In response, we will need a range of capabilities to assure friend and foe alike of U.S. resolve."

J.D. Crouch, assistant defense secretary for international security policy stated in a January 9, 2002 briefing that Nuclear Posture Review changes the strategy from a threat- based approach to a capabilities-based approach. It recognizes that the Cold War is over and that the mutually assured destruction strategy paramount in the stand-off with the Soviet Union has no place in the new relationship between the United States and Russia.

"This means we will deploy the lowest number of nuclear weapons consistent with U.S. security requirements…The Cold War approach to deterrence that was highly dependent on offensive nuclear weapons is no longer appropriate. Nuclear weapons are still a key part of the deterrent strategy, "but we also believe that other kinds of capabilities will be needed in the future. These other capabilities include advanced conventional capabilities, missile defense and better command, control, intelligence and planning."

"We believed it was important to include new kinds of capabilities in this approach, including active and passive defenses and nonnuclear capabilities…Nonnuclear strike forces … have the potential, if fully exploited and fully developed, to reduce our dependency on nuclear forces for the offensive strike leg of the nuclear component."

"The capabilities-based approach argues that there may be multiple contingencies and new threats that we have to deal with. We're focusing on how we will fight, how we will have to fight, not who or when, and we don't really know. We expect to be surprised, and so we have to have capabilities that would deal with a broad range of the potential capabilities that adversaries may array against us."

"These capabilities are not required to be country-specific. Indeed, in some cases, it's -- it would be difficult for them to be country-specific. You know, one example out of -- out of today's situation, obviously, is Afghanistan, where we would not have expected to be in Afghanistan maybe six months earlier."

"We also believed it was very important to include new components or new kinds of capabilities in this approach, including active and passive defenses and non-nuclear capabilities. The non-nuclear strike forces, we believe, have the potential, if fully exploited, fully developed, to reduce our dependency on nuclear forces for the offensive-strike leg of the -- of the component. And even defenses give us more options and will allow us to do the same."

"We believe that by improving the effectiveness of command control, intelligence and adaptive planning -- investing in these areas and improving in these particular areas we're going to create a more efficient capability, one that, in fact, will allow us to reduce our forces overall but to maintain the overall capability that will be necessary as we move forward in the 21st century.
"Further, the unilateral move means the reduction can take place without long, involved and complicated arms control treaties."

"The new policy will place greater emphasis on many arrows in the U.S. quiver. It will mean credible nuclear and non- nuclear responses to support the United States and allies."

"There may be multiple contingencies and new threats we have to deal with…We're focusing on how we will have to fight, not who or when. We don't really know. We expect to be surprised, so we have to have capabilities that would deal with a broad range of the capabilities adversaries may array against us."

Source: Jim Garamone**, "Review Changes Status of Nuclear Deterrent,"** American Forces Press Service Washington, Jan. 9, 2002

The Nature of the US Nuclear Posture Review: January 10, 2001

- Conducted in an atmosphere of strategic change
- Multiple potential opponents, sources of conflict, and unprecedented challenges versus past focus on Soviet Union.
- New friendly relationship with Russia versus known ideological peer opponent.
- Spectrum of uncertain contingencies versus focus on prolonged conflict, defined blocs, limited number of contingencies.
- Varying and unequal risks and stakes versus existential threats and survival as stakes.
- 12 nations have nuclear weapons programs,
- 28 nations have ballistic missiles,
- 13 nations have biological weapons
- 16 nations have chemical weapons.
- Implications
- Uncertain deterrence and need to assure, dissuade, deter and defeat versus emphasis on high confidence deterrence.
- Synergy of nuclear/non-nuclear & offense/defense versus reliance on offensive nuclear forces exclusive of other forces.
- Nuclear planning is:
- Capabilities versus threat based.
- Great flexibility for range of contingencies versus some flexibility for a few contingencies.
- Unilateral arms reductions to preserve flexibility and transparency versus arms levels fixed by elaborate treaties and verification.
- Presidential Guidance
- Encourage and facilitate a “new framework” of cooperation with Russia.
- Cold War approach to deterrence no longer appropriate.
- End relationship with Russia based on MAD.
- Deploy lowest number of nuclear weapons consistent with the security requirements of the US, its allies, and friends.
- Achieve reductions without requirement for Cold War-style treaties.
- Develop and field missile defenses more capable than ABM Treaty permits,
- Place great emphasis on advanced conventional weapons.
- Source: Department of Defense background briefing of January 9, 2002

The Results of the US Nuclear Posture Review: January 10, 2001

- Transition to a New Triad in Mid to Far Term
- Go from Bombers+ICBMs+SLBMs to mix of non-nuclear and nuclear strike capabilities + defenses + responsive infrastructure.
- Command and control, intelligence and planning given equal weight with forces.
- Offers a portfolio of capabilities and the flexibility require to address a spectrum of contingencies.

- Sizing the Nuclear Force
- Size to address the spectrum of immediate and potential contingencies.
- Operationally deployed force for immediate and unexpected contingencies.
- Responsive force for potential contingences. This is not a separate force, but the ability to augment the operationally deployed force in a way where, over weeks, months and even years, that could respond to changes such as changes in the security environment that were more adverse than expected, technological surprise, and changes in assumptions about how well the US can introduce or field new elements of the new triad
- Preplanning for immediate and potential contingencies.
- Trying to achieve these reductions without having to wait for Cold War arms-control treaties, and placing greater emphasis both on missile defense capabilities and also on the development of advanced conventional capabilities.

- Strategic Background
- Force sizing not driven by an immediate contingency involving Russia.
- Force structure and down-loaded warheads preserved for the responsive force..
- End relationship with Russia based on MAD.
- Deploy lowest number of nuclear weapons consistent with the security requirements of the US, its allies, and friends.
- Achieve reductions without requirement for Cold War-style treaties.
- Develop and field missile defenses more capable than ABM Treaty permits,
- Place great emphasis on advanced conventional weapons.
- No change in the administration's policy at this point on nuclear testing.
- Continue to oppose CTBT [comprehensive test ban treaty] ratification.
- Continue to adhere to a testing moratorium.
- There are a number of weapons in that stockpile. Many of them are in the queue for dismantlement and destruction.

Source: Department of Defense background briefing of January 9, 2002

Projected US Force Size and Character

- United States has about 6,000 warheads in its nuclear arsenal.
- Under the new plan, that arsenal would drop to around 3,800 warheads by fiscal 2007 and to between 1,700 and 2,200 operationally deployed warheads by fiscal 2012.
- Go with the existing force of ICBMs -- submarine-launched ballistic missiles on SSBNs [ballistic missile submarines] and bombers.
- Fully fund the Trident D-5 SLBM life-extension program in this five-year defense plan, Accelerate its test-readiness program.
- SSBN fleet of 14 submarines. Two of those submarines will be in overhaul at all times, and those submarines will not have missiles available to fire, and they will not be part of the operationally deployed nuclear weapons.
- START I will continue to be in force, and all of its applicable rules, including the verification provisions as well as the counting rules, are still in force. However, when we talk about 1,700 to 2,300 operationally deployed systems, we are talking -- this is what we might call truth in advertising. There are no phantom warheads here. This is the actual number of weapons that we will deploy on the force.
- In addition to the 1,300 START accountable warheads that will come off the force as a result of the retirement of Peacekeeper, the Tridents and the like, US will take additional operationally deployed warheads off existing ICBMs and SLBMs down to a level of about 3,800 by fiscal 2012.
- Goal of 1,700-2,200 operational deployed warheads by 2012 to meet requirements of new defense policy goals.
- Retire Peacekeeper ICBMs beginning 2002.
- Remove four Trident submarines from strategic service.
- The Air Force's B-1 bomber would not be nuclear capable
- “most important, the United States would remove some warheads from operationally deployed ICBMs and submarine-launched missiles.”
- The inactive stockpile will be separate. Typically the limited-life components that go into a nuclear warhead, such as tritium, neutron generators, things that live for a relatively short period of time in comparison with the weapon, are typically removed, and when the weapon is transitioned to the active stockpile from the inactive, those components are reinstalled in the weapon. So the inactive weapon consists of those weapons that are not fielded with limited-life components.
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Source: Department of Defense background briefing of January 9, 2002

Part Four

Russian Force Trends

US Department of Defense Estimate of Russian Actions and Intentions Involving Nuclear, Biological, and Chemical Weapons

Capabilities, Intentions, and Trends

Russia retains a significant strategic nuclear force capability, despite the decline in overall force size since the dissolution of the Soviet Union, and despite apparent defense budgetary shortfalls and system aging. Russia also inherited sizeable biological and chemical warfare establishments from the FSU, and some components of these programs remain largely intact. Russian entities have exported various nuclear and ballistic missile technologies to states of proliferation concern, and Russia also remains a source for offensive biological and chemical warfare technologies and expertise.

There is little threat from FSU-sponsored NBC weapons and missiles in Eastern Europe. Regional states are focused on joining the Western community, and former Warsaw Pact states in neighboring Central Europe have already joined the North Atlantic Treaty Organization (NATO). Thus, most states in the region have eliminated or will eliminate all NBC weapon or missile capabilities that they had as members of the Warsaw Pact. (Serbia is an exception, and it may retain some chemical warfare capabilities). In addition, all tactical nuclear weapons were returned to Russia by 1992.

Objectives, Strategies, and Resources

The Russian leadership generally agrees that Moscow should maintain strong nuclear forces particularly in light of the reduced capability of Russian conventional forces in recent years. The overall reduction in Russian military capabilities, especially the conventional forces, has caused Russian military planners to emphasize Moscow's threat to use nuclear weapons to deter a large-scale conventional attack, a policy that Moscow stated in its military doctrine published in October 1999 and reiterated in January 2000 and again in April 2000.

Russia is prepared to conduct limited nuclear strikes to warn off an enemy or alter the course of a battle. Russia's strategic offensive forces are experiencing serious budget constraints but will nonetheless remain the cornerstone of its military power. These forces will remain formidable through and beyond 2015, although the overall size of the force will likely continue to decrease, primarily as a result of economic factors and system aging. Despite its ratification of biological and chemical weapons conventions, there are serious concerns about remaining offensive Russian biological and chemical warfare capabilities.

The Russian government has passed new export control legislation to punish wrongdoers and created institutional foundations to implement it. The challenge is whether the Russian leadership can build on that foundation, ensure that dangerous transfers stop, and use these new tools to crack down on violators. Russia's defense spending also has declined steadily since the late 1980s. Although evidence of the need for reform is overwhelming, the key question is whether the Putin government will show the requisite political will to implement long-overdue reform measures. Macroeconomic improvements are already visible, but these will not address the underlying problems of the Russian economy unless matched by a strong push on structural reforms. Consequently, Russian funding for its strategic forces, and any remaining biological and chemical warfare efforts, will in part be limited by the state of its economy.

Russian Nuclear Forces

Moscow increasingly has stated it will rely more heavily on its nuclear forces for deterrent purposes, especially given the serious deterioration of their con-ventional forces' capability. Russia conditionally rati-fied (START II) in May 2000, which, once it enters into force, will limit the number of operational launch-ers and deployed warheads to 3,000-3,500. In June 1999, former President Yeltsin proposed discussions with the United States for further force reductions in the context of a START III Treaty, with proposed force levels of 1,500-2,000.

The Russian nuclear warhead stockpile is being reduced as a result of tactical nuclear warhead reduction initiatives, while the START I treaty (which entered into force in December 1994) and system aging have resulted in the reduction of deployed strategic warheads. In December 2000, the stockpile was estimated to be well under 25,000 warheads, a reduction of over 11,000 warheads since eliminations began in 1992. By the end of 2010, the overall stockpile likely will be further reduced, depending on the economic situation in Russia, Moscow's willingness and ability to abide by tactical nuclear warhead reduction pledges, and future arms control agreements. Moscow has consolidated many of its strategic and tactical warheads at central storage locations, and numer-ous warhead storage

sites for holding warheads have been deactivated since the early 1990s. While this consolidation has improved security, current resource shortages have subjected the nuclear storage system to stresses and risks for which it was not designed. Indeed, warhead reductions have had the collateral effect of increasing near- to mid-term fissile material storage requirements, pending the long-term elimination relevant weapons-usable fissile materials.

Strategic Nuclear Forces

While Russia's strategic nuclear forces will retain considerable capability over the next ten years and will serve as its primary means of deterrence, the overall force is expected to continue to decrease because of arms control, economic constraints, and aging equipment. Within ten years, the number of operational strategic warheads will continue to decline. At the same time, however, production of warheads will continue into the 21st century as new strategic missile systems are deployed and obsolete warheads replaced.

For strategic delivery, Russia retains a significant strategic ballistic missile force of some 1,130 operational ICBMs and SLBMs. There no longer are any operation-ally deployed ICBMs in Ukraine, Kazakhstan, and Belarus. More than 1,250 FSU ICBMs and SLBMs have been removed from the overall force since 1991. This force is likely to decline further as a result of systems aging, chronic funding problems, and arms control agreements. On the other hand, Russia has begun deployment of a new ICBM, the SS-27 (TOPOL-M), and has other missiles planned for deployment in the 21st century. Russia has ratified the NPT and the CTBT.

Tactical Nuclear Forces

Because of economic and other difficulties facing Russia and its armed forces, tactical nuclear weapons will remain a viable component of its general purpose forces for at least the next decade. Russia likely believes that maintaining tactical nuclear forces is a less expensive way to compensate for its current prob-lems in maintaining conventional force capabilities. In late 1991 and early 1992, Russia agreed in the Pres-idential Nuclear Initiatives to a dramatic reduction in its tactical nuclear forces, including the elimination of its ground-launched tactical weapons. Russia still has significant numbers and types of deliv-ery systems capable of performing the tactical nuclear mission. For example, Russia continues to have large inventories of tactical SRBMs (SS-21s), deactivated SCUDs, and a variety of artillery capable of delivering NBC weapons. In fact, Russia employed its tactical SRBMs (with conventional warheads) against the Chechens in the fall of 1999. Air systems include fighter aircraft and bombers. Naval tactical nuclear systems include torpedoes, anti-shipping and anti-sub-marine warfare missiles, and air-launched munitions carried on naval aircraft. Further, Russia's industrial base can support production of the full range of solid-and liquid-propellant ballistic missiles, space launch vehicles, and all associated technologies.

In November 1993, the Russian Ministry of Defense formally dropped its wholly declaratory "no first use" of nuclear weapons policy. In its place, the Ministry of Defense published its Basic Provisions of the Military Doctrine of the Russian Federation, in which it articulated its current nuclear policy: "The Russian Federation will not employ its nuclear weapons against any state party to the treaty on the nonproliferation of nuclear weap-ons, dated 1 July 1968, which does not possess nuclear weapons except in the cases of (a) an armed attack against the Russian Federation, its territory, armed forces, other troops, or its allies by any state that is connected by an alliance agreement with a state that does not possess nuclear weapons or; (b) joint actions by such a state with a state possessing nuclear weapons in the carrying out or in support of any invasion or armed attack upon the Russian Federation, its territory, armed forces, other troops, or its allies."

The current Russian doctrine and strategy involving the use of nuclear weapons, reiterated in October 1999, states that "the possibility of the use of nuclear weapons has not been excluded if the situation deterio-rates during the course of conventional war." A revised version of this document was approved by then-Acting President Putin in January 2000, which further lowers the threshold for nuclear use in order to protect Russia's national interests and territorial integrity; it states: "The application of all forces and means, including nuclear weapons, if necessary to repel armed aggression, if all other measures for resolving the crisis situation have been exhausted or proven ineffective." In April 2000, the Russians elaborated on this threshold, stating that "the Russian Federation retains the right to use nuclear weapons in response to the use of nuclear weapons, or other types of weapons of mass destruction against itself or its allies, and also in response to large scale aggression with the use conventional weapons in situations critical to the national security of the Russian Federation."

Biological Warfare

The FSU offensive biological program was the world's largest and consisted of both military facilities and civilian research and development institutes. According to Ken Alibek, the former Deputy Director of BIO-PREPARAT, the

principal Soviet government agency for biological weapons research and development, by the early 1970s, the Soviet Union had developed a bio-logical warfare employment doctrine, where biological weapons were categorized as strategic or operational. Alibek stated that they were not to be employed as tactical weapons. Strategic biological agents, those to be used on "deep targets," such as the continental United States, were the lethal variety and included smallpox, anthrax, and plague. Operational agents, those intended for use on medium-range tar-gets, but well behind the battlefront, were the incapacitating variety and included tularemia, glanders, and Venezuelan equine encephalitis.

For both strategic and operational employment, the Soviet goal was to create large numbers of casualties and extensive disruption of vital civilian and military activities. The Former Soviet Biological Warfare Program was a massive program involving tens of thousands of personnel. Thousands of tons of agent reportedly produced annually, including anthrax, smallpox, plague, tularemia, glanders, and Venezuelan equine encephalitis. Perceived for strategic use against targets in the United States. Dual-use nature of virtually all materials involved in production process makes it difficult to determine conclusively the exact size and scope of the former Soviet program, or any remaining effort

The former Deputy Director further stated that although the Soviet Union became a signatory to the 1972 BWC, it continued a massive program to develop and manufacture biological weapons. Alibek claims that in the late-1980s and early-1990s, over 60,000 people were involved in the research, development, and production of biological weapons in the Soviet Union. The annual production capacity of all of the facilities involved was several thousand tons of various agents.

The Russian government has publicly committed to ending the former Soviet biological weapons program and claims to have ended the program in 1992. Nevertheless, serious concerns remain about Russia's offensive biological warfare capabilities and the status of some elements of the offensive biological warfare capability inherited from the FSU. Since the breakup of the Soviet Union, more extensive downsizing and restructuring of the program have taken place. Many of the key research and production facilities have taken severe cuts in funding and personnel. However, some key components of the former Soviet program may remain largely intact and may support a possible future mobilization capability for the production of biological agents and delivery systems. Despite Russian ratification of the BWC, work outside the scope of legitimate biological defense activity may be occurring now at selected facilities within Russia, and the United States continues to receive unconfirmed reports of some ongoing offensive biological warfare activities.

Chemical Warfare

Moscow has acknowledged the world's largest stock pile of chemical agents of 40,000 metric tons of agent. The Russian chemical warfare agent inventory con sists of a comprehensive array of blister, choking, and nerve agents in weapons and stored in bulk. These agents can be employed by tube and rocket artillery, bombs, spray tanks, and SRBM warheads. In addition, since 1992, Russian scientists familiar with Moscow's chemical warfare development program have been publicizing information on a new generation of agents, sometimes referred to as "Novichoks." These scientists report that these compounds, some of which are binaries, were designed to circumvent the CWC and to defeat Western detection and protection measures. Furthermore, it is claimed that their production can be hidden within commercial chemical plants. There is concern that the technology to produce these compounds might be acquired by other countries.

As a state party to the CWC, Russia is obligated to declare and destroy its chemical weapons stockpile and to forego the development, production, and possession of chemical weapons. However, we believe that the Russians probably have not divulged the full extent of their chemical agent and weapon inventory. Destruction facil ities are being planned at Shchuch'ye and Gornyy, two of the seven declared storage locations for the Russian chemical warfare stockpile; these efforts are being funded in large part by foreign assistance programs.

Nevertheless, Russia admitted it could not meet its first obligation to destroy one percent of its stockpile by April 2000. Subsequently, the Organization for the Prohibition of Chemical Weapons (OPCW) granted Russia an extension until April 2002, but with the stipulation that it must also meet 20 percent destruction deadline by the same date, as called for under the CWC. However, international experts agree that it will be extremely difficult for Russia to destroy its huge chemical arsenal by 2007 as mandated by the CWC. Even if Russia were to be granted a five-year extension by the OPCW, it is unlikely that Russia's declared stockpile will be completely destroyed because of serious technical, ecological, financial, and political problems.

Cruise Missiles and Other Means of Delivery

Russia has a variety of land-, sea-, and air-launched cruise missiles. Many are designated as short-range anti-ship weapons, although other tactical cruise missile systems have ranges of up to 500 kilometers. All of these systems were produced by the FSU and many were exported to numerous countries worldwide. Russia also has long-range land-attack nuclear capable cruise missiles. While Russia may have plans to develop new land-, sea- or air-launched cruise missiles, funding problems and other priorities likely will delay deployments. In addition, Russia has a variety of fighter aircraft, helicopters, artillery, rockets, and SRBMs available as potential means of delivery for NBC weapons

Role as Supplier

Russia expresses public support for various nonproliferation regimes and treaties and has ratified key arms control treaties. Some Russian entities have provided ballistic missile and nuclear technology to states of proliferation concern. Entities also have been a source of dual-use biological and chemical expertise and technology. Russia has been a key supplier for civilian nuclear pro-grams in Iran, primarily focused on the Bushehr nuclear power plant project. This assistance provides cover for Iran's nuclear weapons development efforts. Because of the dual-use nature of many nuclear technologies involved, even the transfer of civilian technology may be of use in Iran's nuclear weapons program. In addition, Russia supplied India with technologies and mate-rials for its unsafeguarded civilian nuclear program. Russian entities have been key sources of biotechnology and chemicals for Iran. Russia's world-leading expertise in biological and chemical weapons makes it an attractive source for Iranians seeking technical information and training on biological and chemical warfare agent production processes. During the last two years, Russian entities supplied a large quantity and variety of ballistic missile-related goods and technical know-how to countries such as Iran and India.

For example, Iran's earlier success in gaining technology and materials from Russian and North Korean companies accelerated Iranian development of the Shahab-3 MRBM, which was flight tested in July 1998 and again in July and September 2000. Russian entities provided substantial missile-related technology, training, and expertise to Iran, which has helped to accelerate Iranian efforts to build new indigenous ballistic missile systems. As a result, during 1998 and 1999 the United States imp osed penalties against ten Russian entities for their assistance to the Iranian missile and nuclear programs. These penalties remain in place. Further, during the 1999 Moscow air show, the Russians unveiled a missile called the Iskander-E, which may be the export version of a new SRBM. The Russians claim that it has a range of 280 kilometers and a payload below 500 kilograms and therefore, sales would not violate the MTCR. Since the breakup of the Soviet Union, Russia has not sold any finished ballistic missiles to any country.

In recent years Russia has issued export control measures —including a July 1999 law-prohibiting the export of items that can be used for the development of NBC weapons- or missile-related materials. It has begun developing the foundation for a modern export control system. Despite these actions, Moscow's commitment, willingness, and ability to curb proliferation-related transfers remain uncertain. Moreover, economic conditions at many facilities continue to deteriorate, putting more pressure on Russian entities to circumvent export controls to gain hard currency.

Conclusion

Despite the significant decline in the number of its operational strategic nuclear warheads and associated delivery vehicles since 1991, Russia retains sizeable and capable strategic nuclear forces. However, Russia has indicated a desire for additional reductions of strategic forces in the future. On the other hand, Russia has thousands of tactical nuclear warheads that it is unlikely to dismantle soon and that are not subject to current arms control agreements. Recent Russian pub-lic

statements about their willingness to use nuclear weapons indicate that Russia's threshold for the use of these weapons is lower, due to the decline of the capabilities of its conventional forces. Although Russia has ratified the BWC and the CWC, there are still serious questions about the former Soviet biological and chemical warfare programs. At the same time, Russian military leaders may view the retention of at least some of these capabilities as desirable, given the decline in Russia's conventional forces. Russia's large NBC weapon and missile arsenals, even if deactivated, together with questionable security for at least a portion of these weapons, make Russia a prime source for technologies, materials, expertise and information for states of proliferation concern, such as those examined in previous chapters. The ongoing economic and political turmoil in Russia, together with questions about the central government's ability to enforce export controls, adds another dynamic to. the serious potential for the proliferation of NBC-and missile-related technologies from Russia.

Source: Department of Defense, Proliferation and Response, Washington, DC, January 2001, p. 54-56

CIA Estimate of Russian Missile Force Trends – January 2002

Russia maintains the most comprehensive ballistic missile force capable of reaching the United States, although force structure decisions resulting from resource problems, program development failures, weapon system aging, the dissolution of the Soviet Union, and arms control treaties have resulted in a steep decline in Russian strategic nuclear forces over the last 10 years. From a high of approximately 10,000 warheads in 1990, Russia now maintains almost 4,000 warheads on its ICBMs and SLBMs.

- Russia currently has about 700 ICBMs with 3,000 warheads and a dozen SSBNs, equipped with 200 launchers for SLBMs that can carry 900 warheads.
- In the current day-to-day operational environment—with all procedural and technical safeguards in place—an unauthorized or accidental launch of a Russian strategic missile is highly unlikely.

Unless Moscow significantly increases funding for its strategic forces, the Russian arsenal will decline to less than 2,000 warheads by 2015—with or without arms control.

Although Russia still maintains the most comprehensive ballistic missile force capable of reaching the United States, force structure decisions resulting from resource problems, program development failures, weapon system aging, the dissolution of the Soviet Union, and arms control treaties have resulted in a steep decline in Russian strategic nuclear forces over the last 10 years.

Strategic Missile Forces

ICBMs. Russia's Strategic Rocket Forces (SRF) is extending the service lives of its older ICBMs—silo-based SS-18s and SS-19s, and road-mobile SS-25s—in part to compensate for the slow deployment of its newest ICBM, the SS-27.

Russia's ICBMs and US Missile Defense: Concerns over the US Missile Defense (MD) program have led several high-ranking Russian political, military, and industry officials to openly discuss military countermeasures to the system. The SS-27—developed in the 1980s as a response to the Strategic Defense Initiative—probably is the basis for Russia's most credible responses to MD.

SLBMs: The disintegration of the Soviet Union, developmental problems, and resource constraints have resulted in significant SSBN/SLBM program delays and the requirement to simultaneously extend the service lives of older systems while maintaining newer, more capable systems.

The Intelligence Community has various projections of Russia's strategic forces for 2015, all less than 2,000 deployed nuclear weapons. The availability of resources, inclusion of missiles with multiple independently targetable reentry vehicles (MIRVs), and the success of development programs are the key factors in determining the ultimate force size.

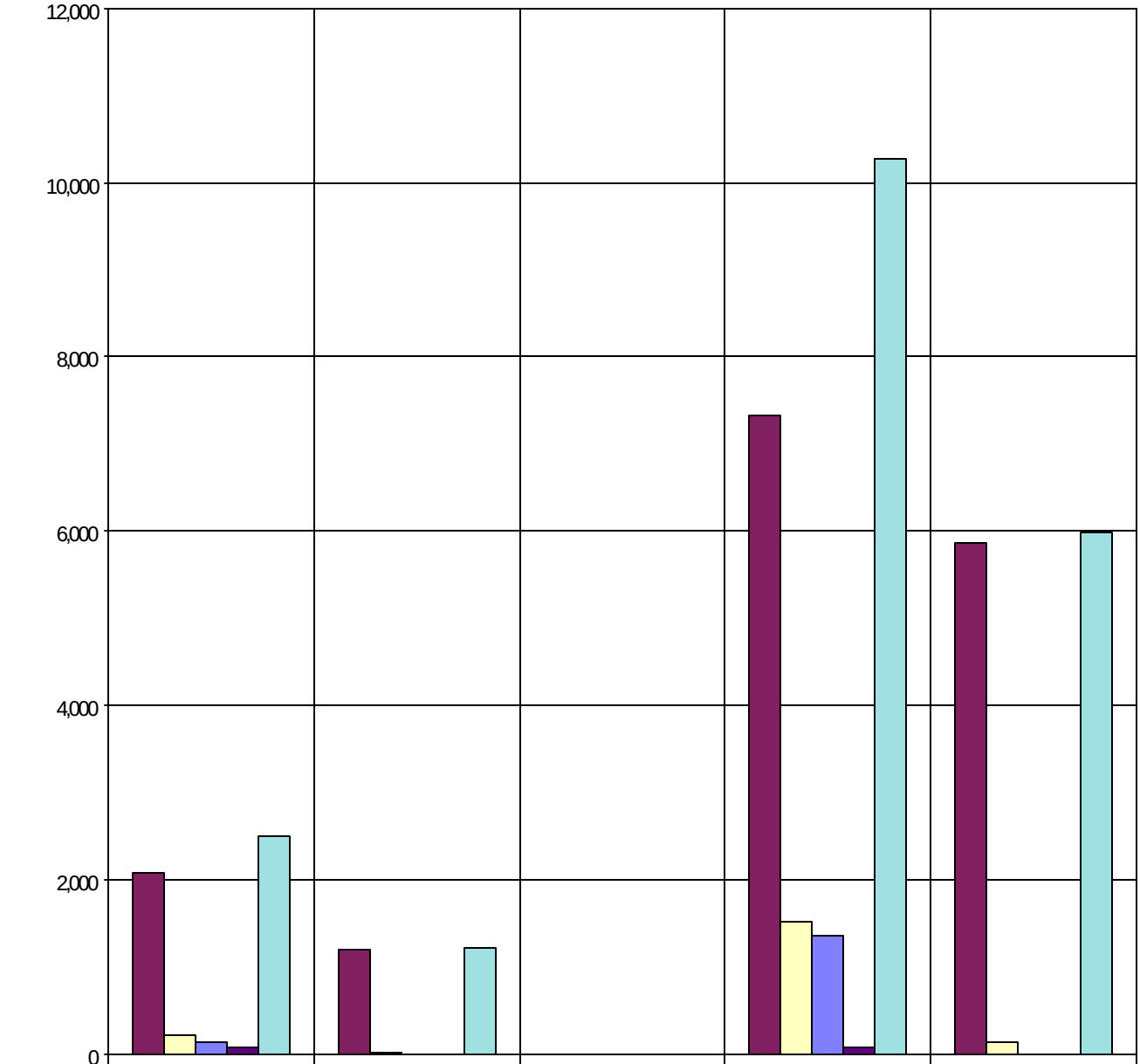
Theater Ballistic Missile Force: Russia has the most technologically evolved and best-equipped, maintained, and trained theater ballistic missile force in the world today. The SS-21 and SS-26 SRBMs provide Russian general-purpose ground forces with a rapid, precision-guided, theater deep-strike capability.

CIA Estimate of Russian Role in Proliferation: January 30, 2002

- Despite improvements in Russia's economy, the state-run defense, biotechnology, and nuclear industries remain strapped for funds, even as Moscow looks to them for badly needed foreign exchange through exports. We remain very concerned about the proliferation implications of such sales in several areas. Monitoring Russian proliferation behavior, therefore, will remain a very high priority.
- Russian entities during the reporting period continued to supply a variety of ballistic missile-related goods and technical know-how to countries such as Iran, India, China, and Libya. Iran's earlier success in gaining technology and materials from Russian entities has helped to accelerate Iranian development of the Shahab-3 MRBM, and continuing Russian assistance likely supports Iranian efforts to develop new missiles and increase Tehran's self-sufficiency in missile production.
- Russia also remained a key supplier for civilian nuclear programs in Iran, primarily focused on the Bushehr Nuclear Power Plant project. With respect to Iran's nuclear infrastructure, Russian assistance enhances Iran's ability to support a nuclear weapons development effort, even though the ostensible purpose of most of this assistance is for civilian applications. Despite Iran's NPT status, the United States is convinced Tehran is pursuing a nuclear weapons program. The Intelligence Community will be closely monitoring Tehran's nuclear cooperation with Moscow for any direct assistance in support of a nuclear weapons program.
- In January 2000, Moscow approved a draft cooperative program with Syria that included civil use of nuclear power. Broader access to Russian scientists and Russia's large nuclear infrastructure could provide opportunities to solicit fissile material production expertise and other nuclear-related assistance if Syria decided to pursue nuclear weapons. In addition, Russia supplied India with material for its civilian nuclear program during this reporting period.
- President Putin in May 2000 amended the presidential decree on nuclear exports to allow the export in exceptional cases of nuclear materials, technology, and equipment to countries that do not have full-scope IAEA safeguards. The move could clear the way for expanding nuclear exports to certain countries that do not have full-scope safeguards, such as India.
- During the first half of 2001, Russian entities remained a significant source of dual-use biotechnology, chemicals, production technology, and equipment for Iran. Russia's biological and chemical expertise makes it an attractive target for Iranians seeking technical information and training on BW and CW agent production processes.
- Russia continues to be a major supplier of conventional arms. Following Moscow's abrogation of the Gore-Chernomyrdin agreement in November 2000, Russian officials stated that they see Iran to be a significant source of potential revenue from arms sales, and believe Tehran can become Russia's third largest conventional arms customer after China and India. In early 2001, Russia was the primary source of ACW for China, Iran, Libya, and Sudan, and one of the largest sources for India.
- Russia continues to be the main supplier of technology and equipment to India and China's naval nuclear propulsion programs. In addition, Russia has discussed leasing nuclear-powered attack submarines to India.
- The Russian Government's commitment, willingness, and ability to curb proliferation-related transfers remain uncertain. The export control bureaucracy was reorganized again as part of President Putin's broader government reorganization in May 2000. The Federal Service for Currency and Export Controls (VEK) was abolished and its functions assumed by a new department in the Ministry of Economic Development and Trade. VEK was tasked with drafting the implementing decrees for Russia's July 1999 export control law; by the end of the reporting period, seven of these decrees had been approved, and four—including two control lists—were still awaiting presidential signature. However, the enacted legislation will have little impact on several of the export control system's key shortfalls, including weak enforcement and insufficient penalties for violations.
- Export enforcement continues to need improvement. In February 2000, Sergey Ivanov, then Secretary of Russia's Security Council, said that during 1998-99 the government had obtained convictions for unauthorized technology transfers in three cases. The Russian press has reported on cases where advanced equipment is simply described as something else in the export documentation and is exported. Enterprises sometimes falsely declare goods to avoid government taxes.

Cuts in Russian and FSU Strategic Nuclear Delivery Systems and Warheads: 1991-2001

(Declarations as of July 31, 2001)



	1991-Delivery Systems	2001-Delivery Systems	.	1991-Nuclear Warheads	2001-Nuclear Warheads
Russia	2,074	1,198		7,327	5,858
Ukraine	210	13		1,512	130
Kazakhstan	144	0		1,360	0
Belarus	81	0		81	0
Total FSU	2,509	1,211		10,280	5,988

Source: Adapted by Anthony H. Cordesman from data provided by US State Department on July 31, 2001. Belarus and Kazakhstan report zero in every category. All data reflect START counting rules.

Estimate of Russian Nuclear Forces - 2001

Type/Name	Launcher/ SLBMs	Year Deployed	Warheads x yield (kt)	Total warheads	Throwweight In Megatons
ICBMs					
SS-18 Satan (RS-20)	166	1979	10 x 550/750	1,660	1,460.8
SS-19 Stiletto (RS-18)	150	1979	6 x 550	900	652.5
SS-24 Scalpel (RS-22)		1987	10 x 550		
Silo	6			60	24.3
Rail Mobile	36			360	145.8
Total	42			420	170.1
SS-25 Sickle (RS-12M)	360	1985	1 x 550	360	360 .
(SS-27 (Topol-M)	15	1997	1 x 550	10)*	
Total	733(180 Heavy)			3,350	2643.4
SLBMs					
SSN-8 Sawfly	36			36	39.6
SS-N-18 Stingray (RSM-50)	128	1978	3 x 500	384	211.20
SS-N-20 Sturgeon (RSM-52)	100	1983	10 x 200	1000	255.0
SS-N-23 Skiff (RSM-54)	112	1986	4 x 100	448	313.60
Total	376			1,868	819.4
BOMBERS					
Tu-95/Bear-ALCM	65	1984	6 AS-15A ALCMs		174
Tu-95/Bear-Non-ALCM	2	1984	16 AS-15A ALCMs or bombs		560
Tu-160/Blackjack	15	1987	AS-15B ALCMs or AS-16 SRAMSs or bombs		72
Total	68		202		806
NON-STRATEGIC WEAPONS					
Strategic Defense					
ABM	64 SH-08 Gazelle, 36 SH-11 Gorgon		100		100
SAM	SA-5B Gammon, SA-10 Grumble		1900		1100
Land-based Non-strategic					
Bombers and Fighters	Backfire(188), Fencer (432)		620		1600
Naval Non-strategic					
Attack aircraft	Backfire (63), Fencer (359)		422		400
SLCMs	SS-N-9, SS-N-12, SS-N-19, SS-N-21, SS-N-22				500
ASW Weapons	SS-N-15, SS-N-16, torpedoes		300		
Total					~4,000
OTHER WEAPONS					
Reserve/Awaiting Dismantlement					~12,000
GRAND TOTAL			~2,400 MT (strategic weapons)		~22,250

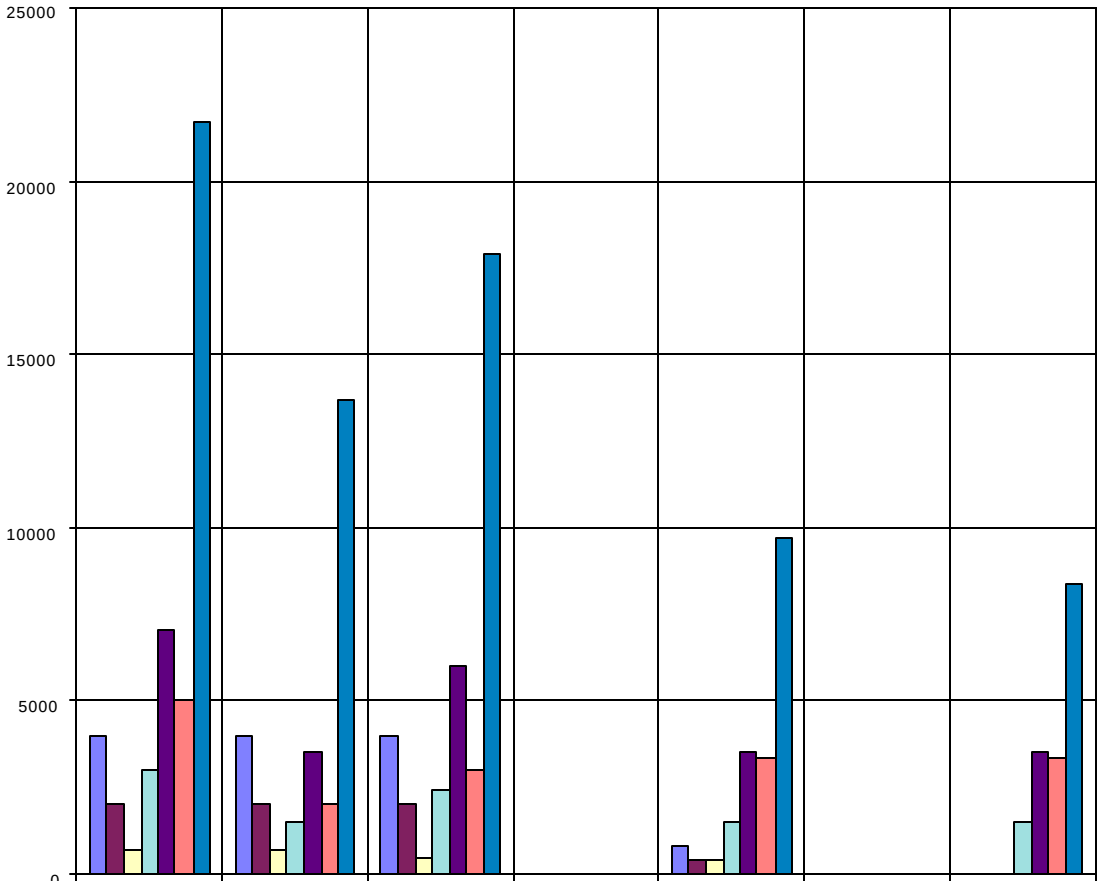
NOTES

* Shown in some Western sources but not in State Department estimate.

1. Figures in this table represent total operational forces, not just forces accountable under START I.
2. Principle sources for this table include: The US State Department Fact Sheet on Aggregate Numbers of Strategic Offensive Arms, July 31,2001, Washington, DC, US Department of State. The numbers have been updated in part by Anthony H. Cordesman, using the International Institute for Strategic Studies, *The Military Balance, 1999-2000, 2000-2001, and 2001-2002*, (London: Oxford University Press) and data from the Carnegie Endowment.

Russian Theater Nuclear Forces

(Declarations as of January 1, 2000)



	Total in 1991	Subject to Elimination Under 1991/92 Initiatives	Subject to Elimination by 1997	Share Eliminated by January 1998	Total Warheads by January 1998	Share Eliminated by Spring 2000	Total in Spring 2000
Land-Based Missiles	4000	4000	4000	80%	800	@100%	@0
Artillery Shells	2000	2000	2000	80%	400	@100%	@0
Mines	700	700	500	80%	400	@100%	@0
Air Defense	3000	1500	2400	50%	1500	50%	1500
Air Force	7000	3500	6000	50%	3500	50%	3500
Navy	5000	2000	3000	33.30%	3400	33.30%	3400
Total	21700	13700	17900		9740		8400

There figures are the authors' best estimate drawn from their caclulations of the range of deployed and non-deployed warheads. The figures for columns 1, 2 and 3 are based on Alexei Arbatov, Yadernye Vooruzheniya Bezopasnost Rossi, IMEMO, 1997. Column 4 is based on the Russian Delegation Paper at the Experts Meeting at NATO on February 25, 1998. Column 5 = 1+4. Column 6 is based on H.E. Grigory Berdennikov at the 3rd Session of the Preparatory Committee for the 200 Review Conference of the NPT, May 10, 1999 and the National Report on the Implementation of the Nuclear Non-Proliferation Treaty by the Russian Federation, April 25, 2000.

Source: Adapted from work by William C. Potter and Dr. Nikolai Sokov, and Dr. Potter's draft of "Reducing the Threat of Tactical Nuclear Weapons, Problems and Prospects."

Part Five

Chinese Force Trends

US Department of Defense Estimate of Chinese Actions and Intentions Involving Nuclear, Biological, and Chemical Weapons

Capabilities, Intentions, and Trends

Beijing continues to emerge as an increasingly active player in the region. Therefore, it is focused on becoming a world-class industrialized power through a countrywide modernization effort, which includes economic, technological, and military components of national power. Beijing already wields significant international influence by virtue of its permanent membership on the United Nations (UN) Security Council and its economic influence. China's public support for nonproliferation regimes is motivated by several factors, including a desire to enhance its image as a responsible world power and support for nonproliferation objectives.

China's leaders have articulated that a limited but long-range nuclear capability is a key component of national strength and prestige, a capability critical to carrying out Beijing's independent foreign policy and to supporting its international status. China is qualitatively improving its nuclear arsenal through a modernization program and, by 2015, China likely will have tens of missiles capable of reaching the United States. Moreover, despite its ratification of the BWC and the CWC, China is believed to retain some biological and chemical warfare capabilities. Beijing also has under-taken a ballistic missile modernization effort. For example, it is expanding its SRBM force, which it likely views as an important tool for military and political influence in the region. It also is improving its ICBM capability by developing two road-mobile solid-propellant ICBMs and a new submarine launched ballistic missile (SLBM).

Overall funding for these programs will likely reflect, in part, China's evolving perceptions of global and regional threats and its response to changing domestic economic conditions. Beijing will be challenged to maintain the high growth rates of recent years and the defense budget is likely to vary between about 3.5 per-cent and 5 percent of China's total nominal Gross Domestic Product (GDP). Thus, funding for China's NBC and missile programs likely will increase gradually. Projecting a realistic modest growth pattern, including expected economic fluctuations, total military funding levels are expected to average between $44 and $70 billion (in constant 1998 dollars) annually between 2000 and 2004. China has made numerous nonproliferation pledges and ratified several key nonproliferation treaties and arms control regimes. In response to U.S. concerns that Chinese companies have provided support,

Nuclear Program

China currently has over 100 nuclear warheads and is increasing the size, accuracy, and survivability of its nuclear missile force. It is likely that the number of deployed Chinese theater and strategic systems will increase in the next several years. However, as its stra-tegic requirements evolve, it may change the pace of its modernization effort for its nuclear missile force (particularly if the United States deploys NMD); any warhead improvements will complement China's mis-sile modernization effort. China currently is not believed to be producing fissile material for nuclear weapons, but has a stockpile of fissile material suffi-cient to improve or increase its weapons inventory. China has ratified the NPT and signed the CTBT, and has declared it will never use its nuclear forces against a non-nuclear weapons state. China maintains a no-first- use pledge in its strategic nuclear doctrine and regards its strategic nuclear force as a deterrent against intimidation or actual attack. Thus, China's stated doc-trine reportedly calls for a survivable long-range mis-sile force that can hold a significant portion of the U.S. population at risk in a retaliatory strike. As China's strategic forces and doctrine further evolve, Beijing will continue to develop and deploy more modern ICBMs and SLBMs

Biological Program

China continues to maintain some elements of an offensive biological warfare program it is believed to have started in the 1950s. China possesses a sufficiently advanced biotechnology infrastructure to allow it to develop and produce biological agents. Its munitions industry is sufficient to allow it to weaponize any such agents, and it has a variety of delivery means that could be used for biological agent delivery. China is believed to possess an offensive biological warfare capability based on technology developed prior to its accession to the BWC in 1984. China actively participates in international efforts to negotiate a BWC compliance protocol.

Since 1984, China consistently has claimed that it never researched, produced, or possessed any biological weapons and never would do so. Nevertheless, China's declarations under the voluntary BWC declarations for confidence building purposes are believed to be inaccurate and incomplete, and there are some reports that China may retain elements of its biological warfare program.

Chemical Program

Beijing is believed to have an advanced chemical warfare program including research and development, production, and weaponization capabilities. China's chemical industry has the capability to produce many chemicals, some of which have been sought by states trying to develop a chemical warfare capability. Foreign sales of such chemicals have been a source of foreign exchange for China. The Chinese government has imposed restrictions on the sale of some chemical pre-cursors and its enforcement activities generally have yielded mixed results. While China claims it possesses no chemical agent inventory, it is believed to possess a moderate inventory of traditional agents. It has a wide variety of potential delivery systems for chemical agents, including cannon artillery, multiple rocket launchers, mortars, land mines, aerial bombs, SRBMs, and MRBMs.
Chinese military forces most likely have a good under-standing of chemical warfare doctrine, and its forces routinely conduct defensive chemical warfare training. Even though China has ratified the CWC, made its declaration, and subjected its declared chemical weapons facilities to inspections, we believe that Beijing has not acknowledged the full extent of its chemical weapons program.

Ballistic Missiles

China has continued to modernize its ballistic missile force over the last several years and its industrial base can support production of the full range of ballistic missiles. China's missile force is designed to serve as a strategic deterrent against Russia and the United States. While the ultimate extent of China's strategic modernization is unknown, it is clear that the number, reliability, survivability, and accuracy of Chinese strategic missiles capable of hitting the United States will increase during the next two decades.

China currently has about 20 CSS-4 ICBMs with a range of over 13,000 kilometers, which can reach the United States. Some of its ongoing missile modernization programs likely will increase the number of Chinese warheads aimed at the United States. For example, Beijing is developing two new-road mobile solid-propellant ICBMs. China has conducted successful flight tests of the DF-31 ICBM in 1999 and 2000; this missile is estimated to have a range of about 8,000 kilometers. Another longer-range mobile ICBM also is under development and likely will be tested within the next several years. It will be targeted primarily against the United States.
China currently has a single XIA class SSBN, which is not operational; it is intended to carry 12 CSS-NX-3 missiles; these missiles have a range greater than 1,000 kilometers. In addition, the Chinese are designing a new SSBN that will carry the JL-2 ballistic missile, which is expected to have a range of over 8,000 kilometers. The JL-2 likely will be tested in the next decade, and, when deployed, it probably will be able to target the United States from operating areas near the Chinese coast.

In addition, China increasingly sees conventionally armed ballistic missiles, such as the solid-propellant road-mobile CSS-6, with a range of 600 kilometers, as important weapons for a regional conflict and for their political and military deterrent effect. The size of this SRBM force is expected to grow in the next several years, as China will augment it with more modern CSS-7 road-mobile solid-propellant missiles, which have a range of 300 kilometers. These missiles are expected to incorporate satellite-assisted navigation technology to improve their accuracy. While continuing to increase the number of missiles and launchers in its inventory, Beijing also is concentrating on replacing liquid-propellant missiles with mobile solid-propellant missiles, reflecting a preference for diminished maintenance and improved survivability and reliability.

Cruise Missiles and Other Means of Delivery

China produces several types of land-, sea-, and air-launched cruise missiles, which are potential means of delivery for NBC weapons. While most are short-range and are deployed for anti-ship operations, China is developing land attack cruise missiles (LACMs) as well as a submarine-launched anti-ship cruise missile; this effort appears to have a relatively high priority. China's research and development of LACMs is being aided by an aggressive acquisition of foreign technology and subsystems, particularly from Russia. The first LACM will be an air-launched version, and may be operational in the next few years. China has exported several versions of anti-ship cruise missiles to countries in the Middle East and South Asia, and to North Korea. China also has a variety of fighters, bombers, helicopters, artillery, rockets, mortars, and sprayers available as potential means of delivery for NBC weapons.

Role as Supplier

China has made numerous nonproliferation pledges since 1992, publicly supports a number of nonproliferation regimes, and has ratified several nonproliferation related treaties. China has maintained that it will not assist any country in developing nuclear weapons or the MTCR-class missiles to deliver them, and has taken numerous steps over the last several years to strengthen its control over sensitive exports. Nevertheless, Chinese entities have supported some nuclear, chemical, and missile programs in countries of proliferation concern, driven by China's overall strategic interests in South Asia and the Middle East and by

domestic economic pressures. China joined the Zangger Committee, which clarifies certain nuclear export obligations under the NPT, in October 1997 and participated in the Zangger Conversion Technology Holders meeting in February 1999.

This was China's first opportunity to participate in a discussion of this type that could result in changes to the Zangger trigger list coverage. In late 1997, China pledged not to engage in any new nuclear cooperation with Iran and to complete work on two remaining nuclear projects —a small research reactor and a zirconium production facility —in a relatively short period of time. An Agreement for Peaceful Nuclear Cooperation between the United States and China would have entered into force on 30 December 1985, but Congress intervened owing to concerns about China's nonproliferation policies and practices. Following these major and positive changes in China's approach to its nuclear nonproliferation obligations and responsibilities, the United States in March 1998 made the certifications necessary to permit peaceful U.S. nuclear cooperation, including some exports, under the U.S.-China Agreement.

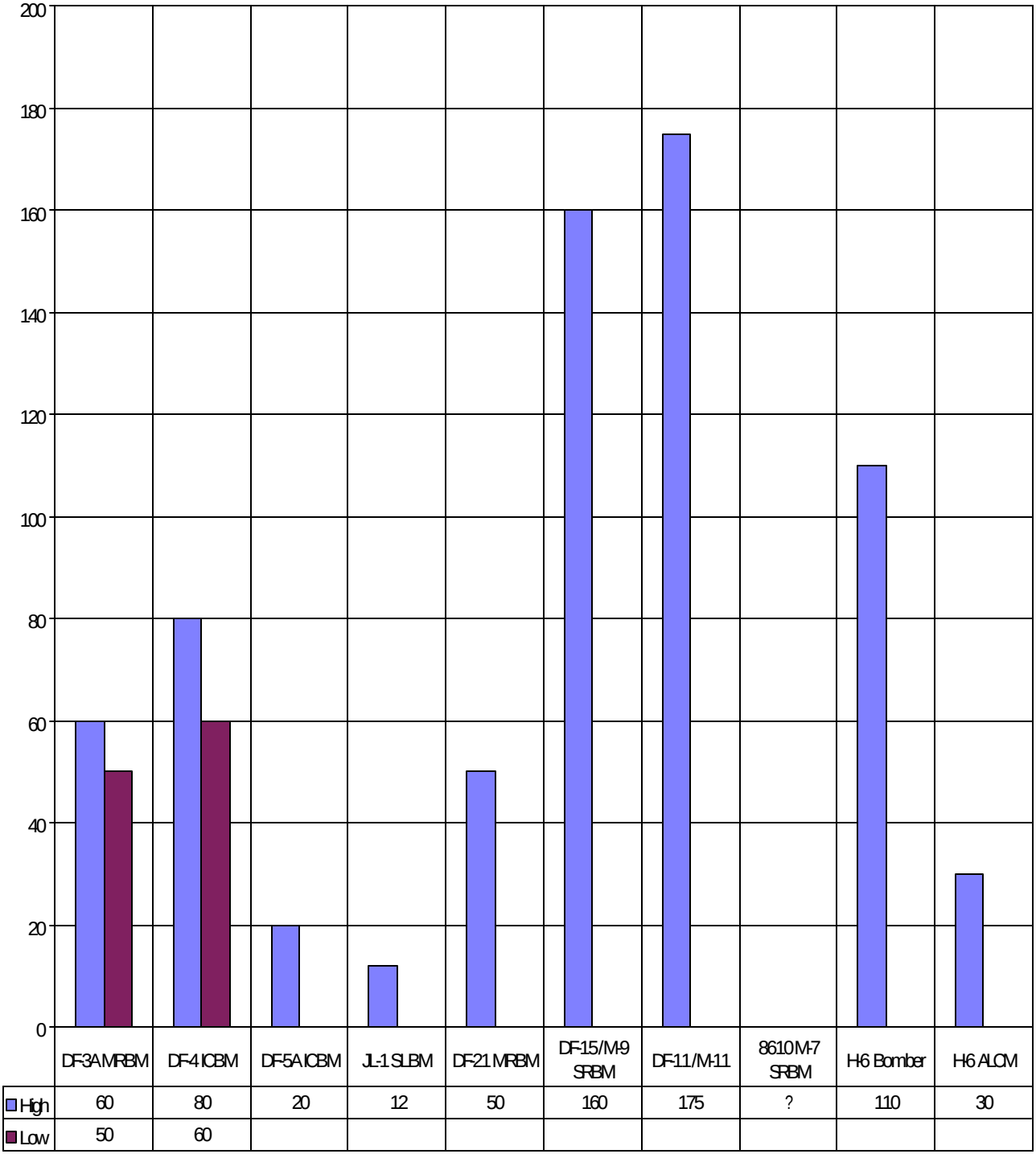
In the past, Chinese firms supplied chemical warfare-related production equipment and technology to Iran. The U.S. sanctions, imposed in May 1997 on seven Chinese entities for knowingly and materially contributing to Iran's chemical warfare program, remain in effect. In June 1998, China announced that it had expanded its chemical export controls to include 10 of the 20 Australia Group chemicals not listed on the CWC schedules.

In October 1994, China reaffirmed its commitment not to export ground-to-ground MTCR-class missiles. In November 2000, China made a clear policy commitment not to assist, in any way, other countries to develop ballistic missiles that can be used to deliver nuclear weapons, and to further improve and reinforce its export control system, including by publishing at an early date a comprehensive export control list of missile-related items, including dual-use items. This pledge provides constraints on China's missile exports. In consideration of China's commitment to strengthen its missile-related export control system, the U.S. government decided to waive sanctions required by U.S. law for past assistance by Chinese entities to missile programs in Pakistan and Iran.

…In recent years, Chinese firms have provided some important missile-related items and assistance to several countries of concern, such as Iran, Libya, and North Korea. China also has provided extensive support in the past to Pakistan's nuclear and ballistic missile pro-grams, and some ballistic missile assistance continues.

Source: Department of Defense, Proliferation and Response, January 2001, China section.

Chinese Deployed Nuclear-Capable Delivery Systems



	DF-3A MRBM	DF-4 ICBM	DF-5A ICBM	JL-1 SLBM	DF-21 MRBM	DF-15/M-9 SRBM	DF-11/M-11	8610 M-7 SRBM	H6 Bomber	H6 ALCM
High	60	80	20	12	50	160	175	?	110	30
Low	50	60								

Source: Adapted by Anthony H. Cordesman from IISS, Military Balance, 2001-2002, and Shirley A. Kan, China: Ballistic and Cruise Missiles, Congressional Research Service, CRS 97-391 F, September 28, 1998

Estimate of Total Chinese Nuclear Forces, 2001-2002

Type/ Designation	Launchers Deployed	First Deployed	Range (km)	Warheads x yield	Warheads
LAND - BASED MISSILES					
DF-3 (3A)	60-80	1971	2,650 (2,800)	1 x 3.3 MT	60-80
DF-4	20+	1980	4,750	1 x 3.3 MT	20
DF-5 (5A)	20+	1981	12,000 (13,000)	1 x 4-5 MT; MIRV tested	~20
DF-21 (21A)	50	1985-6	1,700 (1,800	1 x 200-300 kt	36
DF-25	0	development	1,700	n/a	0
DF-31	1	Tested in 1999	8,000	1 x 200-300 kt; 50-90 kt; MIRV?	10-20 to be built
DF-41	0	development	12,000	250 kt; MIRV	12 to be built
SEA LAUNCHED BALLISTIC MISSILES					
Julang-1	12	1986	1,700 (2150)	1 x 200-300 kt	12
Julang-2	0	development	8,000-9,000	1 x 100-200 kt	16 to be built?
AIRCRAFT					
H-6	110	1965	3,100	1-3 bomb (10kt -3MT)	110
Q-5	300	1970	400	1 bomb (10kt - 3 MT)	300
TACTICAL WEAPONS					
Artillery/SRMs				low kt	120
TOTAL				~410 MT	400

Sources for this table include: Rodney Jones and Mark McDonough, Tracking Nuclear Proliferation, 1998 (Washington D.C.: Carnegie Endowment for International Peace, 1998); William Arkin, Robert Norris, and Joshua Handler, Taking Stock: Worldwide Nuclear Deployments, 199*8* (Washington, D.C.: NRDC Nuclear Program, 1998); "Table of Chinese Nuclear Forces," Natural Resources Defense Council, nrdc.org/nuclear/nudb/datab17.asp; Center for Nonproliferaion Studies, Proliferation Challenges and Nonproliferation Opportunities for New Administrations, Occasional Paper No. 4, Monterey Institute of International Studies, September 2000; IISS, Military Balance, 2001-2002, and Department of Defense, Proliferation and Response, January 2001, p. 54-56.

1. There are varying reports as to the number of DF-5 (CSS-4) missiles in China's inventory. Unconfirmed reports by anonymous intelligence officials have placed the number as high as 24, while the International Institute for Strategic Studies places the total count at 7. See Bill Gertz, "China adds 6 ICBMs to arsenal," *The Washington Times*, July 21, 1998, p. A1, and "China Targets Nukes at U.S.:CIA Missile Report contradicts Clinton," *Washington Times*, May 1, 1998, p. A1; Most recently, Robert Walpole, National Intelligence Officer for Strategic and Nuclear Programs placed the number at "about 20." in remarks given at the Carnegie Endowment, September 17, 1998.

2. Recent reports have claimed that China is increasing its ballistic missile force aimed at Taiwan. (see Bill Gertz, "Chinese Missiles Menace Taiwan," *Washington Times*, February 11, 1999. The report claimed that China had produced 150 M-9 and M-11 (short-range ballistic missiles) and was facing the majority of the force toward Taiwan. It should be noted that these are non-nuclear systems, and are not represented in this chart.

3. 310 MT is a good estimate for the yield of China's ballistic missile forces. The bombs, however, with a range of 10kt to 3MT pose a slight problem. We estimate the bomb force to have a yield of approximately 100 megatons.

4. China's first test of the mobile three-stage DF-31 intercontinental ballistic missile (ICBM) took place on August 2, 1999, at Wuzhai, 250 miles southwest of Beijing.

Chinese Missile Programs and Developments[1]

Type	Chinese Name	US Name	No. Deployed	Range (Km)	Warhead (Kg)	CEP (M)	Launch Platform	Fuel	Status
ICBM	DF-4[1]	CCS-3	20+	4,750	2200 (3.3 megaton warhead)	1370	cave	liquid	in service 1980
ICBM	DF-5A[2]	CSS-4	20+	13,000	3,200 (4-5 megaton warhead)	500	hardened silos	liquid	in service 1981
ICBM	DF-31[3]	-	1	8000	700	?	land-mobile	solid	2002
ICBM	DF-41[4]	-	-	12,000	800	?	land-mobile	solid	2005
MRBM	DF-3A[5]	CSS-2	60-80	2800	2150 (3.3 megaton warhead)	1000	land-mobile	liquid	in service 1971
MRBM	DF-21/ 21A[6]	CSS-5	50	1800	600-800 (200-300 kiloton warhead)	?	Mobile-TEL	solid	in service
MRBM	DF-25[7]	-	-	1700	2000	?	land-mobile	solid	after 2000
SLBM	JL-1[8]	CSS-N-3	12	1700	600 (200-300 kiloton warhead)	?	Xia SSBN	solid	in service
SLBM	JL-2[9]	-	-	8000-10,000	700	?	094 SSBN	solid	after 2005
SRBM	DF-15[10] M-9	CSS-6	160+	600	500 (50-350 kiloton warhead)	300	Mobile TEL	solid	in service 1995
SRBM	DF-11[11] M-11	CSS-7	175	120-300	500-800	?	Mobile TEL	solid	in service 1995
SRBM	8610[12]	CSS-8	?	150	190	?	Mobile	solid	in service

[1] Adapted from work by Shirley A. Kan in China: Ballistic and Cruise Missiles, Congressional Research Service, CRS 97-391 F, September 28, 1998

[2] Deployed since 1981, most targeted on the US. Gyroplatform inertial guidance with on-board computer and storable liquid fuel. Deployed in hardened underground silos. Normally kept unfueled and without warheads

[3] Possible MIRVing capability. Booster tested in 1998.

[4] Supposedly road, rail, river mobile.

[5] Deployed since 1971, strap-down inertial guidance. Reaction time 110 minutes. China sold 36 to Saudi Arabia.

[6] Same fuel and guidance as JL-1. Automatic command-control-firing system from TEL. Reports of terminal guidance, possible radar. May be a DF-21A.First regiment deployed in 1985.

[7] Land mobile for truck transfer from semi-hardened sites to launch sites. No reports of test firings. One report that development has been abandoned

[8] All on one Jia submarine. Deployed since 1983, successful underwater launch tests in 1988. Operational status uncertain. Gyroplatform inertial guidance with on-board computer.

[9] To be deployed on new 094 SSBN with 16 tubes each. First SSBN that could target US from waters near China.

[10] Launch from mobile TEL with preparation time of 30 minutes. Strap-down inertial guidance with on-board computer with terminal velocity correction. May be seeking GPS guidance. Four fired in Taiwan crisis in 1995. Three landed in general target area, one crashed prematurely. Four more fired in Taiwan crisis in 1996. Four landed in general target area. Some reported indicate that 20-30 more had been prepared for firing.

[11] US imposed sanctions on China and Pakistan because this system was sold to China.

M-71	(mod HQ-2 SAM)	launcher

Note: High side of range deployed is generally most likely to be correct with the exception of the JL-1. Low side reflects doubt as to actual operational reliability of systems Chinese regard as deployed and combat operational. DF: Dong Feng means "East Wind." JL: Julang means "Giant Wave." According to "The Bulletin of the Atomic Scientist, Chinese Nuclear Forces, 2000," China canceled the development of a sixth type of Dong Feng missile, the DF, it has begun developing a new mobile. Solid-propellant ICBM. The nuclear capability of the 600-kilometer range M-9 and the 300-kilometer range m-11 is unconfirmed. The Chinese define missile ranges as follows: short range, <1,000 kilometers; medium-range,1,000-3,000 kilometers; long-range,3,000-8,000 kilometers; and intercontinental range,>8,000 kilometers

1 Deployed since 1980. Response time of 2.5 hours, strap-down inertial guidance. Stored in caves and mountainside tunnels.

2 Deployed since 1981, most targeted on the US. Gyroplatform inertial guidance with on-board computer and storable liquid fuel. Deployed in hardened underground silos. Normally kept unfueled and without warheads

3 Possible MIRVing capability. Booster tested in 1998.

4 Supposedly road, rail, river mobile.

5 Deployed since 1971, strap-down inertial guidance. Reaction time 110 minutes. China sold 36 to Saudi Arabia.

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8 All seem to be on one Jia submarine. Deployed since 1983, successful underwater launch tests in 1988. Operational status uncertain. Gyroplatform inertial guidance with on-board computer.

Adapted from Jason D. Ellis and Todd M. Koca, "China Rising: New Challenges to the US Security Posture," Strategic Forum, No. 175, October 2000, IISS, Military Balance, 2001-2002, and Department of Defense, Proliferation and Response, January 2001, p. 54-56.

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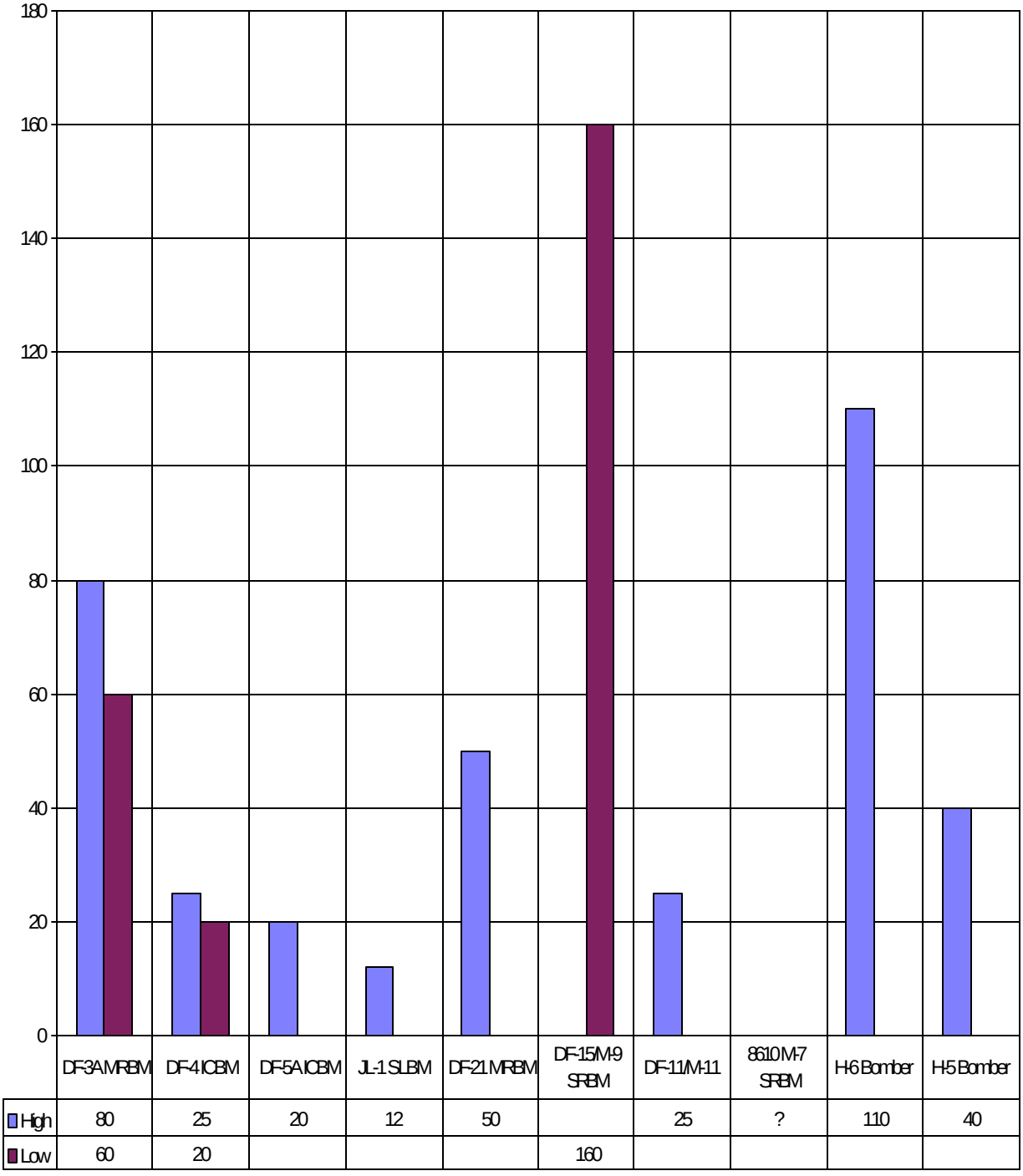
12 Unconfirmed reports that Iran has acquired this missile technology.

Chinese Deployed Nuclear-Capable Delivery Systems



	DF-3A MRBM	DF-4 ICBM	DF-5A ICBM	JL-1 SLBM	DF-21 MRBM	DF-15/M-9 SRBM	DF-11/M-11	8610/M-7 SRBM	H-6 Bomber	H-5 Bomber
High	80	25	20	12	50		25	?	110	40
Low	60	20				160				

Source: Adapted by Anthony H. Cordesman from IISS, Military Balance, 2001-2002, and Shirley A. Kan, China: Ballistic and Cruise Missiles, Congressional Research Service, CRS 97-391 F, September 28, 1998

US Intelligence Estimates of Chinese Modernization – January 2001

The US National Intelligence Council report summarizes the Chinese ballistic missile threat to the US as follows:[i]

- "Chinese strategic nuclear doctrine calls for a survivable long-range missile force that can hold a significant portion of the US population at risk in a retaliatory strike.
- China's current force of about 20 CSS-4 ICBMs can reach targets in all of the United States.
- Beijing also is developing two new road-mobile, solid propellant ICBMs.
  - It conducted the first flight test of the mobile DF-31 ICBM in August 1999; we judge it will have a range of about 8,000 km and will be targeted primarily against Russia and Asia.
  - We expect a test of a longer range mobile ICBM within the next several years; it will be targeted primarily against the United States.
- China is developing the JL-2 SLBM, which we expect to be tested within the next decade. The JL-2 probably will be able to target the United States from launch areas near China.
- By 2015, China will likely have tens of missiles targeted against the United States, having added a few tens of more survivable land- and sea-based mobile missiles with smaller nuclear warheads—in part influenced by US technology gained through espionage.
- China has had the technical capability to develop multiple RV payloads for 20 years. If China needed a multiple-RV (MRV) capability in the near term, Beijing could use a DF-31-type RV to develop and deploy a simple MRV or multiple independently targetable reentry vehicle (MIRV) 1 for the CSS-4 in a few years. MIRVing a future mobile missile would be many years off.
- China is also significantly improving its theater missile capabilities and is increasing the size of its SRBM force deployed opposite Taiwan.
- We assess that an unauthorized launch of a Chinese strategic missile is highly unlikely."

A Department of Defense report makes the following comments about Chinese attitudes and force developments:[ii]

- "Although the PLA is still decades from possessing a comprehensive capability to engage and defeat a modern adversary beyond China's boundaries, Beijing believes that the PLA can develop *asymmetric* abilities in certain niches--such as advanced cruise missiles and conventional short-range ballistic missiles (SRBMs). Asymmetric warfare generally is defined as attacks by a weaker or more technologically backward opponent on a stronger foe's vulnerabilities using unexpected or innovative means, while avoiding the adversary's strengths. China's effort to "leapfrog" generations of technology in weapons programs is often times perceived as an effort to develop new and surprising capabilities, but most of the actual programs are derivative of efforts already well underway in more developed countries. Rather than technological breakthroughs, Beijing's military modernization effort could more accurately be described as a focus on *asymmetric engagement* capabilities. China is seeking to identify innovative tactics and employment parameters for systems and technologies which the PLA has successfully employed or can be reasonably expected to employ in the next two decades.
- "… Beijing's military modernization program, underway for the past two decades, is designed to prepare the PLA to conduct regional active defensive warfare in support of Chinese economic interests and sovereignty claims--a doctrinal shift away from a focus on the large-scale, land-based guerrilla warfare of Mao's classic "People's War." Chinese doctrine and tactics, however, still bear the indelible mark of Mao's teachings, particularly as they apply to concentration of power by a technologically inferior force at select times and places on the battlefield to overcome a foe armed with superior weapons.
- "Rather than shifting priority resources from civil infrastructure and economic reform programs to an across-the-board modernization of the PLA, Beijing is focusing on those programs and assets which will give China the most effective means for exploiting critical vulnerabilities in an adversary's military capabilities. This approach potentially will give Beijing the "credible intimidation" needed to accomplish political and military goals without having to rely on overwhelming force-on-force superiority. China's modernization programs thus seek to realize short-term improvements in anti- surface warfare (ASuW) and precision strike and longer term advances in missile defense, counter- space, and information warfare (IW). Concurrently, the PLA is acquiring weapons that would be useful in countering potential adversaries operating on naval platforms or from bases in the East and South China Seas, particularly stand-off weapons such as anti-ship cruise missiles (ASCMs) and long-range land-attack cruise missiles (LACMs), as well as SRBMs. Beijing also is working to address problems associated with integrating advanced weapons systems into their inventory; and weaknesses in command, control,

communication, computers, and intelligence (C4I); training; and logistics, so as to improve the PLA's overall warfighting capability.

- "As demonstrated in military exercises in the Taiwan Strait in 1995 and 1996, China views its growing conventionally armed ballistic missile force as a potent military and political weapon to influence Taiwan's populace and their leaders. New LACM designs, when operational, will increase China's capability to strike regional targets accurately with conventional warheads. These kinds of weapons systems will play an increasingly important role in modern combat. By 2005, the PLA likely will have deployed two types of SRBMs and a first generation LACM. An expanded arsenal of accurate, conventional SRBMs and LACMs targeted against critical facilities, such as key airfields and C4I nodes, will complicate Taiwan's ability to conduct military operations.

- *"Short-Range Ballistic Missiles (SRBMs)*. Within the next several years, the size of China's SRBM force is expected to grow substantially. The PLA currently has one regimental-sized CSS-6 (DF-15/M-9) SRBM unit deployed in southeastern China. The CSS-6 is a solid propellant, road mobile missile which can deliver a 500-kilogram conventional payload to a maximum range of 600 km. The CSS-X-7 SRBM—better known by its export designator, the M-11—also is a solid propellant, road-mobile SRBM with an estimated range of 300 km. This missile, however, has not yet entered the PLA's inventory; and an improved, longer range version may be under development. Moreover, both the CSS-6 and the CSS-X-7 are expected to incorporate satellite-assisted navigation technology to improve their accuracy. In an armed conflict with Taiwan, China's SRBMs likely would target air defense installations, airfields, naval bases, C4I nodes, and logistics facilities.

- *"Land -Attack Cruise Missiles (LACMS)*. China also is developing LACMs. These missiles appear to have a relatively high development priority. Chinese research and development of LACMs is being aided by an aggressive effort to acquire foreign cruise missile technology and subsystems, particularly from Russia. The first LACM to enter production probably would be air-launched and could be operational early in the next century.

- *"Antiship Cruise Missiles (ASCMs)*. Technological improvements to the C-801/SARDINE and the C-802/ SACCADE are providing a gradual upgrade to China's current force of antiquated, first generation, CSS-N-1/SCRUBBRUSH ASCMs. Despite the obsolescence of many of its ships, its lack of operational experience and its inability to resupply ASCMs at sea, the PLA Navy could assemble a sizeable ASuW force against Taiwan and, most likely, saturate the Taiwan Navy with barrages of ASCMs. In addition, B-6D bombers subordinate to the PLA Naval Air Force (PLANAF) are capable of firing the C-601/KRAKEN ASCM. The Navy's new FB-7 bomber likely will carry C-801/C-802 ASCMs. China's ASCM capability is expected to improve further with the planned acquisition of two Russian-built SOVREMENNYY-class destroyers armed with the SS-N-22/SUNBURN ASCM.

- "… Within the next several years, the size of China's SRBM force is expected to grow substantially. An expanded arsenal of conventional SRBMs and LACMs targeted against critical facilities, such as key airfields and C4I nodes, will complicate Taiwan's ability to conduct military operations. By 2005, China will have deployed both the CSS-6 and CSS-7 SRBM. In addition, the PLA could have a first generation, air-launched LACM in its inventory. Should Beijing choose escalation, a rapid transition from relatively low-intensity blockade operations to massive missile strikes would be a likely step, particularly as a pretext to an invasion. These missile attacks most likely would be high-volume, precision strikes against priority military and political targets, including air defense facilities, airfields, Taiwan's C2 infrastructure, and naval facilities. China, however, could encounter problems coordinating missile firings with other concurrent military operations, such as air and maritime engagements. Exclusive Taiwan reliance on active missile defenses and associated BM/C3I, however, will not sufficiently offset the overwhelming advantage in offensive missiles which Beijing is projected to possess in 2005.

- "…Despite anticipated improvements to Taiwan's missile and air defense systems, by 2005, the PLA will possess the capability to attack Taiwan with air and missile strikes which would degrade key military facilities and damage the island's economic infrastructure. China will continue to give priority to long-range precision-strike programs. Similarly, despite improvements in Taiwan's ability to conduct ASW operations, China will retain the capability to interdict Taiwan's SLOCs and blockade the island's principal maritime ports. Should China invade Taiwan, such an operation would require a major commitment of civilian air and maritime transport assets, would be prolonged in duration, and would not be automatically guaranteed to succeed. In the end, any of these options would prove to be costly to Beijing--politically, economically, diplomatically, and militarily.

- "Beyond 2005, development of a modern military force capable of exerting military influence within the region, achieving deterrence against potential enemies, preserving independence of action in domestic and foreign affairs, protecting the nation's economic resources and maritime areas, and defending the sovereignty of the nation's territory will remain one of China's national priorities. Beijing will strive to create a smaller, more modern, better trained, more professional, and better logistically supported force, with an emphasis on air, naval and missile forces. China will continue to improve its regional force projection capabilities, but will not possess the conventional military capabilities to exert global influence.

- "The PLA will field large numbers of increasingly accurate SRBMs and introduce LACMs into its inventory. China's naval forces will continue their transition from a large coastal defense force to a smaller, more modern force able to conduct

limited sea control operations against regional opponents in the East and South China Seas. China's air force will continue to assimilate greater numbers of fourth generation aircraft into its inventory, upgrade its regional IADS, and expand its airborne refueling and AEW capabilities. China will retain a numerical advantage over Taiwan in terms of both personnel and weapons."

CIA Estimate of Chinese Missile Force Trends – January 2002

China has been modernizing its long-range strategic missile force since the mid-1980s, shifting from reliance primarily on silo-based liquid-propellant CSS-4s to mobile solid-propellant systems. The Intelligence Community projects that by 2015, the total number of Chinese strategic warheads will rise several-fold, though it will remain still well below the number of Russian or US forces.

The Intelligence Community projects that Chinese ballistic missile forces will increase several-fold by 2015, but Beijing's future ICBM force deployed primarily against the United States—which will number around 75 to 100 warheads—will remain considerably smaller and less capable than the strategic missile forces of Russia and the United States.

Proliferation of ballistic missile-related technologies, materials, and expertise—especially by Russian, Chinese, and North Korean entities—has enabled emerging missile states to accelerate the development timelines for their existing programs, acquire turnkey systems to gain previously non-existent capabilities—in the case of the Chinese sale of the M-11 SRBM to Pakistan—and lay the groundwork for the expansion of domestic infrastructures to potentially accommodate even more capable and longer range future systems.

Strategic Missile Forces

China's current ICBM force consists of large, liquid-propellant missiles armed with single nuclear warheads. Of these ICBMs, about 20 are CSS-4 silo-based missiles that can reach targets in the United States. The Chinese also have about a dozen CSS-3 ICBMs that are almost certainly intended as a retaliatory deterrent against targets in Russia and Asia. China also has a medium-range SLBM (the CSS-NX-3/JL-1).

Beijing is concerned about the survivability of its strategic deterrent against the United States and has a long-running modernization program to develop mobile, solid-propellant ICBMs. The IC projects that by 2015, most of China's strategic missile force will be mobile.

China has three new, mobile, solid-propellant strategic missiles in development—the road-mobile CSS-X-10 ICBM (also called the DF-31), which is now in the flight-test stage; a longer range version of the DF-31; and the JL-2 SLBM. This modernization effort, which dates from the mid-1980s, forms the foundation of Beijing's efforts to field a modern, mobile, and more survivable strategic missile force.

- China could begin deploying the DF-31 ICBM during the first half of the decade.
- Beijing could begin deploying the DF-31 follow-on ICBM and JL-2 SLBM in the last half of the decade.

China has had the capability to develop and deploy a multiple reentry vehicle system[3] for many years, including a MIRV system. The IC assesses that China could develop a multiple RV system for the CSS-4 ICBM in a few years. Chinese pursuit of a multiple RV capability for its *mobile* ICBMs and SLBMs would encounter significant technical hurdles and would be costly.

The IC has differing projections of the overall size of Chinese strategic ballistic missile forces over the next 15 years, ranging from about 75 to 100 warheads deployed primarily against the United States. MIRVing and missile defense counter-measures would be factors in the ultimate size of the force. In addition, China would have about two dozen shorter range DF-31 and CSS-3 ICBMs that could reach parts of the United States.

Theater Ballistic Missile Force: China maintains a robust CSS-5 MRBM force and continues to increase the capabilities of its SRBM force deployed opposite Taiwan.

Conventionally Armed Ballistic Missiles: China's leaders calculate that conventionally armed ballistic missiles add a potent new dimension to Chinese military capabilities, and they are committed to continue fielding them at a rapid pace. Beijing's growing SRBM force provides China with a military capability that avoids the political and practical constraints associated with the use of nuclear-armed missiles. The latest Chinese SRBMs provide a survivable and effective conventional strike force and expand conventional ballistic missile coverage.

The IC projects an SRBM force in 2005 of several hundred missiles

CIA Estimate of Chinese Role in Proliferation: January 30, 2002

- Beijing continued to take a very narrow interpretation of its bilateral nonproliferation commitments with the United States. In the case of missile-related transfers, Beijing has on several occasions pledged not to sell Missile Technology Control Regime (MTCR) Category I systems but has not recognized the regime's key technology annex. China is not a member of the MTCR.
- In November 2000, China committed not to assist, in any way, any country in the development of ballistic missiles that could be used to deliver nuclear weapons, and to enact at an early date a comprehensive missile-related export control system.
- The CIA reported on January 30, 2002 that Chinese entities continued to provide Pakistan with missile-related technical assistance. Pakistan has been moving toward domestic serial production of solid-propellant SRBMs with Chinese help. Pakistan also needs continued Chinese assistance to support development of the two-stage Shaheen-II MRBM. In addition, firms in China have provided dual-use missile-related items, raw materials, and/or assistance to several other countries of proliferation concern—such as Iran, North Korea, and Libya.
- In the nuclear area, China has made bilateral pledges to the United States that go beyond its 1992 NPT commitment not to assist any country in the acquisition or development of nuclear weapons. For example, in May 1996 Beijing pledged that it would not provide assistance to unsafeguarded nuclear facilities.
- With respect to Pakistan, Chinese entities in the past provided extensive support to unsafeguarded as well as safeguarded nuclear facilities, which enhanced substantially Pakistan's nuclear weapons capability. We cannot rule out some continued contacts between Chinese entities and entities associated with Pakistan's nuclear weapons program subsequent to Beijing's 1996 pledge and during this reporting period.
- In October 1997, China gave the United States assurances regarding its nuclear cooperation with Iran. China agreed to end cooperation with Iran on supply of a uranium conversion facility and undertake no new cooperation with Iran after completion of two existing projects—a zero-power reactor and a zirconium production plant. The Chinese appear to have lived up to their UCF pledge, but we are aware of some interactions between Chinese and Iranian entities that have raised questions about its "no new nuclear cooperation" pledge. According to the State Department, the Administration is seeking to address these questions with appropriate Chinese authorities.
- Prior to the reporting period, Chinese firms had supplied dual-use CW-related production equipment and technology to Iran. The US sanctions imposed in May 1997 on seven Chinese entities for knowingly and materially contributing to Iran's CW program remain in effect. Evidence during the current reporting period shows Iran continues to seek such assistance from Chinese entities.
- China is a primary supplier of advanced conventional weapons to Pakistan and Iran, among others. Beijing and Islamabad also have negotiated the sale of an additional 40 F-7 fighters for delivery to Pakistan.

Part Six

North Korean Force Trends

US Department of Defense Estimate of North Korean Actions and Intentions Involving Nuclear, Biological, and Chemical Weapons

Objectives, Strategies, and Resources

Despite the June 2000 summit meeting and meetings between high level U.S. and North Korean officials on the one hand, and economic turmoil and continued food shortages on the other, we believe North Korea remains committed to maintaining strong military forces. These forces continue to be deployed close to the border with South Korea in an offensively oriented posture, and North Korea's NBC and missile programs likely remain key components of its overall security strategy. The most likely large-scale regional war scenario over the near term, which would involve the United States, would be on the Korean peninsula. In recent years, North Korea has continued to pose a com-plex security challenge to the United States and its allies. Prior to the 1994 Agreed Framework, North Korea is believed to have produced and diverted sufficient plutonium for at least one, and possibly two, nuclear weapons. In addition, although North Korea froze the production of plutonium in 1994, there are concerns that North Korea is continuing with some elements of a nuclear weapons program. North Korea also possesses stockpiles of chemical weapons, which could be used in the event of renewed hostilities on the peninsula. Research and development into biological agents and toxins suggest North Korea may have a biological weapons capability. North Korea has hundreds of ballistic missiles available for use against targets on the peninsula, some of which are capable of reaching tar-gets in Japan. Its missile capabilities are increasing at a steady pace, and it has progressed to producing medium-range ballistic missiles (MRBMs). North Korea also has continued development of even longer-range missiles that would be able to threaten areas well beyond the region, including portions of the continental United States. As a result of U.S. diplomatic efforts, however, the Democratic People's Republic of Korea (DPRK) has maintained a moratorium on launches of long-range missiles for over one year.

Lastly, North Korea's willingness to sell its ballistic missiles and related missile technologies and, potentially, share its NBC expertise are major proliferation concerns. North Korea's centrally planned economic system has been crippled over the past decade and is unable to meet the most basic needs of its people, although there is limited evidence that the economic decline may have slowed. Certainly, international food aid administered through the United Nations World Food Program has played a significant role in alleviating the food crisis. North Korea likely will continue to require inter-national food assistance for the foreseeable future. The regime continues with its decades old policy to fund its military programs, including NBC and missile forces, at the expense of its civil economy.

Nuclear Program

The 1994 Agreed Framework between the United States and North Korea froze nuclear weapons material production at the Yongbyon and Taechon facilities. However, the United States believes North Korea pro-duced and diverted sufficient plutonium for at least one nuclear weapon prior to the agreement. (In any event, North Korea will have to satisfy the Interna-tional Atomic Energy Agency (IAEA) as to its exact plutonium holdings before key nuclear components can be delivered for the two light-water reactors that are to be provided under the Agreed Framework.) North Korea removed spent fuel from the Yongbyon reactor in 1994. Had Pyongyang reprocessed the spent fuel from the Yongbyon reactor, it could have pro-duced enough plutonium for several nuclear weapons. As part of the Agreed Framework, the IAEA has main-tained a continuous presence at Yongbyon, and IAEA personnel have monitored canning of the spent fuel from the reactor. The canning of all accessible spent fuel rods and rod fragments, which was carried out by a team from the United States, under the auspices of the Department of Energy (DOE), was completed in April 2000. The U.S. team maintains a presence at the site to continue maintenance activities. In 1998, the United States became concerned about an underground construction project at Kumchang-ni, in northern North Korea. The site was believed to be large enough to house a plutonium production facility and possibly a reprocessing plant. Through successful negotiations, U.S. officials were permitted to visit the facility at Kumchang-ni in May 1999. Based on the 1999 team's findings, it was concluded that the facility as then concurrently configured, was not suited to house graphite-moderated reactors or reprocessing operations. A second visit to Kumchang-ni was conducted in May 2000, during which the team found no evidence to contradict the 1999 conclusions. In the summer of 1999, the United States dispatched former Secretary of Defense William Perry to consult with North Korea on key U.S. security concerns such as its nuclear and missile programs. In the North Korea Policy Review, Dr. Perry concluded that the nuclear freeze instituted at Yongbyon's facilities remained in effect, although the U.S. remains concerned about possible continuing North Korean interest in a nuclear weapons program. Moreover, there is some evidence that North Korea has tried to procure technology that could have applications in its nuclear program. North Korea has ratified the NPT. It has not signed the Comprehensive Test Ban Treaty (CTBT). Dr. Perry recommended that the U.S. should seek the complete and verifiable cessation of testing, production, and deployment of missiles exceeding the parameters of the MTCR, and the complete cessation of export sales of such missiles and the equipment and technology associated with them.

Biological Program

North Korea has acceded to the Biological and Toxin Weapons Convention (BWC), but nonetheless has pursued biological warfare capabilities since the 1960s.Pyongyang's resources include a rudimentary (by Western standards) biotechnical infrastructure that could support the production of infectious biological warfare agents and toxins such as anthrax, cholera, and

plague. North Korea is believed to possess a munitions-production infrastructure that would allow it to weaponize biological warfare agents and may have biological weapons available for use.

Chemical Program

Like its biological warfare effort, we believe North Korea has had a long-standing chemical warfare program. North Korea's chemical warfare capabilities include the ability to produce bulk quantities of nerve, blister, choking, and blood agents, using its sizeable, although aging, chemical industry. We believe it possesses a sizeable stockpile of these agents and weapons, which it could employ should there be renewed fighting on the Korean peninsula.

North Korea is believed to be capable of weaponizing such stocks for a variety of delivery means. These would include not only ballistic missiles, but also artillery and aircraft, and possibly unconventional means.

In fact, the United States believes that North Korea has some long-range artillery deployed along the demilitarized zone (DMZ) and ballistic missiles, some of which could deliver chemical warfare agents against forward-based U.S. and allied forces, as well as against rear-area targets.

North Korean forces are prepared to operate in a contaminated environment; they train regularly in chemical defense operations and are taught that South Korean and U.S. forces will employ chemical munitions. North Korea has not signed CWC, nor it is expected to do so in the near future.

Ballistic Missiles

During the last several years, North Korea has made substantial progress with its ballistic missile forces in the areas of research and development, testing, deployment, and, most worrisome, exports. Despite efforts on the part of the United States and its East Asian allies to constrain North Korea's missile development, Pyongyang continues to move ahead.

North Korea produces SCUD B and SCUD C short-range ballistic missiles (SRBMs) as well as the No Dong MRBM. North Korea has over 500 SCUD missiles of various types in its inventory, and enough No Dong missiles for its own use as well as for export. In any attack on the South Korea, Pyongyang could use its missiles in an attempt to isolate the peninsula from strategic reinforcement. In addition, North Korea's No Dong missiles, with their 1,300 kilometer range, are capable of striking targets throughout the peninsula as well as in nearly all of Japan.

In August 1998, North Korea launched a three-stage Taepo Dong 1 system, which it characterized as a space launch vehicle (SLV) attempting to orbit a small satellite. The launch demonstrated several of the key technologies required to develop an ICBM, including stage separation. The existence of a third stage itself was an unanticipated development in the North Korean ballistic missile program. With the Taepo Dong 1, North Korea has now demonstrated the capability to reach the entire territory of South Korea and Japan, as well as large portions of China and Russia. Potentially, a three-stage Taepo Dong 1 SLV could deliver a light payload to the United States, although with very poor accuracy.

North Korea also has moved forward with the development of other longer-range missiles, which has become a matter of growing international concern. North Korea is developing the Taepo Dong 2 (ICBM), which could deliver a several-hundred kilogram pay-load to Alaska or Hawaii, and a lighter payload to the western half of the United States. A three stage Taepo Dong 2 could deliver a several-hundred kilogram pay-load anywhere in the United States. North Korea is much more likely to weaponize the more capable Taepo Dong 2 than the three-stage Taepo Dong 1 as an ICBM. During 1999, there were indications that North Korea would test the Taepo Dong 2, but Pyongyang in September 1999, announced it would refrain from testing long-range missiles while high-level talks to improve bilateral relations with the U.S. are ongoing. The DPRK subsequently reaffirmed the moratorium in June 2000, and again, in writing, in the October 2000 Joint Communique issue at the conclusion of Vice Marshal Jo Myong Rok's visit to Washington. During Secretary Albright's historic trip to Pyongyang 23-25 October, she discussed with DPRK Chairman Kim Jong Il a range of missile-related issues, including Kim's idea of trading long-range missile restraint for launches, outside DPRK borders, of DPRK civil satellites on non-DPRK boosters. However, significant issues remain to be resolved.

Cruise Missiles and Other Means of Delivery

North Korea has several types of short-range land-, air- and sea-launched anti-ship cruise missiles, which are potential means of delivery for NBC weapons. In the past, North Korea has produced two versions of anti-ship cruise missiles based on Soviet and Chinese designs; these have ranges of about 100 kilometers. In the future, North Korea may try to modify some of these anti-ship missiles to extend their range or acquire the technology to do so. Moreover, it may try to develop or purchase land attack cruise missiles. North Korea also has a variety of fighters, bombers, helicopters, artillery, rockets, mortars, and sprayers available as potential means of delivery for NBC weapons.

Role as Supplier

During the last several years, North Korea has been a major proliferator of ballistic missiles and related technologies. The sale of No Dong missile technology to Iran has created an immediate, serious and growing capability to target U.S. forces, and our allies in the Middle East. North Korea also has provided missile technology to Pakistan. Further, these sales have had an impact on the strategic balance in the Middle East and in South Asia. In addition, these exports could lead to additional proliferation. For example, were states like Iran or Pakistan to become missile producers, they in turn could sell the missiles to other states of concern, further upsetting regional balances of power. In the past, North Korea also has brokered deals for missle-related technologies and components produced by third parties for customers in the Middle East. Pyongyang attaches a high priority to the development and sale of ballistic missiles, equipment, and related technology, as these exports are one of the North's major sources of hard currency, which fuel continued missile development and production.

Source: Department of Defense, Proliferation and Response, January 2001, North Korea section.

The Uncertain Status of North Korean Force Developments

- There is no debate within the US intelligence community over the fact that North Korea has long had large stocks of chemical and biological weapons, and has deployed them in warheads that can be used in its Scud and extended range Scud missiles. There is more debate over whether North Korean has nuclear weapons and is continuing its nuclear weapons development and production program.

- The first major reports of North Korea's nuclear program began in 1993, when analysts found satellite reconnaissance evidence that a North Korean nuclear reprocessing center at Yongbyon had gone had begun to process plutonium. This led to a diplomatic confrontation and talks where the Clinton administration obtained a North Korean pledge to freeze plutonium production at the site. In exchange, the United States, South Korea and Japan agreed to give the North oil and technical assistance to build a peaceful nuclear power program. The agreement called for international monitoring of the Yongbyon site, and Energy Department experts were allowed to encase the spent fuel rods at the center to ensure that they could not be used for warheads. Before this production freeze, however, North Korea was able to produce about 26 pounds of weapons-grade plutonium. As a result, a consensus developed that North Korea could produce one or two bombs.

- The current debate focuses on what North Korean has done since that time. The Clinton Administration initially declared that North Korea had agreed to freeze its entire nuclear program. It later became clear, however, that the agreement covered only Yongbyon and did not preclude nuclear activity at other sites. North Korea then dumped radioactive nuclear fuel out of the heavy water reactor into a cooling pool in order to replace it with fresh fuel rods. The US intelligence community estimated that the spent fuel rods contained enough plutonium for 10 nuclear warheads, and this raised serious questions as to whether North Koreans was covertly going on with its nuclear program.

- A report in the *New York Times*, which has been informally confirmed by several US experts, indicates that the Defense Intelligence Agency (DIA) began to report that it had detected a series of other secret sites, many of them underground, that analysts suspected were related to an ongoing nuclear program. By the late-1990's, DIA and the National Imagery and Mapping Agency, compiled a list of at least 10 potential sites which raised questions about their function without providing clear evidence of any weapons activity.

- One installation, at Kumchangri, was believed to house an underground nuclear reactor and plutonium reprocessing operation. In May 1999, this led the US to pressure North Korea to allow an inspection of the installation which had the same visual signatures as if North Korea was installing an underground a reactor, including the water supplies for water cooling. When North Korea did allow inspection, however, the US only found a series of empty tunnels with no large underground chamber able to hold a nuclear reactor. Another inspection in May 2000 had the same result.

- The *Times* reported that some intelligence experts feel the US gave North Korea too much warning before inspecting the site, making it possible for the North Koreans to hide its purpose. However, State Department officials became leary of the DIA estimates, another installation DIA suspected proved to be nothing more that an underground storage site for the memorabilia of the North Korean leadership.

- This eventually led Secretary of State Madeleine K. Albright and Lt. Gen. Patrick Hughes, director of the DIA, to clash over intelligence report suggesting that North Korea had built a storage installation that housed components for nuclear warheads. State Department officials indicated that DIA was reporting an over-pessimistic picture. DIA indicated in turn that the State Department was too willing to overlook reports of suspicious activity. In their view, the failure of a single inspection does not mean the United States should stop pressing the North Koreans about suspect installations, including the building suspected of housing warhead components. Some of the debate focused on an installation DIA suspected of being a storage building for components of nuclear warheads. The identity and exact location of this center, whose existence has not been released, but the Times reports that intelligence on the storage center was obtained at least three years ago, and was based not only on spy satellite photographs and intercepted communications, but also on "human intelligence" -- spies -- reporting to DIA.[iii]

- What is clear is that North Korea is steadily acquiring more advanced missile forces in spite of major economic problems, its rapproachment talks with South Korea in June 2000, and its agreements to suspend the test firing of long-range missiles in September 1999 and June 2000. It has tested a booster that could allow it to develop missiles that could strike the US, and it has had a serious nuclear weapons development effort in the past. As Table III.5 shows, North Korea also has a wide range of missile programs. It also has already deployed large numbers of shorter-range missiles with chemical and probably biological warheads. These include extended range Scud-type missiles with ranges over 1,300 kilometers. The US intelligence community also reported in June 2000 that North Korea did not suspend any other aspects of development and production after it agreed to suspend missile tests in September 1999.

- North Korea launched a multistage Taepo Dong-1 missile across Japan on August 31, 1998 -- in an effort to place a satellite in orbit. The mission failed, but the United States and its allies were surprised and shocked by the missile's 2,000-kilometer range. David J. Osias, an officer of the Defense Intelligence Agency, stated that "The third stage concerns us. Nobody knew

they had it," during a national media update April 26-27, 1998 at the Army Space and Missile Defense Command headquarters.[iv]

- North Korea has limits. The Tapeo Dong 1 test was a failure, and the missile was anything but an advanced design. The first stage was modified from a liquid-fueled Scud and the second from the No Dong. Both are 1960s technology. The third stage was a small, solid-fueled rocket designed to put a small satellite into space. It was too small to carry a nuclear weapon or an effective biological payload and dispersal system, and the system was so inherently inaccurate that it was unclear it had growth potential to hit a city-sized target. US experts feel that North Korea has since abandoned work on the Taepo Dong-1 missile, and is now developing the Taepo Dong-2. This missile is a two-stage system that uses a cluster of No Dong engines in the first stage and a single No Dong in the second stage. It has never been tested.[v]

- Furthermore, North Korea agreed to suspend further tests of long-range missiles in September 1999 -- largely as a result of the negotiating efforts of former Secretary of Defense William Perry,.[vi] This agreement was reached after the NIC report was written, and was renewed in June 2000.. However, US intelligence community also reported in June 2000 that North Korea did not suspend any other aspects of development and production after it agreed to suspend missile tests in September 1999.

- A CIA report in August 2000 also summarized the state of proliferation in North Korea as follows,[vii]

- P'yongyang continues to acquire raw materials from out-of-country entities to produce WMD and ballistic missiles. During the reporting period, there were increased reflections of North Korean procurement of raw materials and components for its ballistic missile programs from various foreign sources, especially through firms in China. North Korea produces and is capable of using a wide variety of chemical and possibly biological agents, as well as their delivery means.

- During the second half of 1999, Pyongyang sought to procure technology worldwide that could have applications in its nuclear program, but we do not know of any procurement directly linked to the nuclear weapons program. We assess that North Korea has produced enough plutonium for at least one, and possibly two, nuclear weapons. The United States and North Korea are nearing completion on the joint project of canning spent fuel from the Yongbyon complex for long-term storage and ultimate shipment out of the North in accordance with the 1994 Agreed Framework. That reactor fuel contains enough plutonium for several more weapons.

- P'yongyang continues to seek conventional weapons via the gray market. In 1999, for example, North Korea acquired MiG-21 fighter aircraft from Kazakhstan.

- …Throughout the second half of 1999, North Korea continued to export significant ballistic missile-related equipment and missile components, materials, and technical expertise to countries in the Middle East, South Asia, and North Africa. P'yongyang attaches a high priority to the development and sale of ballistic missiles, equipment, and related technology. Exports of ballistic missiles and related technology are one of the North's major sources of hard currency, which fuel continued missile development and production.

- These factors help explain why the report of the National Intelligence Council has seen North Korea as presenting the most serious near term threat to the US, and why this threat has been used as the rationale for setting early deadlines for the deployment of a US NMD system:[viii]

- "After Russia and China, North Korea is the most likely to develop ICBMs capable of threatening the United States during the next 15 years.

- North Korea attempted to orbit a small satellite using the Taepo Dong-1 SLV in August 1998, but the third stage failed during powered flight; other aspects of the flight, including stage separation, appear to have been successful.

- If it had an *operable* third stage and a reentry vehicle capable of surviving ICBM flight, a converted Taepo Dong-1 SLV *could* deliver a light payload to the United States. In these cases, about two-thirds of the payload mass would be required for the reentry vehicle structure. The remaining mass is probably too light for an early generation nuclear weapon but could deliver biological or chemical (BW/CW) warfare agent.

- Most analysts believe that North Korea *probably will test* a Taepo Dong-2 this year, unless delayed for political reasons. A two-stage Taepo Dong-2 could deliver a several-hundred kilogram payload to Alaska and Hawaii, and a lighter payload to the western half of the United States. A three-stage Taepo Dong-2 could deliver a several-hundred kilogram payload anywhere in the United States.

- North Korea is much *more likely* to weaponize the more capable Taepo Dong-2 than the three-stage Taepo Dong-1 as an ICBM."

- These comments are particularly striking in view of the fact North Korea launched a multistage Taepo Dong-1 missile across Japan on August 31, 1998 -- in an effort to place a satellite in orbit. The mission failed, but the United States and its allies were surprised and shocked by the missile's 2,000-kilometer range. David J. Osias, an officer of the Defense

Intelligence Agency, stated that "The third stage concerns us. Nobody knew they had it," during a national media update April 26-27, 1998 at the Army Space and Missile Defense Command headquarters.[ix]

- The fact remains, however, that the Korean test was a failure, and that the missile was anything but an advanced design. The first stage was modified from a liquid-fueled Scud and the second from the No Dong. Both are 1960s technology. The third stage was a small, solid-fueled rocket designed to put a small satellite into space. It was too small to carry a nuclear weapon or an effective biological payload and dispersal system, and the system was so inherently inaccurate that it was unclear it had growth potential to hit a city-sized target. US experts feel that North Korea has since abandoned work on the Taepo Dong-1 missile, and is now developing the Taepo Dong-2. This missile is a two-stage system that uses a cluster of No Dong engines in the first stage and a single No Dong in the second stage. It has never been tested.[x]
- Furthermore, North Korea agreed to suspend further tests of long-range missiles in September 1999 -- largely as a result of the negotiating efforts of former Secretary of Defense William Perry,.[xi] This agreement was reached after the NIC report was written, and was renewed in June 2000.

CIA Estimate of North Korean Missile Force Trends – January 2002

North Korea has hundreds of Scuds and No Dong missiles and continues to develop the longer range Taepo Dong-2, which will enable the North to target the United States. In May 2001, however, Kim Chong-il unilaterally extended the North's voluntary flight-test moratorium—in effect since 1999—until 2003, provided negotiations with the United States proceeded.

North Korea has extended until 2003 the missile launch moratorium it announced late in 1999, although the North continues to work on the Taepo Dong-2 program. The Taepo Dong-2—capable of reaching parts of the United States with a nuclear weapon-sized payload—may be ready for flight-testing. The initial test likely would be conducted in a space launch configuration. Iran also is pursuing a longer range missile capability.

North Korea has assumed the role as the missile and manufacturing technology source for many programs. North Korean willingness to sell complete systems and components has enabled other states to acquire longer range capabilities earlier than otherwise would have been possible—notably the sale of the No Dong MRBM to Pakistan. The North also has helped countries to acquire technologies to serve as the basis for domestic development efforts—as with Iran's reverse-engineering of the No Dong in the Shahab-3 program. Meanwhile, Iran is expanding its efforts to sell missile technology.

Ballistic Missile Programs

Taepo Dong-2. The multiple-stage Taepo Dong-2—capable of reaching parts of the United States with a nuclear weapon-sized payload—may be ready for flight-testing. The North probably also is working on improvements to its current design.

The Taepo Dong-2 in a two-stage ballistic missile configuration could deliver a several-hundred-kg payload up to 10,000 km—sufficient to strike Alaska, Hawaii, and parts of the continental United States. If the North uses a third stage similar to the one used on the Taepo Dong-1 in 1998 in a ballistic missile configuration, then the Taepo Dong-2 could deliver a several-hundred-kg payload up to 15,000 km—sufficient to strike all of North America. A Taepo Dong-2 flight test probably would be conducted as an SLV with a third stage to place a small payload into the same orbit the North Koreans tried to achieve in 1998.

No Dong. The 1,300-km-range No Dong remains the longest-range ballistic missile North Korea has deployed.

WMD Payload Options: The Intelligence Community judged in the mid-1990s that North Korea had produced one, possibly two, nuclear weapons, although the North has frozen plutonium production activities at Yongbyon in accordance with the Agreed Framework of 1994. North Korea also has chemical and biological weapons programs.

In April 2001, P'yongyang signed a Defense Industry Cooperation Agreement with Russia, laying the groundwork for potential arms sales and transfers to North Korea. Actual sales and deliveries, however, will be dependent on P'yongyang's ability to pay.

During the second half of 2001, P'yongyang continued its attempts to procure technology worldwide that could have applications in its nuclear program. We assess that North Korea has produced enough plutonium for at least one, and possibly two, nuclear weapons. Spent fuel rods canned in accordance with the 1994 Agreed Framework contain enough plutonium for several more weapons.

Foreign Assistance: North Korea is nearly self-sufficient in developing and producing ballistic missiles and has demonstrated a willingness to sell complete systems and components that have enabled other states to acquire longer range capabilities earlier than would otherwise have been possible and to acquire the basis for domestic development efforts.

Role as Proliferator: Throughout the first half of 2001, North Korea continued to export significant ballistic missile–related equipment, components, materials, and technical expertise to countries in the Middle East, South Asia, and North Africa. P'yongyang attaches a high priority to the development and sale of ballistic missiles, equipment, and related technology. Exports of ballistic missiles and related technology are one of the North's major sources of hard currency, which fuel continued missile development and production.

North Korean Missile Programs and Developments

Type	Names	Range (KM)	Warhead (Kg)	Stages	Service Status
SRBM	Hawsong 5, Scud B	302-340	1000	1	Since 1985
	Storable liquid fuel; TEL launch Sold to Iran and a number of other states.				
SRBM	Hwasong 6, Scud C	500	770	1	Since 1989
	Storable liquid fuel; TEL launch. Sold to Iran and Syria. Deployed in hardened, underground shelters in North Korea.				
MRBM	No Dong 1, Rodong 1, Scud D	1,350	1200	1	Since 1997
	Storable liquid fuel; Uses missile-erector-launcher (MEL). Seems similar to Shihab 3 in Iran and Ghauri program In Pakistan. First test over East China Sea in May 1993, but did not go over 500 kilometers. Iranian and Pakistani observers present at test. Estimate 50-100 missiles no produced.				
IRBM	Taep'o-Dong 1, No-Dong 2. Rodong 2, Scud X	1,500- 2,200	700- 1,000	2	1998?
	Some reports is similar to the Chinese DF-3.				
SLV	Taep'o-Dong 1 Space Launch-Vehicle	4,000	50-100	3	1998
	Partially successful test launch on August 23, 1998. Claim launched small satellite.				
ICBM	Taep'o-Dong 2, No Dong 3	4,000- 6,000	700- 1,000	2	2000+
ICBM	?	6,000+	100-500	3	?

Source: Adapted from Joseph S. Bermudez, Jr., "The Rise and Rise of North Korea's ICBMs, International Defense Review, 7/1999, pp. 57-61.

Part Seven

Indian Force Trends

US CIA Estimate of Indian Force Developments as of September 2001

India continues its nuclear weapons development program, for which its underground nuclear tests in May 1998 were a significant milestone. The acquisition of foreign equipment will benefit New Delhi in its efforts to develop and produce more sophisticated nuclear weapons. During this reporting period, India continued to obtain foreign assistance for its civilian nuclear power program, primarily from Russia.

India continues to rely on foreign assistance for key missile technologies, where it still lacks engineering or production expertise. Entities in Russia and Western Europe remained the primary conduits of missile-related and dual-use technology transfers during the latter half of 2000.

India continues an across-the-board modernization of its armed forces through ACW acquisitions, mostly from Russia, although many of its key programs have been plagued by delays. During the reporting period, New Delhi concluded a $3 billion contract with Russia to produce under license 140 Su-30 multirole fighters and continued negotiations with Moscow for 310 T-90S main battle tanks, A-50 Airborne Early Warning and Control (AWACS) aircraft, Tu-22M Backfire maritime strike bombers, and an aircraft carrier. India also continues to explore options for leasing or purchasing several AWACS systems from other entities. India also signed a contract with France for 10 additional Mirage 2000H multirole fighters and is considering offers for jet trainer aircraft from France and the United Kingdom. In addition to helping India with the development of its indigenous nuclear-powered submarine, Russia is negotiating with India the possible lease of a Russian nuclear-powered attack submarine.

Russian entities continue to supply a variety of ballistic missile-related goods and technical know-how to countries such as Iran, India, China, and Libya. Iran's earlier success in gaining technology and materials from Russian entities has helped to accelerate Iranian development of the Shahab-3 MRBM, and continuing Russian assistance likely supports Iranian efforts to develop new missiles and increase Tehran's self-sufficiency in missile production.

Russia continues to be a major supplier of conventional arms. It is the primary source of ACW for China and India, it continues to supply ACW to Iran and Syria, and it has negotiated new contracts with Libya and North Korea.
Russia continues to be the main supplier of technology and equipment to India and China's naval nuclear propulsion programs. In addition, Russia has discussed leasing nuclear-powered attack submarines to India.

The Russian Government's commitment, willingness, and ability to curb proliferation-related transfers remain uncertain. The export control bureaucracy was reorganized again as part of President Putin's broader government reorganization in May 2000. The Federal Service for Currency and Export Controls (VEK) was abolished and its functions assumed by a new department in the Ministry of Economic Development and Trade. VEK had been tasked with drafting the implementing decrees for Russia's July 1999 export control law; the status of these decrees is not known. Export enforcement continues to need improvement. In February 2000, Sergey Ivanov, then Secretary of Russia's Security Council, said that during 1998-99 the government had obtained convictions for unauthorized technology transfers in three cases. The Russian press has reported on cases where advanced equipment is simply described as something else in the export documentation and is exported. Enterprises sometimes falsely declare goods to avoid government taxes.

CIA Estimate of Indian Missile Force Trends – January 2002

New Delhi believes that a nuclear-capable missile delivery option is necessary to deter Pakistani first use of nuclear weapons and thereby preserve the option to wage limited conventional war in response to Pakistani provocations in Kashmir or elsewhere. Nuclear weapons also serve as a hedge against a confrontation with China. New Delhi views the development, not just the possession, of nuclear-capable ballistic missiles as the symbols of a world power and an important component of self-reliance.

Missile Programs

Growing experience and an expanding infrastructure are providing India the means to accelerate both development and production of new systems. New Delhi is making progress toward its aim of achieving self-sufficiency for its missile programs, but it continues to rely on foreign assistance.

Converting the Indian SLV into an ICBM?

Rumors persist concerning Indian plans for an ICBM program, referred to in open sources as the Surya. Some Indian defense writers argue that possession of an ICBM is a key symbol in India's quest for recognition as a world power and useful in preventing diplomatic bullying by the United States. Most components needed for an ICBM are available from India's indigenous space program. India could convert its polar space launch vehicle into an ICBM within a year or two of a decision to do so.

* The 150-km-range Prithvi I SRBM continues to be India's only deployed ballistic missile.

* The Prithvi II SRBM is a modified Prithvi I with an increased range of 250 km.

* The Agni series, which probably will be deployed during this decade, will be the mainstay of India's nuclear-armed missile force.

The Sagarika SLBM probably will not be deployed until 2010 or later.

Foreign Assistance

India continues to push toward self-sufficiency, especially in regard to its missile programs. Nevertheless, New Delhi still relies heavily on foreign assistance.

US Department of Defense Estimate of Indian Actions and Intentions Involving Nuclear, Biological, and Chemical Weapons

Objectives, Strategies, and Resources

In his speech to the UN General Assembly on 24 September 1998, Indian Prime Minister Vajpayee noted that while India hoped to fully participate in international arms-control negotiations, it had no intention of scaling back its nuclear weapons program. He stated that, "Mindful of its deteriorating security environment which has obliged us to stand apart from the CTBT in 1996, India undertook a limited series of five under-ground tests. These tests were essential for ensuring a credible nuclear deterrent for India's national security in the foreseeable future." He also declared that "in announcing a moratorium (on further nuclear tests), India has already accepted the basic obligation of the CTBT. In 1996, India could not have accepted the obligation, as such a restraint would have eroded our capability and compromised our national security." India's goal of indigenous production for all its pro-grams is another element of New Delhi's strategy to demonstrate its technological and military achievements and to help it to establish independence from foreign suppliers and outside political influence. The Indian economy will continue to grow moderately, with the real GDP expected to grow at an aver-age annual rate of 5-6 percent for the next few years, assuming India avoids major conflicts, pursues eco-nomic reforms, and has reasonable weather. Despite the announced 28-percent nominal increase in the 2000 defense budget, some of which reflects inflation and definitional differences, military spending is expected to increase by about 2-3 percent annually in real terms over the next ten years. Future defense bud-gets likely will include a focus on investments for long-term military production self-sufficiency, including those for nuclear and missile forces, in keeping with India's overall goal of achieving independence from foreign suppliers.

Nuclear Program

On 11 and 13 May 1998, India conducted what it claimed were five nuclear explosive tests. According to Indian officials, the 11 May tests included a fission device with a yield of about 12 kilotons, a thermonuclear device with a yield of about 43 kilotons, and a third test with a yield of about 0.2 kilotons. An Indian spokesman stated that the first set of tests was intended "to establish that India has a proven capability for a weaponized nuclear program."

India claimed that its 13 May tests had yields of about 0.5 and 0.2 kilotons, which were carried out to gener-ate additional data for computer simulations. According to the Chairman of India's Atomic Energy Commission, the tests enabled India to build "an adequate scientific database for designing the types of devices that [India] needs for a credible nuclear deter-rent." The tests triggered international condemnation and the United States imposed wide-ranging sanctions against India.

The tests were India's first since 1974, and reversed the previously ambiguous nuclear posture where Indian officials denied possession of nuclear weapons. Indian officials cited a perceived deterioration of India's security environment, including increasing Pakistani nuclear and missile capabilities and perceived threats from China, to justify the tests. India has a capable cadre of scientific personnel and a nuclear infrastructure, consisting of numerous research and development centers, 11 nuclear power reactors, uranium mines and processing plants, and facilities to extract plutonium from spent fuel. With this large nuclear infrastructure, India is capable of manufacturing complete sets of components for plutonium-based nuclear weapons, although the acquisition of foreign nuclear-related equipment could benefit New Delhi in its weapons development efforts to develop and pro-duce more sophisticated nuclear weapons. India probably has a small stockpile of nuclear weapon components and could assemble and deploy a few nuclear weapons within a few days to a week. The most likely delivery platforms are fighter-bomber air-craft. New Delhi also is developing ballistic missiles that will be capable of delivering a nuclear payload in the future.

India is in the beginning stages of developing a nuclear doctrine. In August 1999, the Indian government released a proposed nuclear doctrine prepared by a private advisory group appointed by the government. It stated that India will pursue a doctrine of credible minimum deterrence. The document states that the role of nuclear weapons is to deter the use or the threat of use of nuclear weapons against India, and asserts that India will pursue a policy of "retaliation only." The draft doctrine maintains that India "will not be the first to initiate a nuclear strike, but will respond with punitive retaliation should deterrence fail." The doc-trine also reaffirms India's pledge not to use or threaten to use nuclear weapons against states that do not possess nuclear weapons. It further states that India's nuclear posture will be based on a triad of aircraft, mobile land-based systems, and sea-based plat-forms to provide a redundant, widely dispersed, and flexible nuclear force. Decisions to authorize the use of nuclear weapons would be made by the Prime Minister or his "designated successor(s)." The draft doc-trine has no official standing in India, and the United States has urged Indian officials to distance themselves from the draft, which is nor consistent with India's stated goal of a minimum nuclear deterrent. India expressed interest in signing the CTBT, but has not done so. It has pledged not to conduct further nuclear tests pending entry into force of the CTBT. Indian officials have tied signature and ratification of the CTBT to developing a domestic consensus on the issue. Similarly, India strongly opposed the NPT as discriminatory but it is a member of the IAEA. Only four of India's 13 operational nuclear reactors currently are subject to IAEA safeguards. In June 1998, New Delhi signed a deal with Russia to purchase two light-water reactors to be built in southern India; the reactors will be under facility-specific IAEA safeguards. However, the United States has raised concerns that Russia is circumventing the 1992 NSG guidelines by providing NSG trigger list technology to India, which does not allow safeguards on all of its nuclear facilities.

India has taken no steps to restrain its nuclear or missile programs. In addition, while India has agreed to enter into negotiations to complete a fissile material cutoff treaty, it has not agreed to refrain from producing fissile material before such a treaty would enter into force.

Biological and Chemical Programs

India has many well-qualified scientists, numerous biological and pharmaceutical production facilities, and biocontainment facilities suitable for research and development of dangerous pathogens. At least some of these facilities are being used to support research and development for biological warfare defense work. India has ratified the BWC.

India: NBC Weapons and Missile Program

- Nuclear Conducted nuclear experiment tests on 11 and 13 May 1998; claimed a total of five tests.
- Conducted a peaceful nuclear explosive (PNE) in 1974. Capable of manufacturing complete sets of components for plutonium-based nuclear weapons.
- Has small stockpile of nuclear weapons components and probably can deploy a few nuclear weapons within a few days to a week. It can deliver these weapons with fighter aircraft.
- Announced draft nuclear doctrine in August 1999 of no-first-use; stated intent to create triad of air-, land-, and sea-based missile delivery systems.
- Has signed neither the NPT nor the CTBT.
- Biological Has substantial biotechnical infrastructure and expertise, some of which is being used for biological warfare defense research.
- Ratified the Biological and Toxin Weapons Convention.
- Chemical Acknowledged chemical warfare program in 1997 and stated that related facilities would be open for inspection.
- Has sizeable chemical industry, which could be source of dual-use chemicals for countries of proliferationconcern.
- Ratified the CWC.
- Ballistic Missiles Has development and production facilities for solid- and liquid-propellant fuel missiles.
- Three versions of liquid-propellant
    - Prithvi SRBM: Prithvi I (Army) —150 kilometer range (produced)
    - Prithvi II (Air Force) —250 kilometer range (tested)
    - Dhanush (Navy) —250 kilometer range (unsuccessfully tested)
    - Solid-propellant Agni MRBM:
    - Agni tested in 1994 (estimated range 2,000 kilometers)
    - Agni II tested in April 1999 (estimated range 2,000 kilometers)
- SLBM and IRBM also under development. Is not a member of the MTCR.
- Is not a member of the MTCR.
- Other Means of Delivery
    - Has ship-borne and airborne anti-ship cruise missiles; none have NBC warheads.
    - Aircraft: fighter bombers.
    - Ground systems: artillery and rockets.

India is an original signatory to the CWC. In June 1997, it acknowledged that it had a dedicated chemical warfare production program. This was the first time India had publicly admitted that it had a chemical warfare effort. India also stated that all related facilities would be open for inspection, as called for in the CWC, and subsequently, it has hosted all required CWC inspections. While India has made a commitment to destroy its chemical weapons, its extensive and well-developed chemical industry will continue to be capable of producing a wide variety of chemical agent pre-cursors should the government change its policy. In the past, Indian firms have exported a wide array of chemical products, including Australia Group-con-trolled items, to several countries of proliferation concern in the Middle East. (Australia Group-controlled items include specific chemical agent precursors, microorganisms with biological warfare applications, and dual-use equipment that can be used in chemical or

biological warfare programs.) Indian companies could continue to be a source of dual-use chemicals to countries of proliferation concern.

Ballistic Missiles

The development of Indian and Pakistani ballistic missile capabilities has raised concerns about destabilizing efforts to develop and deploy nuclear-armed missiles. India has an extensive, largely indigenous ballistic missile program involving both SRBMs and MRBMs, and has made considerable progress with this program in the past several years. For example, India now has the Prithvi SRBM in production and successfully tested the Agni II MRBM in April 1999. India has development and production infrastructures for both solid- and liquid-propelled missiles. By striving to achieve independence from foreign suppliers, India may be able to avoid restrictions imposed by the MTCR. Nevertheless, India's ballistic missile pro-grams have benefited from the acquisition of foreign equipment and technology, which India has continued to seek, primarily from Russia.

India's Prithvi SRBM is a single-stage, liquid-fuel, road-mobile, ballistic missile, and it has been developed in three different versions. The Prithvi I has been produced for the Indian Army and has a payload of 1,000 kilograms and a range of 150 kilometers. The Prithvi II has a 500 kilograms payload and a range of 250 kilometers and was designed for use by the Indian Air Force. Another variant, called the Dhanush, is under development for the Navy and is similar to the Air Force version; it is designed to be launched from a surface vessel. The Indians conducted a flight test of the Dhanush in April 2000, which failed. India's MRBM program consists of the Agni missile, with an estimated range of about 2,000 kilometers with a 1,000 kilograms payload. An early version was tested in 1994 and India successfully tested the follow-on version, the rail-mobile Agni II, in April 1999. This missile will allow India to strike all of Pakistan as well as many key areas of China. Development also is underway for an Intermediate Range Ballistic Missile (IRBM), which would allow India to target Beijing. Lastly, an Indian submarine-launched missile, called the Sagarika, also is under development with Russian assistance. Its intended launch platform is the "Advanced Technology Vessel" nuclear submarine.

Cruise Missiles and Other Means of Delivery

India has ship-launched and airborne short-range anti-ship cruise missiles and a variety of short-range air-launched tactical missiles, which are potential means of delivery for NBC weapons. All were purchased from foreign sources including Russia and the United Kingdom. In the future, India may try to purchase more modern anti-ship cruise missiles, or try to develop the missiles themselves. However, funding priorities for such efforts will be well below that for ballistic missiles. India also has a variety of fighter air-craft, artillery, and rockets available.

Source: Department of Defense, Proliferation and Response, January 2001, India section.

India and Weapons of Mass Destruction

Delivery Systems

- Despite the announced 28-percent nominal increase in the 2000 defense budget, some of which reflects inflation and definitional differences, military spending is expected to increase by about 2-3 percent annually in real terms over the next ten years. Future defense budgets likely will include a focus on investments for long-term military production self-sufficiency, including those for nuclear and missile forces, in keeping with India's overall goal of achieving independence from foreign suppliers.
- The CIA reported in September 2001 that India continues an across-the-board modernization of its armed forces through ACW acquisitions, mostly from Russia, although many of its key programs have been plagued by delays. During the reporting period, New Delhi concluded a $3 billion contract with Russia to produce under license 140 Su-30 multirole fighters and continued negotiations with Moscow for 310 T-90S main battle tanks, A-50 Airborne Early Warning and Control (AWACS) aircraft, Tu-22M Backfire maritime strike bombers, and an aircraft carrier. India also continues to explore options for leasing or purchasing several AWACS systems from other entities. India also signed a contract with France for 10 additional Mirage 2000H multirole fighters and is considering offers for jet trainer aircraft from France and the United Kingdom. In addition to helping India with the development of its indigenous nuclear-powered submarine, Russia is negotiating with India the possible lease of a Russian nuclear-powered attack submarine.
- The CIA reported on January 30, 2002 that India continues an across-the-board modernization of its armed forces through ACW acquisitions, mostly from Russia, although many of its key programs have been plagued by delays. New Delhi received the first two MiG-21-93 fighter aircraft, and Hindustan Aeronautics Limited will now begin the licensed upgrade of 123 more aircraft. During the reporting period, New Delhi concluded an $800 million contract with Russia for 310 T-90S main battle tanks, as well as a smaller contract for KA-31 helicopters. India is in negotiations with Russia for nuclear submarines and an aircraft carrier, and it also continues to explore options for leasing or purchasing several AEW systems. The Indian air force has reopened the competition for jet trainer aircraft and is considering bids from the Czech Republic, France, Italy, Russia, and the United Kingdom.
    - India has two main delivery options: aircraft and missiles.
    - India posses several different aircraft capable of nuclear delivery, including the Jaguar, Mirage 2000, MiG-27 and MiG-29.
    - India is upgrading 150 Mig-21Bis fighters. It has 88 Jaguars, 147 MiG-27s, and 53 MiG-23 BN/UM configured in the strike/attack mode.
    - India has 36-38 Mirage-2000Hs strike aircraft with a significant nuclear strike capability, and is considering buying and deploying 18 Mirage 2000Ds. It has 64 MiG-29s.
    - India is acquiring 40 long-range Su-30 strike aircraft; 8 have been delivered The Su-30 has a strike range of 5,000 kilometers with in-flight refueling.
    - The MiG-27 and the Jaguar are strike/attack aircraft and require little or no modification to deliver nuclear weapons. The MiG-29, Su-30 and Mirage 2000 were designed for air-to-air combat combat but could be modified to deliver air-dropped nuclear weapons using external racks.
    - It can also mount a weapon on a ballistic missile. The Carnegie Endowment estimates that India has developed nuclear warheads for this purpose, but is not known to have tested such a warhead.
    - India has two major families of missile systems: The Prithvi and Agni. Reporting on these systems differs sharply by source. Estimates based on NGO sources indicate that,
    - The Prithvi is a relatively short-range missile that was tested extensively during 1995-1997, with publicly announced tests on January 27, 1996 and February 23, 1997.
    - The Indian army has one Prithvi regiment with 3-5 launchers.
    - There seem to be three variants:
        - The Prithvi SS-150 is a liquid fueled missile with a 150-kilometer range and a 1,000-kg. payload. It was ordered in 1983 and became operational in 1996. It is in low-rate production. A total of 150 seem to have been produced.
        - The Prithvi SS-250 is a liquid fueled missile with a 250-kilometer range and a 500-750 kg. payload. It was ordered in 1983 and became operational in 201. It is in low-rate production. A total of 50 seem to have been produced.
        - The Prithvi SS-1350 is a liquid fueled missile with a 350-kilometer range and a 700-1,000 kg. payload.

- Reports in 1997 indicated that India had possibly deployed, or at least was storing, conventionally armed Prithvi missiles in Punjab, very near the Pakistani border. India began test-firing the Prithvi (25) II, the Air Force version capable of targeting nearly all of Pakistan, in early 1996. In June 1997, Prithvi (150) I mobile missile systems were moved from factories in the south into Punjab, bringing many Pakistani cities within direct range of the missile.
- India has claimed the Prithvi only has a conventional warhead. This claim seems unlikely to be true.
- Estimates based on NGO sources indicate that the Agni is,
- A two-stage medium-range missile:
- It has been tested several times.
- The original Agni I was a liquid and solid-fueled missile with a 1,500-kilometer range with a 1,000-kg. warhead.
- In July 1997, the Indian defense ministry announced the revival of the Agni medium-range missile program.
- Testing of the Agni II resumed on April 11 1999 and reached a range near 2,000 kilometers. The maximum range of the missile is stated to be 2,500 kilometers, but a nominal range of 2,000 seems more likely. It is a solid fueled missile and can be launched quickly without waiting for arming or fueling. India stated in August 1999 that it was deploying the Agni II. It was first ordered in 1983, and seems to have entered production in 2000. Indian sources have said that 20 will be deployed by the end of 2001.
- India is believed to be developing the Agni III with a range of 3,700 kilometers, and possible an Agni IV with a range of 4,000-5,000 kilometers. It was first ordered in 1983, and seems to have entered production in 2000.
- India is reported to have an ICBM called the Surya under development with a range of 5,000 kilometers.
- The CIA reported in February 1999 that India's ballistic missile programs still benefited from the acquisition of foreign equipment and technology. India sought items for these programs during the reporting period from a variety of sources worldwide, including many countries in Europe and the former Soviet Union.

- The Department of Defense reported in January 2001 that,
  - India has an extensive, largely indigenous ballistic missile program involving both SRBMs and MRBMs, and has made considerable progress with this program in the past several years. For example, India now has the Prithvi SRBM in production and successfully tested the Agni II MRBM in April 1999. India has development and production infrastructures for both solid- and liquid-propelled missiles. By striving to achieve independence from foreign suppliers, India may be able to avoid restrictions imposed by the MTCR. Nevertheless, India's ballistic missile programs have benefited from the acquisition of foreign equipment and technology, which India has continued to seek, primarily from Russia.
    - India's Prithvi SRBM is a single-stage, liquid-fuel, road-mobile, ballistic missile, and it has been developed in three different versions.
    - The Prithvi I has been produced for the Indian Army and has a payload of 1,000 kilograms and a range of 150 kilometers.
    - The Prithvi II has a 500 kilograms payload and a range of 250 kilometers and was designed for use by the Indian Air Force.
    - Another variant, called the Dhanush, is under development for the Navy and is similar to the Air Force version; it is designed to be launched from a surface vessel. The Indians conducted a flight test of the Dhanush in April 2000, which failed.
  - India's MRBM program consists of the Agni missile, with an estimated range of about 2,000 kilometers with a 1,000 kilograms payload. An early version was tested in 1994 and India successfully tested the follow-on version, the rail-mobile Agni II, in April 1999.
    - This missile will allow India to strike all of Pakistan as well as many key areas of China.
    - Development also is underway for an Intermediate Range Ballistic Missile (IRBM), which would allow India to target Beijing.
  - Lastly, an Indian submarine-launched missile, called the Sagarika, also is under development with Russian assistance. Its intended launch platform is the "Advanced Technology Vessel" nuclear submarine.
  - India has ship-launched and airborne short-range anti-ship cruise missiles and a variety of short-range air-launched tactical missiles, which are potential means of delivery for NBC weapons. All were purchased from foreign sources

including Russia and the United Kingdom. In the future, India may try to purchase more modern anti-ship cruise missiles, or try to develop the missiles themselves. However, funding priorities for such efforts will be well below that for ballistic missiles.

- The CIA summarized India's missile development programs in January 2002 by stating that:
  - New Delhi believes that a nuclear-capable missile delivery option is necessary to deter Pakistani first use of nuclear weapons and thereby preserve the option to wage limited conventional war in response to Pakistani provocations in Kashmir or elsewhere. Nuclear weapons also serve as a hedge against a confrontation with China. New Delhi views the development, not just the possession, of nuclear-capable ballistic missiles as the symbols of a world power and an important component of self-reliance.
  - Growing experience and an expanding infrastructure are providing India the means to accelerate both development and production of new systems. New Delhi is making progress toward its aim of achieving self-sufficiency for its missile programs, but it continues to rely on foreign assistance.
  - Converting the Indian SLV into an ICBM? Rumors persist concerning Indian plans for an ICBM program, referred to in open sources as the Surya. Some Indian defense writers argue that possession of an ICBM is a key symbol in India's quest for recognition as a world power and useful in preventing diplomatic bullying by the United States. Most components needed for an ICBM are available from India's indigenous space program. India could convert its polar space launch vehicle into an ICBM within a year or two of a decision to do so.
  - The 150-km-range Prithvi I SRBM continues to be India's only deployed ballistic missile.
  - The Prithvi II SRBM is a modified Prithvi I with an increased range of 250 km.
  - The Agni series, which probably will be deployed during this decade, will be the mainstay of India's nuclear-armed missile force.
  - The Sagarika SLBM probably will not be deployed until 2010 or later.
  - India continues to push toward self-sufficiency, especially in regard to its missile programs. Nevertheless, New Delhi still relies heavily on foreign assistance.
  - The DCI Nonproliferation Center (NPC) reported in February 2000, and again in August 2000 that, "While striving to achieve independence from foreign suppliers, India's ballistic missile programs still benefited from the acquisition of foreign equipment and technology. India sought items for these programs during the reporting period primarily from Russia. New Delhi successfully flight-tested its newest MRBM, the Agni 2, in April 1999 after months of preparations." It also reported that, Russian entities continued to supply a variety of ballistic missile-related goods and technical know-how to Iran and were expanding missile-related assistance to Syria and India.
- India seems to be considering nuclear submarines and cruise missiles as a possible future basing mode.
  - The Indian fleet has 15 are submarines, although their operational readiness and performance is low to medicore..
  - They include a total of ten diesel-powered 'Project 877' Kilo-class submarines, known in India as the the EKM or Sindhu class, have been built with Russian cooperation under a contract between Rosvooruzhenie and the Indian Defense Ministry, with the tenth unit delivered to India in 2000. At least one is equipped with the SS-N-27 antiship cruise missiles with a range of 220 km.
  - The FAS reports that India has a number of foreign-produced cruise missile systems in its arsenal, to include Exocet, Styx, Starbright, Sea Eagle. It also has some indigenous cruise missile systems under development such as the Sagarika and Lakshya variant. The Sagarika is a SLCM with a potential range of 300-1000 kilomters. Its IOC is estimated to be in 2005.
  - India leased a Charlie-class Soviet nuclear powered attack submarine for three years beginning in 1968. It was manned by a Russian crew training Indian seamen to operate it. India then returned it to Russia in 1991, and it was decommissioned.
  - India has been working since 1985 to develop and build its own nuclear-powered submarine. It obtained plans and drawings for the Charlie II-class from the FSU in 1989. This FAS reports that the project illustrates India's industrial capabilities and weaknesses.
  - "The secretive Advanced Technology Vessel (ATV) project to provide nuclear propulsion for Indian submarines has been one of the more ill-managed projects of India. Although India has the capability of building the hull and developing or acquiring the necessary sensors, its industry has been stymied by several system integration and fabrication problems in trying to downsize a 190 MW pressurized water reactor (PWR) to fit into the space available within the submarine's hull."

- The Proto-type Testing Centre (PTC) at the Indira Gandhi Centre For Atomic Research. Kalpakkam, will be used to test the submarine's turbines and propellers. A similar facility is operational at Vishakapatnam to test the main turbines and gear box.
- Once the vessel is completed, it will be equipped with Sagarika cruise missiles and an advanced sonar system.
- India has a sea-launched cruise missile under development called the Sagarika. It has an estimated range of 300 kilometers. According to some experts, it may be a ballistic missile.

- The CIA reported in September 2001 that India continues to rely on foreign assistance for key missile technologies, where it still lacks engineering or production expertise. Entities in Russia and Western Europe remained the primary conduits of missile-related and dual-use technology transfers during the latter half of 2000.

Chemical Weapons

- India has a well-developed chemical industry which produces the bulk of the chemicals India consumes domestically.
- India has long been involved in the development of chemical weapons; possibly since the early 1980s.
- The FAS reports that the Indian government has set up Nuclear, Biological and Chemical (NBC) warfare directorates in each of its military services, and an inter-Services coordination committee to monitor the program. The Indian Army established a Nuclear, Biological and Chemical (NBC) cell at Army HQ to study the effects of NBC warfare.
  - The Defence Research and Development Organisation (DRDO) is also participating in the program. Research on chemical weapons has continued in various establishments of the military and DRDO research labs. In addition, work is carried out by DRDO to design and fabricate protective clothing and equipment for troops on the battlefield in case of a chemical weapons attack.
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  - The Defence Research and Development Establishment (DRDE) at Gwalior is the primary establishment for studies in toxicology and biochemical pharmacology and development of antibodies against several bacterial and viral agents. In addition, research is carried out on antibodies against chemical agent poisoning and heavy metal toxicology. Chemical agents such as Sarin and nerve gas are produced in small quantities to test on protective equipment.
  - Protective clothing and equipment are designed and manufactured amongst other places at the Defence Materials and Stores Research and Development Establishment at Kanpur. India has developed five types of protective systems and equipment for its troops as a safeguard against nuclear, biological and chemical (NBC) hazards. The development of all five types of protective systems and equipment has been completed and their induction into the service has been formally approved. The five types of protective systems and equipment are: NBC individual protective equipment, NBC collective protection system, NBC medical protection equipment, NBC detection equipment and the NBC decontamination system.
- It has probably reached the point of final development and weaponization for a number of agents no later than the mid-1980s.
  - Work by the Federation of American Scientists (FAS) shos that India has a mixed history of compliance with the Chemical Weapons Convention (CWC):
  - India became one of the original signatories of the in 1993, and ratified it on 02 September 1996. The treaty came into force on April 29, 1997. India denied that it had chemical weapons during the negotiation of the CWC and when it signed it. It stated formally that it did not have chemical weapons and the capacity or capability to manufacture chemical weapons. India did so, however, knowing that he full destruction of the weapons grade chemicals would l take place only at the end of a 10-year period, and that India's large chemical industry would benefit from the unrestricted trade and technology access which would be denied to non-members of the treaty.
  - India claimed again at the Third UN Disarmament Conference, held in 1988 that India had no chemical weapons. Foreign Minister K Natwar Singh repeated this claim in 1989 in the Paris Conference of the State Parties to the Geneva Protocol of 1925, as did Minister of State Eduardo Faleiro repeated at the January 1993 Paris Conference CWC signing ceremony.
  - However, when India declared its stockpile of chemical weapons to the Chemical Weapons Convention in Geneva on 26 June 1997 -- the deadline for all signatories to the pact -- India filed initial declarations on "testing and development of chemical weapons and their related facilities which were developed only to deal with the situation arising out of possible use of chemical warfare against India."
  - In its required declarations under the CWC, India acknowledged the existence of a chemical warfare program. and disclosed the details of its stockpiles and the availability of manufacturing facilities on a very small scale. India pledged

that all facilities related to its CW program would be open for inspection, but this declaration kept India's chemical armory classified, since the CWC Secretariat maintains the confidentiality of such declarations.

- Some reports indicate that Indian, efforts continued for manufacturing and stockpiling chemical weapons for use against Pakistan. On 25 June 1997, however, the Indian government stated that "India will disclose to Pakistan stocks of its chemical weapons."
- In June 1999, the FAS reported that Pakistan published allegations that India had used or was planning to use chemical weapons against the Mujahideen and Pakistani army elements fighting at the Kashmir border. Former Pakistani Inter-Services Intelligence chief Gen.(retd) Hamid Gul [who had opposed Pakistani ratification of the Chemical Weapons Convention] claimed that Mujahideen had captured a very sensitive posts at Kargil and that there were clear chances that India would use chemical weapons against the Mujahideen.

- The US Department of Defense reported in January 2001 that,
  - India is an original signatory to the CWC. In June 1997, it acknowledged that it had a dedicated chemical warfare production program. This was the first time India had publicly admitted that it had a chemical war-fare effort. India also stated that all related facilities would be open for inspection, as called for in the CWC, and subsequently, it has hosted all required CWC inspections. While India has made a commitment to destroy its chemical weapons, its extensive and well-developed chemical industry will continue to be capable of producing a wide variety of chemical agent pre-cursors should the government change its policy.
  - In the past, Indian firms have exported a wide array of chemical products, including Australia Group-con-trolled items, to several countries of proliferation concern in the Middle East. (Australia Group-controlled items include specific chemical agent precursors, microorganisms with biological warfare applications, and dual-use equipment that can be used in chemical or biological warfare programs.) Indian companies could continue to be a source of dual-use chemicals to countries of proliferation concern.

Biological Weapons

- India is a signatory to the BWC of 1972.
- India has long been involved in the development of biological weapons; possibly since the early 1980s.
- India has a well-developed biotechnology research base and its production facilities include includes numerous pharmaceutical production facilities and bio-containment laboratories (including BL-3) for working with lethal pathogens. It also has qualified scientists with expertise in infectious diseases
- The FAS estimates that some of India's facilities are being used to support research and development for BW defense purposes. These facilities constitute a substantial potential capability for offensive purposes as well.
- The FAS reports that Defence Research and Development Establishment (DRDE) at Gwalior is the primary establishment for studies in toxicology and biochemical pharmacology and development of antibodies against several bacterial and viral agents. Work is in progress to prepare responses to threats like Anthrax, Brucellosis, cholera and plague, viral threats like smallpox and viral haemorrhage fever and bio-toxic threats like botulism. Researchers have developed chemical/biological protective gear, including masks, suits, detectors and suitable drugs.
- India has probably reached the point of final development and weaponization for a number of agents.
- US experts feel there is no evidence of production capability, stockpiling, or deployment.
- The US Department of Defense reported in January 2001 that, India has many well-qualified scientists, numerous biological and pharmaceutical production facilities, and biocontainment facilities suitable for research and development of dangerous pathogens. At least some of these facilities are being used to support research and development for biological warfare defense work..

Nuclear Weapons

- India exploited the Atoms for Peace program the US began in 1953, and bout a heavy water reactor from Canada in 1995 that it later used to provide the Plutonium for a nuclear test in 1974. It has since developed a massive indigenous civil and military nuclear program, all of which is free from IAEA safeguards.
  - The Bahaba Atomic Research Center is the key nuclear weapons facility.
  - Three Plutonium reprocessing facilities at Tarapur, Trombay, and Kalpakkum. Can use output from Madras 1 & 2, Kakrapur 1 & 2, and Narora 1 & 2 reactors.
  - Two unsafeguarded heavy water reactors – Cirus with 40 megawatts and Dhruva with 100 megawatts at the Bahaba Atomic Research Center.

- Mines Uranium in the area around Jaduguda.
- Nuclear test site at Pokaran.

- India has had a clear interest in nuclear weapons since its a 1962 border clash with China and China's first test of nuclear weapons in 1964.
  - India first demonstrated its nuclear capability when it conducted a "peaceful nuclear experiment" in May 1974.
  - India probably began work on a thermonuclear weapon prior to 1980. By 1989 it was publicly known that India was making efforts to isolate and purify the lithium-6 isotope, a key requirement in the production of a thermonuclear device.
  - India relies largely on Plutonium weapons, but is experimenting with systems that could be used to make U-235. Some U-235 is useful in producing thermonuclear weapons. A pilot scale Uranium enrichment plant is located at Rattehalli in southern India, and a laser enrichment center at the Center for Advanced Technology near Indore.
  - India is experimenting with fact breeder reactors at the Indira Ghandi Atomic Research Center south of Madras.
- Views differ over the reasons for the timing of India's first major series of tests. The FAS estimates that, "The nuclearisation of India has been an article of faith for the BJP. One of the few concrete steps taken by Vajpayee in his brief 13-day term as Prime Minister s in 1996 was approval for DRDO and DAE to begin preparations for a nuclear test. However, the Government fell two days before the tests could begin, and the succeeding United Front government of H.D. Deve Gowda declined to proceed. Operation Shakti was authorised two days after the Ghauri missile test-firing in Pakistan. On 08 April 1998 Prime Minister Vajpayee met with Department of Atomic Energy (DAE) chief R. Chidambaram and head of the Defence Research and Development Organisation (DRDO) A.P.J. Abdul Kalam and gave the go-ahead for nuclear weapons tests.
- India conducted its second series of tests 24 years later on May 11, 1998.
  - India exploded five nuclear devices in underground tests between May 11 and May 13, 1998. According to Indian Prime Minister Vajpayee, the weapons included:
  - A "fission device,
  - A low-yield device, and a
  - Thermonuclear device."
  - It emplaced the devices on May 8, when scientists from DRDO and DAE arrived at the test site Pokhran
  - On 11 May 1998 India carried out three underground nuclear tests at the Pokhran range. The three underground nuclear tests carried out at 1545 hours involved three different devices - a fission device with a yield of about 12 KT, a "thermonuclear device?" with a yield of about 43 KT and a sub-kiloton device of around 0.2 kilotons. All three devices were detonated simultaneously.
  - The two tests carried out at 1221 hours on 13 May were also detonated simultaneously. The yields of the sub-kiloton devices were in the range of 0.2 to 0.6 KT." The Indian government then announced the completion of the planned series of tests.
  - These tests broke breaks an international moratorium on nuclear tests; China had conducted its last test in 1996. India deliberate scheduled activity around the test site to avoid coverage by US surveillance satellites.
  - The Carnegie Endowment estimates that India has built steadily larger-scale plutonium production reactors, and facilities to separate the material for weapons use, and has approximately 400 kg of weapons-usable plutonium today. It takes about 6 kg of plutonium to construct a basic plutonium bomb, this amount would be sufficient for 65 bombs. With more sophisticated designs, it is possible that this estimate could go as high as 90 bombs.
  - India officials stated in May 1998, however, that India had enough material for 125 nuclear weapons.
- The CIA reported in February 1999 that India continued to seek nuclear-related equipment, materials, and technology during the first half of 1998, some of which could be used in nuclear weapons applications. The most sought-after goods were of Russian- and UK-origin. India continues to pursue the development of advanced nuclear weapons, as evidenced by the underground nuclear tests that it conducted in May 1998. The acquisition of foreign equipment could benefit India in its efforts to develop and produce more sophisticated nuclear weapons.
- The DCI Nonproliferation Center (NPC) reported in February 2000 that India continues to pursue the development of nuclear weapons, and its underground nuclear tests in May 1998 were a significant milestone. (The US imposed sanctions against India as a result of these tests.) The acquisition of foreign equipment could benefit New Delhi in its efforts to

develop and produce more sophisticated nuclear weapons. India obtained some foreign nuclear-related assistance during the first half of 1999 from a variety of sources worldwide, including in Russia and Western Europe.

- Geroge Tenet, the Director of the CIA, testified before the Senate Foreign Relations Committee on March 20, 2000 and stated that, "India and Pakistan are developing more advanced nuclear weapons and are moving toward deployment of significant nuclear arsenals. Both sides are postured in a way that could lead to more intense engagements later this year. Our concern persists that antagonisms in South Asia could still produce a more dangerous conflict on the subcontinent."
- The FAS reports as of June 2000 that India is generally estimated as having approximately 60 nuclear weapons. Some estimates as high as 200 nuclear devices are based on estimates of plutonium that could be extracted from India's six unsafeguarded heavy-water nuclear power plants. In 1994 K. Subrahmanyam suggested that a force of 60 warheads carried on 20 Agnis, 20 Prithvis and the rest on aircraft would cost about Rs 1,000 crore over 10 years. In 1996 Sundarji suggested a cost of some Rs 2,760 crore -- Rs 600 crore for 150 warheads, Rs 360 crore for 45 Prithvis and Rs 1,800 crore for 90 Agni missiles.
- The CIA reported in August 2000 that India continues to pursue the development of nuclear weapons, and its underground nuclear tests in May 1998 were a significant milestone. The acquisition of foreign equipment could benefit New Delhi in its efforts to develop and produce more sophisticated nuclear weapons. India obtained some foreign nuclear-related assistance during the second half of 1999 from a variety of sources worldwide, including in Russia and Western Europe.
- The Department of Defense summarized developments as follows in January 2001,
  - On 11 and 13 May 1998, India conducted what it claimed were five nuclear explosive tests. According to Indian officials, the 11 May tests included a fission device with a yield of about 12 kilotons, a thermonuclear device with a yield of about 43 kilotons, and a third test with a yield of about 0.2 kilotons. An Indian spokesman stated that the first set of tests was intended "to establish that India has a proven capability for a weaponized nuclear program."
  - India claimed that its 13 May tests had yields of about 0.5 and 0.2 kilotons, which were carried out to generate additional data for computer simulations. According to the Chairman of India's Atomic Energy Commission, the tests enabled India to build "an adequate scientific database for designing the types of devices that [India] needs for a credible nuclear deter-rent."
  - The tests triggered international condemnation and the United States imposed wide-ranging sanctions against India. The tests were India's first since 1974, and reversed the previously ambiguous nuclear posture where Indian officials denied possession of nuclear weapons. Indian officials cited a perceived deterioration of India's security environment, including increasing Pakistani nuclear and missile capabilities and perceived threats from China, to justify the tests.
  - India has a capable cadre of scientific personnel and a nuclear infrastructure, consisting of numerous research and development centers, 11 nuclear power reactors, uranium mines and processing plants, and facilities to extract plutonium from spent fuel. With this large nuclear infrastructure, India is capable of manufacturing complete sets of components for plutonium-based nuclear weapons, although the acquisition of foreign nuclear-related equipment could benefit New Delhi in its weapons development efforts to develop and produce more sophisticated nuclear weapons.
  - India probably has a small stockpile of nuclear weapon components and could assemble and deploy a few nuclear weapons within a few days to a week. The most likely delivery platforms are fighter-bomber air-craft.
  - New Delhi also is developing ballistic missiles that will be capable of delivering a nuclear payload in the future. India is in the beginning stages of developing a nuclear doctrine. In August 1999, the Indian government released a proposed nuclear doctrine prepared by a private advisory group appointed by the government.
  - It stated that India will pursue a doctrine of credible minimum deterrence. The document states that the role of nuclear weapons is to deter the use or the threat of use of nuclear weapons against India, and asserts that India will pursue a policy of "retaliation only." The draft doctrine maintains that India "will not be the first to initiate a nuclear strike, but will respond with punitive retaliation should deterrence fail." The doc-trine also reaffirms India's pledge not to use or threaten to use nuclear weapons against states that do not possess nuclear weapons. It further states that India's nuclear posture will be based on a triad of air-craft, mobile land-based systems, and sea-based plat-forms to provide a redundant, widely dispersed, and flexible nuclear force. Decisions to authorize the use of nuclear weapons would be made by the Prime Minister or his "designated successor(s)." The draft doctrine has no official standing in India, and the United States has urged Indian officials to distance themselves from the draft, which is nor consistent with India's stated goal of a minimum nuclear deterrent.
  - India expressed interest in signing the CTBT, but has not done so. It has pledged not to conduct further nuclear tests pending entry into force of the CTBT. Indian officials have tied signature and ratification of the CTBT to developing a domestic consensus on the issue. Similarly, India strongly opposed the NPT as discriminatory but it is a member of the IAEA.

- Only four of India's 13 operational nuclear reactors currently are subject to IAEA safeguards. In June 1998, New Delhi signed a deal with Russia to purchase two light-water reactors to be built in southern India; the reactors will be under facility-specific IAEA safe-guards. However, the United States has raised concerns that Russia is circumventing the 1992 NSG guidelines by providing NSG trigger list technology to India, which does not allow safeguards on all of its nuclear facilities. India has taken no steps to restrain its nuclear or missile programs. In addition, while India has agreed to enter into negotiations to complete a fissile material cutoff treaty, it has not agreed to refrain from producing fissile material before such a treaty would enter into force.

- The CIA reported in September 2001 that India continues its nuclear weapons development program, for which its underground nuclear tests in May 1998 were a significant milestone. The acquisition of foreign equipment will benefit New Delhi in its efforts to develop and produce more sophisticated nuclear weapons. During this reporting period, India continued to obtain foreign assistance for its civilian nuclear power program, primarily from Russia.

Missile Defenses

- The CIA reported on January 30, 2002 that India signed a $270 million contract with Israel for the Barak-1 missile defense systems.

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Source: Prepared by Anthony H. Cordesman, Arleigh A. Burke Chair in Strategy, CSIS.

Part Eight

Pakistani Force Trends

US CIA Estimate of Pakistani Force Developments as of September 2001

Chinese entities continued to provide significant assistance to Pakistan's ballistic missile program during the reporting period. With Chinese assistance, Pakistan is moving toward serial production of solid-propellant SRBMs, such as the Shaheen-I and Haider-I. Pakistan flight-tested the Shaheen-I in 1999 and plans to flight-test the Haider-I in 2001. Successful development of the two-stage Shaheen-II MRBM will require continued Chinese assistance or assistance from other potential sources.

Pakistan continued to acquire nuclear-related and dual-use equipment and materials from various sources—principally in Western Europe. Islamabad has a well-developed nuclear weapons program, as evidenced by its first nuclear weapons tests in late May 1998. Acquisition of nuclear-related goods from foreign sources will remain important if Pakistan chooses to develop more advanced nuclear weapons.

China, which has provided extensive support in the past to Islamabad's nuclear weapons and ballistic missile programs, in May 1996 pledged that it would not provide assistance to unsafeguarded nuclear facilities in any state, including Pakistan. We cannot rule out, however, some unspecified contacts between Chinese entities and entities involved in Pakistan's nuclear weapons development.

Pakistan continues to rely on China and France for its ACW requirements and negotiated to purchase an additional 40 F-7 fighters from China.

Beijing continues to take a very narrow interpretation of its bilateral nonproliferation commitments with the United States. In the case of missile-related transfers, Beijing has on several occasions pledged not to sell Missile Technology Control Regime (MTCR) Category I systems but has not recognized the regime's key technology annex. China is not a member of the MTCR.

In November 2000, China committed not to assist, in any way, any country in the development of ballistic missiles that can be used to deliver nuclear weapons, and to enact at an early date a comprehensive missile-related export control system.During the reporting period, however, Chinese entities provided Pakistan with missile-related technical assistance.

Pakistan has been moving toward domestic serial production of solid-propellant SRBMs with Chinese help. Pakistan also needs continued Chinese assistance to support development of the two-stage Shaheen-II MRBM. In addition, firms in China have provided dual-use missile-related items, raw materials, and/or assistance to several other countries of proliferation concern—such as Iran, North Korea, and Libya.

In the nuclear area, China has made bilateral pledges to the United States that go beyond its 1992 NPT commitment not to assist any country in the acquisition or development of nuclear weapons. For example, in May 1996 Beijing pledged that it would not provide assistance to unsafeguarded nuclear facilities. With respect to Pakistan, Chinese entities in the past provided extensive support to unsafeguarded as well as safeguarded nuclear facilities, which enhanced substantially Pakistan's nuclear weapons capability. We cannot rule out some continued contacts between Chinese entities and entities associated with Pakistan's nuclear weapons program subsequent to Beijing's 1996 pledge and during this reporting period.

China is a primary supplier of advanced conventional weapons to Pakistan, Iran, and Sudan, among others. Sudan received military vehicles, naval equipment, guns, ammunition, and tanks from Chinese suppliers in the latter half of 2000.

US Department of Defense Estimate of Pakistani Actions and Intentions Involving Nuclear, Biological, and Chemical Weapons

Objectives, Strategies, and Resources

Pakistan's nuclear and missile programs are part of Islamabad's effort to preserve its territorial integrity against its principal external threat and rival, India. Pakistan attaches a certain immediacy and intensity to its effort and likely will continue to improve its nuclear and missile forces. Pakistan is driven by its perceived need to counter India's conventional superiority and nuclear capability, remains fearful of India's regional and global power aspirations, and continues to seek close security ties with China as a balance. Pakistan's 1998 nuclear weapon tests and its missile tests in 1998 and 1999 likely were seen by Islamabad as necessary responses to India's tests, and as a means of bolstering its own deterrent.

Pakistan, like India, is putting emphasis on becoming self-sufficient for the production of its nuclear weapons and missiles. During the last several years Pakistan has received assistance from both China and North Korea, which will help it to achieve that goal. It has continued to seek a variety of nuclear-related and dual-use items for weapons development. However, Pakistan has less of a military production infrastructure than rival India, and thus will be forced to rely on outside support for its efforts for several years. Pakistan's economy will recover gradually from its recent fiscal crisis and the real GDP is expected to grow at an annual rate of about 3-5 percent for the next several years. This growth assumes no major war, adequate financial assistance from lenders to meet foreign debt obligations, and progress on economic reforms aimed at controlling the government deficit. Pakistan's defense budget will proceed on a generally upward track, with an average annual real increase of 1-2 percent expected over the next ten years. As part of its overall national security strategy, Pakistan likely will continue to attach budget priorities to the further development of nuclear warheads and ballistic missiles.

However, part of this effort will depend on continuing support from China and North Korea, or on alternative sources of financial or technical aid.

Nuclear Program

As a response to India's tests, Pakistan conducted its own series of nuclear tests in May 1998. Pakistan claimed to have tested six devices, five on 28 May and one on 30 May. Dr. A. Q. Khan, a key figure in Pakistan's nuclear program, claimed the five devices tested on 28 May were boosted fission devices: a "big bomb" and four tactical weapons of low yield that could be used on small missiles. He also claimed that Pakistan could conduct a fusion or thermonuclear blast if it so desired. The United States imposed additional sanctions against Pakistan as a result of these tests. Pakistan has a well-developed nuclear infrastructure, including facilities for uranium conversion and enrichment and the infrastructure to produce nuclear weapons. Unlike the Indian nuclear program, which uses plutonium for its weapons, Pakistan's program currently is based on highly-enriched uranium. However, Pakistan also is developing the capability to produce plutonium for potential weapons use. An unsafe-guarded heavy-water research reactor built at Khushab will produce plutonium that could be reprocessed for weapons use at facilities under construction. In the past, China supplied Pakistan with nuclear materials and expertise and has provided critical assistance in the production of Pakistan's nuclear facilities. Pakistan also acquired a significant amount of nuclear-related and dual-use equipment and materials from various sources principally in the FSU and Western Europe. Acquisition of nuclear-related goods from foreign sources will remain important if Pakistan chooses to continue to develop and produce more advanced nuclear weapons, although we expect that, with the passage of time, Pakistan will become increasingly self-sufficient. Islamabad likely will increase its nuclear and ballistic missile stockpiles over the next five years.

Islamabad's nuclear weapons are probably stored in component form. Pakistan probably could assemble the weapons fairly quickly and has aircraft and possibly ballistic missiles available for delivery. Pakistan's nuclear weapons program has long been dominated by the military, a dominance that likely has continued under the new military government and under Pakistan's new National Command Authority (NCA), announced in February 2000. While Pakistan has yet to divulge publicly its nuclear doctrine, the new NCA is believed to be responsible for such doctrine, as well as nuclear research and development and wartime command and control. The NCA also includes two committees that advise Pakistan's Chief Executive, General Musharraf, about the development and employment of nuclear weapons.

Pakistan remains steadfast in its refusal to sign the NPT, stating that it would do so only after India joined the Treaty. Consequently, not all of Pakistan's nuclear facilities are under IAEA safeguards. Pakistani officials have stated that signature of the CTBT is in Pakistan's best interest, but that Pakistan will do so only after developing a domestic consensus on the issue, and have disavowed any connection with India's decision. Like India, Pakistan expressed its intention to sign the CTBT, but, so far, has failed to do so. While Pakistan has provided assurances that it will not assemble or deploy its nuclear warheads, nor will it resume testing unless India does so first; it has taken no additional steps. Pakistan has agreed to enter into negotiations to complete a fissile material cutoff agreement, but has not agreed to refrain from producing fissile material before a cutoff treaty would enter into force.

Biological and Chemical Programs

Pakistan is believed to have the resources and capabilities to support a limited biological warfare research and development effort. Pakistan may continue to seek foreign equipment and technology to expand its bio-technical infrastructure. Pakistan has ratified the BWC and actively participates in compliance protocol negotiations for the treaty.

Pakistan ratified the CWC in October 1997 and did not declare any chemical agent production or development. Pakistan has imported a number of dual-use chemicals that can be used to make chemical agents. These chemicals also have commercial uses and Pakistan is working towards establishing a viable commercial chemical industry capable of producing a variety of chemicals, some of which could be used to make chemical agents. Chemical agent delivery methods available to Pakistan include missiles, artillery, and aerial bombs.

- *Nuclear Conducted nuclear weapon tests on 28 and 30 May 1998 in response to India's tests; claimed a total of six tests.*
- *Capable of manufacturing complete sets of components for highly enriched uranium-based nuclear weapons;*
- *developing capability to produce plutonium.*
- *Has small stockpile of nuclear weapons components and can probably assemble some weapons fairly quickly. It*
- *can deliver them with fighter aircraft and possibly missiles.*
- *Has signed neither the NPT nor the CTBT.*
- *Biological Believed to have capabilities to support a limited biological warfare research effort.*
- *Ratified the BWC.*
- *Chemical Improving commercial chemical industry, which would be able to support precursor chemical production.*
- *Ratified the CWC but did not declare any chemical agent production. Opened facilities for inspection.*
- *Ballistic Missiles Has development and production facilities for solid- and liquid-propellant fuel missiles.*
- *Solid-propellant program:*
  - *Hatf I rocket —80 kilometer range (produced)*
  - *Hatf III —300 kilometer range; based on M-11 (being developed)*
  - *Shaheen I —750 kilometer range claimed (tested)*
  - *Shaheen II/Ghaznavi —2,000 kilometer range claimed (in design)*
  - *Liquid-propellant program:*
  - *Ghauri —1,300 kilometer range; based on No Dong (tested)*
- *Is not a member of the MTCR.*
- *Other Means of Delivery*
  - *Has ship-borne, submarine-launched, and airborne anti-ship cruise missiles; none has NBC warheads.*
  - *Aircraft: fighter-bombers.*
  - *Ground systems: artillery and rockets.*

Ballistic Missiles

Pakistan has placed a high priority on developing ballistic missiles as part of its strategy to counter India's conventional and nuclear capabilities. Pakistan has both solid and liquid-propellant ballistic missile pro-grams and, during the last several years, has received considerable assistance from China and North Korea for these efforts. Pakistan's goal is to produce increasingly longer-range missiles. However, Pakistan likely will continue to require significant foreign assistance in key technologies for several years. In its solid-propellant program, Pakistan has developed and produced the 80 kilometer range Hatf-1 that is now deployed with the Army. Pakistan also has developed the solid-fueled Shaheen-1 SRBM, which it tested in April 1999. According to Pakistani officials, the Shaheen-1 has a range of 750 kilometers and is capable of carrying a nuclear warhead. Pakistan also received M-11 SRBMs from China, upon which it will base its Hatf III.

Pakistan has developed and tested the liquid-propellant Ghauri medium-range ballistic missile, which is based on North Korea's No Dong MRBM. The Ghauri was successfully tested in April 1998 and 1999. Pakistani officials claimed that the Ghauri has a range of 1,500 kilometers and is capable of carrying a payload of 700 kilograms, although its range likely is the same as the No Dong, 1,300 kilometers. Also, in April 1998, the United States imposed sanctions against a Pakistani research institute and a North Korean company for transferring technology controlled under Category I of the MTCR Annex.

Following the April 1999 tests of the Ghauri and Sha-heen-1, Pakistani officials announced the conclusion "for now" of "the series of flight tests involving solid-and liquid-fuel rocket motor technologies…" and called on India to join Pakistan in a "strategic restraint regime" to limit the development of missile and nuclear weapons technology and deployment. Pakistani officials also have stated that they are developing missiles called the Ghaznavi and Shaheen-II, both with an intended range of 2,000 kilometers, which would be able to reach any target in India.

Cruise Missiles and Other Means of Delivery

Pakistan has sea- and submarine-launched short-range anti-ship cruise missiles and a variety of short-range air-launched tactical missiles, which are potential means of delivery for NBC weapons. All were pur-chased from foreign sources, including China, France, and the United States. Pakistan may have an interest in acquiring additional anti-ship cruise missiles, as well as land-attack cruise missiles, in the future but may be slowed in any such efforts by financial constraints. Pakistan also has a variety of fighter aircraft, artillery, and rockets available as potential means of delivery for NBC weapons.

Source: Department of Defense, Proliferation and Response, January 2001, Pakistan section.

CIA Estimate of Pakistani Missile Force Trends – January 2002

- Pakistan sees missile-delivered nuclear weapons as a vital deterrent to India's much larger conventional forces, and as a necessary counter to India's nuclear program. Pakistan pursued a nuclear capability more for strategic reasons than for international prestige.
- **Ballistic Missile Programs**: Since the 1980s, Pakistan has pursued development of an indigenous ballistic missile capacity in an attempt to avoid reliance on any foreign entity for this key capability. Islamabad will continue with its present ballistic missile production goals until it has achieved a survivable, flexible force capable of striking a large number of targets throughout most of India.
- Pakistan's missiles include:
  - The short-range Hatf I, which Pakistan also is attempting to market, as it is relatively inexpensive and easy-to-operate.
  - M-11 missiles that Pakistan acquired from China in the 1990s. (The M-11 SRBM—called the Hatf III in Pakistan—is a single-stage, solid-propellant missile capable of carrying a payload at least 300 km.)
  - Ghauri/No Dong MRBMs that Pakistan acquired from North Korea.
  - The Shaheen I, a Pakistani-produced single-stage, solid-propellant SRBM.
  - The Shaheen II, a road-mobile two-stage solid-propellant MRBM that Pakistan is developing. (Based on several mockups publicly displayed in Pakistan, the Shaheen II probably would be able to carry a 1,000-kg payload to a range of about 2,500 kilometers.)
- Foreign Assistance: Foreign support for Pakistan's ambitious solid-propellant ballistic missile acquisition and development program has been critical.
- During 2001, Chinese entities provided Pakistan with missile-related technical assistance. Pakistan has been moving toward domestic serial production of solid-propellant SRBMs with Chinese help. Pakistan also needs continued Chinese assistance to support development of the two-stage Shaheen-II MRBM. In addition, firms in China have provided dual-use missile-related items, raw materials, and/or assistance to several other countries of proliferation concern—such as Iran, North Korea, and Libya.

Pakistan and Nuclear Weapons

Delivery Systems

- Pakistan can deliver weapons with strike aircraft or ballistic missiles.
- Pakistan has several nuclear-capable aircraft, including the F-16 and Mirage.
- Pakistan has 32 F-16A/B and 56 Mirage 5s.
- The FAS reports that there are open-source reports suggesting that several of the A-5 *Fantan* have been equiped to deliver air-dropped atomic weapons. Other reports have suggested that F-16 aircraft have practiced the "toss-bombing" technique that would be used to deliver nuclear weapons.
- Its other aircraft are 15 aging Mirage IIIEPs with a nominal strike range of 500 kilometers, 30 Mirage 1110s, and low-grade Chinese-made fighters.
- It is developing several different ballistic missile systems:
- The Chinese M-11 (CSS-7), with a range of 280 km.
    - China exported 30 M-11 missiles to Pakistan in 1992.
    - The Carnegie Endowment reports that in 1996, a U.S. National Intelligence Estimate (NIE) estimated, Pakistan had roughly three dozen M-11 missiles. The NIE reportedly stated that these were stored in canisters at the Sargodha Air Force Base, along with maintenance facilities and missile launchers; that the missiles could be launched in as little as 48 hours, even though the missiles had not been used in actual training exercises; and that two teams of Chinese technicians had been sent to Pakistan to provide training and to help unpack and assemble the missiles. In addition, the document reportedly surmised that Pakistan probably had designed a nuclear warhead for the system, based on evidence that Pakistan had been working on such an effort for a number of years. As noted earlier, however, Pakistan had not conducted a full-scale test of any nuclear explosive device, nor had it flight-tested a prototype nuclear warhead with the M-11.
    - The Carnegie Endowment reports that in late August 1996, a U.S. intelligence finding was leaked to the press: Using blueprints and equipment supplied by China, Pakistan reportedly had in late 1995 begun construction of a factory to produce short-range missiles based on the Chinese-designed M-11.
    - The factory, located near Rawalpindi, was expected to be operational in one or two years. It was not clear whether the facility would be able to build complete missiles, or whether it would manufacture some components and use imported parts to produce complete systems.
    - The missile uses a solid propellant and has a 700 kilogram payload.
- The Haft 1A is a 100 kilometer range missile which was tested on February 7, 2000. It is a development of the Haft 1, which had a range of 80 kilometers with a 500 kilogram payload.
- The Hatf 2 is a solid propellant missile with a range of 350 kilometers with a 500-kilogram payload.
    - It seems be a development based on the Chinese M-11.
    - It was ordered in 1994 and began low-rate production in 1996.
- The Hatf 3 is a solid propellant missile with a range of 550 kilometers, although some sources put its range at 600-800 kilometers.
    - It was ordered in 1994 and is still developmental.
    - Some experts believe it is based on the Chinese M-9 design.
    - Others that it is an indigenous two-stage missile similar to the earlier Haft 2, but with a large first-stage solid fuel assembly.
    - In July 1997, Pakistan reportedly tested the Hatf-3 ballistic missile, as a riposte to India's semi-deployment of the Prithvi missile in Punjab. The launch location showed it could strike Lahore.
- The Haft-4, or Shaheen I, is believed to be a solid-propellant missile with a 750 kilometer range based upon the Chinese M-9. It has a 1,000 kilogram payload.
    - Ground tests of the Haft-4 were made in 1997 and 1998. It was flight tested on April 15, 1999.

- It was ordered in 1994, and some reported claim low-rate production started in 1999.
- It was flight tested again in February 2000, and was displayed during the march at the Pakistan Day celebration on March 23, 2000.
- The Shaheen I and Haft 4 are identical.

- Shaheen II is also known as the Haft 7.
  - It is supposed to have a range of 2,500 kilometers.
  - It was displayed during the march at the Pakistan Day celebration on March 23, 2000.
  - The Pakistani government claims it has a range of 2,500 kilometers and a payload of 1,000 kilograms.
  - It is built by Pakistan's Atomic Energy Commission's National Development Complex, which is under the direction of Dr. Samar Mubarak Mund.
  - It uses a transporter-erector-launcher vehicle similar to the Russian MAZ-547V, which was once used to transport the SS-20.
  - Pakistan's Space and Upper Atmosphere Research Company may also be involved in its manufacture.
  - Pakistan said the missile would be tested shortly.
- The Gauri I and II missiles are built by AQ Khan Research Laboratories at Kahuta.
  - The Ghauri I (Haft 5) is an medium-range missile Ghauri (Haft 5), with a range of 1,300-1500 km with a 500-700 kg payload. It is capable of reaching most cities in India.
  - Development began in 1993, with North Korean assistance.
  - The initial test version of the missile was the Ghauri I (Haft V) with a maximum range of 1,500 kilometers and a 500-750 kilogram payload.
  - Various statements indicate that it is similar to the North Korean No Dong and Iranian Shahab 3. Some analyst feel it is similar to the Chinese M-9, but the Ghauri is a 16,000 kg. missile and the M-9 is only a 6,000 kg. system.
  - It had its first test flight on April 6, 1998, and flew 1,100 kilometers (900 miles). It was fired from a site near Jhelum in the northeast to an area near Quetta in the southwest. It uses a TEL launcher – a system Pakistan had not previously demonstrated.
  - Delivery is believed to have begun in 1998. It is believed to have been deployed in May 1998, with 5-10 missiles in the 47th artillery brigade.
  - It is believed to have both "conventional" (BCW?) warheads and a 30-40 KT nuclear payload.
  - A version for a satellite booster may be in development.
  - Pakistan stated in late May 1998 that it was ready to equipment the Ghauri with nuclear weapons.
  - The Ghauri was tested again on April 14, 1999. Territorial limits mean that Pakistan can only test to a maximum range of 1,165 kilometers on its own soil. This time, Pakistan seems to have tested the Ghauri II with a range of 2,000-2,300 kilometers and a 750-1,000 kg. payload.
- The Ghauri II (Haft-6) is sometimes credited with a range of up to 3,000 kilometers.
  - Some US experts believe it has a maximum range of 2,300 kilometers, but can only go 2,000 kilometers with its present nuclear warhead.
  - The missile was ordered in 1993 and limited production began in 1999.
  - It is a liquid fueled missile and takes sometime to prepare, possibly making it vulnerable to Indian strikes.
  - The Carnegie Endowment reports that China is reported to be constructing a factory to build similar missiles.
- The Ghauri III (Haft-7) is sometimes credited with a range of up to 3,000 kilometers.
- The missile was ordered in 1993 and is still; developmental.
  - Pakistan recovered a US cruise missile that went astray during the US attack on Afghanistan in late August 1998.

- The CIA reported in February 1999 that Chinese and North Korean entities continued to provide assistance to Pakistan's ballistic missile program. Such assistance is critical for Islamabad's efforts to produce ballistic missiles.
- In April 1998, the United States imposed sanctions against Pakistani and North Korean entities for their role in transferring Missile Technology Control Regime Category I ballistic missile-related technology.

- The DCI Nonproliferation Center (NPC) reported in February 2000 that Chinese and North Korean entities continued to provide assistance to Pakistan's ballistic missile program during the first half of 1999. Such assistance is critical for Islamabad's efforts to produce ballistic missiles. In April 1998, Pakistan flight-tested the Ghauri MRBM, which is based on North Korea's No Dong missile. Also in April 1998, the US imposed sanctions against Pakistani and North Korean entities for their role in transferring Missile Technology Control Regime Category I ballistic missile-related technology. In April 1999, Islamabad flight-tested another Ghauri MRBM and the Shaheen-1 SRBM.
  - The US intelligence community reported on July 1, 2000 that China continued to aid Pakistan in building long-range missiles, and had stepped up its shipments of specialty steels, guidance systems, and technical expertise. They also stated that Pakistan's newest missile factory seemed to follow Chinese designs.
- The CIA reported in August 2000 that Chinese entities provided increased assistance to Pakistan's ballistic missile program. North Korea continued to provide important assistance as well. Such assistance is critical for Islamabad's efforts to produce ballistic missiles. In April 1998, for example, Pakistan flight-tested the Ghauri MRBM, which is based on North Korea's No Dong missile. As a result, the US imposed sanctions against Pakistani and North Korean entities in April 1998 for their role in transferring Missile Technology Control Regime Category I ballistic missile-related technology. In April 1999, Islamabad flight-tested another Ghauri MRBM and the Shaheen-1 SRBM and can be expected to respond to another successful Indian missile test (e.g., Agni-II or Prithvi-II) with a new test flight of a Ghauri or Shaheen missile.
- The CIA reported on January 30, 2002 that Chinese entities continued to provide significant assistance to Pakistan's ballistic missile program during the reporting period. With Chinese assistance, Pakistan is moving toward serial production of solid-propellant SRBMs, such as the Shaheen-I and Haider-I. Pakistan flight-tested the Shaheen-I in 1999 and plans to flight-test the Haider-I in 2001. Successful development of the two-stage Shaheen-II MRBM will require continued Chinese assistance or assistance from other potential sources. Pakistan needs continued Chinese assistance to support development of the two-stage Shaheen-II MRBM. In addition, firms in China have provided dual-use missile-related items, raw materials, and/or assistance to several other countries of proliferation concern—such as Iran, North Korea, and Libya.

Chemical Weapons

- Pakistan has long been involved in the development of chemical weapons; possibly since the early 1980s.
- It has probably reached the point of final development and weaponization for a number of agents.
- No evidence of production capability,but Pakistan's market for industrial chemicals is expanding gradually, with production of chemicals largely confined to soda ash, caustic soda, sulfuric and hydrochloric acid, sodium bicarbonate, liquid chlorine, aluminum sulfate, carbon black, acetone and acetic acid. Although imports account for most of the market, local production is expected to increase as new plants come on stream. There are over 400 licensed pharmaceutical companies in Pakistan, including 35 multinationals who have over 60 percent of the market share. Approximately one-third of Pakistan's total consumption of pharmaceutical is imported. Major suppliers include the United States, the U.K,, Germany, Switzerland, Japan, Holland and France
- Pakistan ratified the CWC on 28 October 1997. The CWC was neither discussed in the parliament nor brought before the Federal Cabinet. It claimed that it did have chemical weapons capabilities to declare under the Convention. Although Pakistan did not admit to the manufacture of chemical weapons, it uses and consumes a chemicals that can be utilised for producing chemical weapons, and would would have been denied access to such dual-use chemicals if it has not joined the CWC
- The Federation of American Scientists reports that Pakistan has manufactured weapons for blister, blood, choking and nerve agents according to Indian intelligence estimates. China may be an supplier of technology and equipment to Pakistan. India claims that Pakistan used chemical weapons against Indian soldiers in Siachen in 1987.
- In 1992 India declared to Pakistan that it did not possess chemical weapons, and India and Pakistan issued a declaration that neither side possessed or intended to acquire or use chemical weapons.
- Pakistan is now obligated under the CWC to open all its installations for inspection. At the first stage, the team of UN inspectors visited the Wah Ordinance Factory on 19 February 1999to assess whether Pakistan was producing chemical weapons. The FAS states that according to one published report, "the Pakistani government had dismantled the chemical plant in the factory, the earth was dug up quite deeply after the plant was dismantled, and it was followed by a leveling of the land."

Biological Weapons

- Pakistan has long been involved in the development of biological weapons; possibly since the early 1980s.
- It has probably reached the point of final development and weaponization for a number of agents.
- No evidence of production capability, but has a well-developed bioligical and biotechnical R&D and production base by the standards of a developing nation.
- Pakistan has singed the BWC, and is participating in the negotiations to develop a verification protocol. It has opposed artificial deadlines and an emphasis on creating a comprehensive verification regime that could not be based on consensus.

Nuclear Weapons

- According to the Carnegie Endowment, Pakistan began its nuclear weapons program in 1972, in the aftermath of the 1971 war with India. The program accelerated after India's nuclear test in May 1974, and made substantial progress by the early 1980s.
- Carnegie reports that the program was expedited by the return to Pakistan in 1975 of Dr. Abdul Qadeer Khan, a German-trained metallurgist, who was employed at the classified URENCO uranium-enrichment plant at Anselmo in the Netherlands in the early 1970s. Dr. Khan brought to Pakistan personal knowledge of gas-centrifuge equipment and industrial suppliers, especially in Europe, and was put in charge of building, equipping, and operating Pakistan's Kahuta enrichment facility.
- Pakistan halted further production of weapons-grade uranium in 1991, temporarily placing a ceiling on the size of its stockpile of highly enriched uranium (HEU). It has made efforts to expand other elements of its nuclear weapons program, however, including work on weapons design, on unsafeguarded facilities to produce plutonium and, possibly, on facilities to increase the production capacity for weapons-grade uranium.
- The United States terminated economic and military aid to Pakistan in 1977 and 1979 in an effort to force it to halt its nuclear weapons program.
- According to work by the Federation of American Scientists,
  - President Ayub Khan took initial steps in 1965, but , Pakistan's Atomic Energy commission was founded some 15 years after the Indian program. Zulfiqar Ali Bhutto was the founder of Pakistan's Nuclear Program, initially as Minister for Fuel, Power and Natural Resources, and later as President and Prime Minister.
  - Pakistan's nuclear program was launched in earnest shortly after the loss of East Pakistan in the 1971 war with India, when Bhutto initiated a program to develop nuclear weapons with a meeting of physicists and engineers at Multan in January 1972.
- Bhutto reacted strongly to India's successfully test of a nuclear "device" in 1974, and called for an must develop its own "Islamic bomb." Pakistan's activities were initially centered in a few facilities. A.Q. Khan founded the Engineering Research Laboratories at Kahuta in 1976, which later to became the Dr. A. Q. Khan Research Laboratories (KRL).
  - Almost all of Pakistan's nuclear program was and remains focused on weapons applications.
  - Initially, Pakistan focused on plutonium. In October 1974 Pakistan signed a contract with France for the design of a reprocessing facility for the fuel from its power plant at Karachi and other planned facilities. However, France withdrew at the end of 1976, after sustained pressure by the United States.
- In 1975, Dr Abdul Qadeer Khan provided for uranium enrichment centrifuges plans stolen from URENCO, and lists of sources of the necessary technology. Pakistan initially focused its development efforts on highly enriched uranium (HEU), and exploited an extensive clandestine procurement network to support these efforts. Plutonium involves more arduous and hazardous procedures and cumbersome and expensive processes.
- In 1981, a US State Department cable was leaked that stated that "We have strong reason to believe that Pakistan is seeking to develop a nuclear explosives capability…Pakistan is conducting a program for the design and development of a triggering package for nuclear explosive devices." In 1983, the US declassified an assessment that concluded that "There is unambiguous evidence that Pakistan is actively pursuing a nuclear weapons development program…We believe the ultimate application of the enriched uranium produced at Kahuta, which is unsafeguarded, is clearly nuclear weapons."
  - Chinese assistance in the development of gas centrifuges at Kahuta was indicated by the presence of Chinese technicians at the facility in the early 1980s. The uranium enrichment facility began operating in the early 1980s, but suffered serious start up problems. In early 1996 it was reported that the A.Q. Khan Research Laboratory had received 5,000 ring magnets, which can be used in gas centrifuges, from a subsidiary of the China National Nuclear Corporation.
  - Pakistan's became increasingly dependent on China grew as Western export controls and enforcement mechanisms became more stringent. This Chinese assistance predated the 1986 Sino-Pakistani atomic cooperation agreement, with

some critical transfers occurring from 1980 through 1985. Pakistan Foreign Minister Yakub Khan was present at the Chinese Lop Nor test site to witness the test of a small nuclear device in May 1983, giving rise to speculation that a Pakistani-assembled device was detonated in this test.

- At some point near the signing of the 1986 Sino-Pakistani atomic cooperation agreement, Pakistan seems to have embarked on a parrallel Plutonium program. A heavy water reactor at Khushab was built with Chinese assistance and is the central element of Pakistan's program for production of plutonium and tritium for advanced compact warheads. The Khushab facility, like that at Kahuta, is not subject to IAEA inspections. Khushab, with a capacity variously reported at between 40 and 70 MWT, was completed in the mid-1990s, with the start of construction dating to the mid-1980s.

- China has played a major role in many aspects of Pakistan's nuclear program:

  - is reported to have provided Pakistan with the design of one of its warheads, as well as sufficient HEU for a few weapons. The 25-kiloton design was the one used in China's fourth nuclear test, which was an atmospheric test using a ballistic missile launch. This configuration is said to be a fairly sophisticated design, with each warhead weighing considerably less than the unwieldy, first-generation US and Soviet weapons which weighed several thousand kilograms.

  - Pakistan purchased of 5,000 custom-made ring magnets from China, a key component of the bearings that support high-speed rotation of centrifuges. Shipments of the magnets, which were sized to fit the specific type of centrifuge used at the Kahuta plant, were apparently made between December 1994 and mid-1995. It was not clear whether the ring magnets were intended for Kahuta as a "future reserve supply," or whether they were intended to permit Pakistan to increase the number of uranium-enrichment centrifuges, either at Kahuta or at another location.

  - As of the mid-1990s it was widely reported that Pakistan's stockpile consisted of as many as 10 nuclear warheads based on a Chinese design.

  - Pakistan now has extensive nuclear facilities:

  - There is a 50-70 megawatt research and Plutonium production reactor at Khushab.

  - The main Plutonium extraction plant is at Chasma, and is not under IAEA inspection. Pakistani Institute of Nuclear Science and Technology has pilot plants for plutonium extraction that are not under IAEA control.

  - The Khan Research Laboratory at Kahuta is a large-scale Uranium enrichment plant not under IAEA control.

  - The Carnegie Endowment reports that Pakistan has continued work on its 40-MWt, heavy-water research reactor at Khushab, with Chinese assistance, Pakistan reported completed its Khushab reactor in 1996, but it has not been fueled, apparently because of Pakistan's inability to procure (or produce) a sufficient supply of unsafeguarded heavy water.

  - Khushab has not been placed under IAEA controls. It is estimated to be capable of generating enough plutonium for between one and two nuclear weapons annually. Once operational, it could provide Pakistan with the country's first source of plutonium-bearing spent fuel free from IAEA controls. Not only would this increase Pakistan's overall weapons production capabilities by perhaps 20-30 percent (assuming that the Kahuta enrichment plant can produce enough weapons-grade uranium for three to four weapons per year), but the availability of plutonium would permit Pakistan to develop smaller and lighter nuclear warheads. This in turn might facilitate Pakistan's development of warheads for ballistic missiles. In addition, Pakistan might employ the Khushab reactor to irradiate lithium-6 to produce tritium, a material used to "boost" nuclear weapons so as to improve their yield-to-weight efficiency.

  - Weapons-grade plutonium from the Khushab reactor's spent fuel could be extracted at the nearby Chasma reprocessing plant, if that facility becomes operational, or at the pilot-scale New Labs reprocessing facility at the Pakistani Institute of Nuclear Science and Technology (PINSTECH) in Rawalpindi—both facilities being outside IAEA purview.

  - China is reported to be assisting Pakistan with completing a facility linked to the Khushab reactor and thought to be either a fuel fabrication plant or a plutonium separation (reprocessing) plant. Pakistan previously was not thought to have a fuel fabrication facility to manufacture fuel for the new reactor.

  - The status of Pakistan's reprocessing capabilities at New Labs in Rawalpindi and at the Chasma site has not been clear from published sources. A classified U.S. State Department analysis prepared in 1983 said that the New Labs facility was "nearing completion" at that time; thus the facility could well be available for use today. Reports on the Chasma reprocessing facility in the early 1990s suggested that it was progressing, but probably still several years from completion. According to an analysis by the CIA quoted in the press, as of April 1996, China was providing technicians and equipment to help finish the facility. According to reports of August 1997, however, U.S. officials believe that, while some Chinese assistance and equipment may have trickled into the Chasma reprocessing project, the reprocessing complex at Chasma "is an empty shell." If this description is correct, Pakistan may have only the laboratory-scale reprocessing capability at New Labs and may be further from major plutonium reprocessing activities than once thought.

- Pakistani specialists also pursued efforts to improve the Kahuta enrichment plant and, possibly, to expand the country's capacity to enrich uranium. A uranium weapon needs roughly 15 kilograms of U-235 with 93% enrichment.

- On 28 May 1998 Pakistan announced that it had successfully conducted five nuclear tests. These tests came slightly more than 2 weeks after India carried out 5 nuclear tests of its own, and after many warnings by Pakistani officials that they would respond to India (the two countries have fought 3 wars). In addition, Pakistan's President Rafiq Tarar declared a state of emergency, citing "threat by external aggression to the security of Pakistan."

  - According to the announcement, the results were as expected, and there was no release of radioactivity. The Pakistan Atomic Energy Commission claimed that the five nuclear tests conducted on Thursday measured up to 5.0 on the Richter scale, with a reported yield of up to 40 KT (equivalent TNT). According to some reports the detonations took place over a two-hour period. One device was said to be a boosted uranium device, with the four other tests being low yield sub-kiloton devices. On 30 May 1998 Pakistan tested one more nuclear warhead with a yield of 12 kilotons.

  - The tests were conducted at Balochistan, bringing the total number of claimed tests to six. It has also been claimed by Pakistani sources that at least one additional device, initially planned for detonation on 30 May 1998, remained emplaced underground ready for detonation.

  - These claims cannot be independently confirmed by seismic means. Indian sources have said that as few as two weapons were actually detonated, each with yields considerably lower than claimed by Pakistan. Three of the tests on May 28, however, may have been subkiloton, The two larger tests indicate one may have been a test of a boost weapon of 25-36 kilotons. The second has a claimed yield of 12 KT, and a seismic signature of 7-8 KT. The FAS indicates that seismic data showed at least two and possibly a third, much smaller, test in the initial round of tests at the Ras Koh range.

  - The single test on 30 May provided a clear seismic signal, although Pakistan claimed a 12 KT yield and the data indicate 1-3 KT.

  - Pakistan's Foreign Minister announced on May 29, 1999 that Pakistan was a nuclear power.

  - He stated that "Our nuclear weapons capability is solely meant for national self defense. It will never be used for offensive purposes." He also stated, however, that "We have nuclear weapons, we are a nuclear power…we have an advanced missile program" and that Pakistan would retaliate "with vengeance and devastating effect" against any attack by India.

  - He claimed that Pakistan had tested five nuclear devices in the Chagi Hills in Western Pakistan on May 28, 1998. It is not clear that Pakistan tested this many, and it may simply have claimed to have tested as many as India had earlier.

  - Pakistani scientists (Dr. Abdul Qadeer and Samar Mubrik) said at the time that Pakistan would need 60-70 warheads to have a credible deterrent.

  - Pakistan announced in February 2000 that it was creating a new National Command Authority to control its long-range missiles and nuclear program. It is responsible for policy and strategy, and "will exercise employment and development control over all the strategic forces and strategic organizations."

  - It is colocated with the Joint Strategic Headquarters.

  - A new Strategic Plans Division has been created under a Lt. General, and acts as a secretariat for the NCA. The NCA has two committees.

  - The Employment Control Council determines the shape and use of the nuclear arsenal. It is chaired by the head of state with the Foreign Minister as Deputy Chairman. It includes the Chairman of the Joint Chiefs, the service chiefs, the Director General of the Strategic Plans Division, and other scientific, technical, and political representatives as are required by the committee.

  - The Development Council supervises the development of nuclear and missile forces and related C4I systems. It is chaired by the head of government with the Chairman of the Joint Chiefs as a Deputy and the service chiefs, Director General Strategic Plans Division, and scientific and technical representatives are members.

  - The Carnegie Endowment estimates that Pakistan has over 200 kg of weapons-grade highly-enriched uranium — enough to construct fifteen to twenty-five nuclear weapons (India could build about seventy). Pakistan is thought to have received a workable nuclear bomb design from China in the early 1980s, and to have conducted a "cold test" — a full test, but without a core of weapons-grade material — of this design in 1986.

  - The CIA reported in February 1999 that Pakistan sought a wide variety of dual-use nuclear-related equipment and materials from sources throughout the world during the first half of 1998. Islamabad has a well-developed nuclear weapons program, as evidenced by its first nuclear weapons tests in late May 1998. (The United States imposed

sanctions against Pakistan as a result of these tests.) Acquisition of nuclear-related goods from foreign sources will be important for the development and production of more advanced nuclear weapons.

- The CIA reported in February 1999 that Pakistan China had provided extensive support in the past to Pakistan's WMD programs, and some assistance continues.
- The DCI Nonproliferation Center (NPC) reported in February 2000 that Pakistan acquired a considerable amount of nuclear-related and dual-use equipment and materials from various sources-principally in the FSU and Western Europe-during the first half of 1999. Islamabad has a well-developed nuclear weapons program, as evidenced by its first nuclear weapons tests in late May 1998. (The US imposed sanctions against Pakistan as a result of these tests.) Acquisition of nuclear-related goods from foreign sources will be important if Pakistan chooses to develop more advanced nuclear weapons. China, which has provided extensive support in the past to Islamabad's WMD programs, in May 1996 promised to stop assistance to unsafeguarded nuclear facilities-but we cannot rule out ongoing contacts.

- George Tenet, the Director of the CIA, testified before the Senate Foreign Relations Committee on March 20, 2000 and stated that, "India and Pakistan are developing more advanced nuclear weapons and are moving toward deployment of significant nuclear arsenals. Both sides are postured in a way that could lead to more intense engagements later this year. Our concern persists that antagonisms in South Asia could still produce a more dangerous conflict on the subcontinent."
- The CIA reported in August 2000 that Pakistan continued to acquire nuclear-related and dual-use equipment and materials from various sources—principally in Western Europe—during the second half of 1999. Islamabad has a well-developed nuclear weapons program, as evidenced by its first nuclear weapons tests in late May 1998. Acquisition of nuclear-related goods from foreign sources will be important if Pakistan chooses to develop more advanced nuclear weapons. China, which has provided extensive support in the past to Islamabad's WMD programs, in May 1996 promised to stop assistance to unsafeguarded nuclear facilities—but we cannot rule out ongoing contacts.

Source: Prepared by Anthony H. Cordesman, Arleigh A. Burke Chair in Strategy, CSIS.

Part Nine

Israeli Force Trends

Israel's Search for Weapons of Mass Destruction

Delivery Systems

- Israel has done technical work on a TERCOM type smart warhead. It has examined cruise missile guidance developments using GPS navigation systems. This system may be linked to a submarine launch option.
- As part of its first long-range missile force, Israel deployed up to 50 "Jericho I" (YA-1) missiles in shelters on mobile launchers with up to 400 miles range with a 2,200 pound payload, and with possible nuclear warhead storage nearby. These missiles were near copies of the two-stage, solid-fueled, French MD-620 missile. Some reports claim the first 14 were built in France. (Some reports give the range as 500 kilometers.)
    - There are convincing indications that Israel has deployed nuclear armed missiles on mobile launchers. Most outside sources call the first of these missiles the "Jericho I", but Israel has never publicly named its long-range missile systems.
    - These missiles were near-copies of the two-stage, solid-fueled, French MD-620 missile. Some reports claim the first 14 were built in France.
    - A number of sources indicate that Israel deployed up to 50 "Jericho I" (YA-1) missiles on mobile launchers in shelters in the hills southwest of Jerusalem, with up to 400 miles range with a 2,200 pound payload, and with possible nuclear warhead storage nearby.
    - The current deployment of the "Jericho I" force is unclear. Some sources say it has been phased out for the Jericho II missile.[xii]
- Israel has since gone far beyond the Jericho I in developing long-range missile systems. It has developed and deployed the "Jericho II" (YA-2).
    - The "Jericho II" began development in the mid-1970s, and had its first tests in 1986.[xiii] Israeli carried out a launch in mid-1986 over the Mediterranean that reached a range of 288 miles (460 kilometers). It a seems to have been tested in May 1987. A flight across the Mediterranean reached a range of some 510 miles (820 kilometers), landing south of Crete.[xiv] Another test occurred on September 14, 1989.
    - Israel launched a missile across the Mediterranean that landed about 250 miles north of Benghazi, Libya. The missile flew over 800 miles, and US experts felt it had a maximum range of up to 900-940 miles (1,450 kilometers) -- which would allow the Jericho II to cover virtually all of the Arab world and even the Southern USSR [xv]
    - The most recent version of the missile seems to be a two-stage, solid-fueled missile with have a range of up to 900 miles (1,500 kilometers) with a 2,200 pound payload.
    - Commercial satellite imaging indicates the Jericho II missile may be 14 meters long and 1.5 meters wide. Its deployment configuration hints that it may have radar area guidance similar to the terminal guidance in the Pershing II and probably has deployed these systems.
    - Some Jericho IIs may have been brought to readiness for firing during the Gulf War.
- Israel began work on an updated version of the Jericho 2 no later than 1995 in an effort to stretch its range to 2,000 km. At least part of this work may have begun earlier in cooperation with South Africa.
- Israel is also seeking technology to improve its accuracy, particularly with gyroscopes for the inertial guidance system and associated systems software.
- Israel is actively exa mining ways to lower the vulnerability of its ballistic missiles and nuclear weapons. These include improved hardening, dispersal, use of air-launched weapons, and possible sea-basing.
- There are also reports that Israel is developing a Jericho III missile, based on a booster it developed with South Africa in the 1980s.
    - The tests of a longer-range missile seem to have begun in the mid-1980s.[xvi] A major test of such a booster seems to have taken place on September 14, 1989, and resulted in extensive reporting on such cooperation in the press during October 25 and 26, 1989.
    - It is possible that that both the booster and any Israeli-South African cooperation may have focused on satellite launches.[xvii] Since 1994, however, there have been are numerous reports among experts that Israel is seeking a missile with a range of at least 4,800 kilometers, and which could fully cover Iran and any other probable threat.

- Jane's estimates that the missile has a range of up to 5,000 kilometers and a 1,000 kilogram warhead. This estimate is based largely on a declassifed DIA estimate of the launch capability of the Shavit booster that Israel tested on September 19, 1988.[xviii]

- Reports of how Israel deploys its missiles differ.

  - Initial reports indicated that 30-50 Jericho I missiles were deployed on mobile launchers in shelters in the cases southwest of Tel Aviv. A source claimed in 1985, that Israel had 50 missiles deployed on mobile erector launchers in the Golan, on launchers on flat cars that could be wheeled out of sheltered cases in the Negev. (This latter report may confuse the rail transporter used to move missiles from a production facility near Be'er Yaakov to a base at Kefar Zeharya, about 15 kilometers south of Be'er Yaakov.)

  - More recent reports indicate that Jericho II missiles are located in 50 underground bunkers carved into the limestone hills near a base near Kefar Zeharya. The number that are on alert, command and control and targeting arrangements, and the method of giving them nuclear warheads has never been convincingly reported.[xix]

  - *Jane's Intelligence Review* published satellite photos of what it said as a Jericho II missile base at Zachariah (God remembers with a vengeance) several miles southeast of Tel Aviv in September 1997.[xx] According to this report, the transport-erector-launcher (TEL) for the Jericho II measures about 16 meters long by 4 meters wide and 3 meters high. The actual missile is about 14 meter long and 1.5 meters wide. The TEL is supported by three support vehicles, including a guidance and power vehicle. The other two vehicles include communications vehicle and a firing control vehicle. This configuration is somewhat similar to that used in the US Pershing II IRBM system, although there are few physical similarities.

  - The photos in the article show numerous bunkers near the TEL and launch pad, and the article estimates a force of 50 missiles on the site. It also concludes that the lightly armored TEL would be vulnerable to a first strike, but that the missiles are held in limestone caves behind heavy blast-resistant doors. It estimates that a nuclear-armed M-9 or Scud C could destroy the launch capability of the site.[xxi]

- The same article refers to nuclear weapons bunkers at the Tel Nof airbase, a few kilometers to the northwest. The author concludes that the large number of bunkers indicates that Israel may have substantially more nuclear bombers than is normally estimated – perhaps up to 400 weapons with a total yield of 50 megatons.[xxii]

- F-15, F-16, F-4E, and Phantom 2000 fighter-bombers capable of long-range refueling and of carrying nuclear and chemical bombs.

- The same article refers to nuclear weapons bunkers at the Tel Nof airbase, a few kilometers to the northwest. The author concludes that the large number of bunkers indicates that Israel may have substantially more nuclear bombers than is normally estimated – perhaps up to 400 weapons with a total yield of 50 megatons.

  - Israel bought some Lance missile launchers and 160 Lance missiles, with 130 kilometers range, from the US in the 1970s. The US removed them from active duty during 1991-1994. The status of the Israeli missiles is unknown.

  - There are reports of the development of a long-range, nuclear armed version of Popeye with GPS guidance and of studies of possible cruise missile designs that could be both surface-ship and submarine based.

  - Variant of the Popeye air-to-surface missile believed to have nuclear warhead.

  - The MAR-290 rocket with 30 kilometers range is believed to be deployed

  - MAR-350 surface-to-surface missile with range of 56 miles and 735 lb. payload believed to have completed development or to be in early deployment.

  - Israel seeking super computers for Technion Institute (designing ballistic missile RVs), Hebrew University (may be engaged in hydrogen bomb research), and Israeli Military Industries (maker of "Jericho II" and Shavit booster).

- Israel current review of its military doctrine seems to include a review of its missile basing options, and the study of possible hardening and dispersal systems. There are also reports that Israel will solve its survivability problems by deploying some form of nuclear-armed missile on its new submarines.

- Some reports indicate that Israeli submarines may be capable of carrying nuclear-armed Popeye Turbo cruise missiles, to provide a second-strike capability that would ensure Israeli could deter a striking to take out its nuclear weapons with a surprise attack. The most detailed have appeared in Jane's Defense Weekly, the London Sunday Times, and reporting by the The Federation of American Scientists (FAS):

  - The FAS reports that Israel may have secretly carried out its first test launches from two German-built *Dolphin*-class submarines of **130km UGM-84C Sub Harpoon** missiles capable of carrying nuclear warheads in May 2000. The missiles are reported to have been launched from vessels off Sri Lanka in the Indian Ocean and to have hit a target at a

range of about 1,500 kilometers [about 930 statute miles]. Israel is reported to possess a 200kg nuclear warhead, containing 6kg of plutonium, that could be mounted on cruise missiles.

- Israel has reportedly developed an air-launched cruise missile that could be operational by 2002, called the Popeye Turbo.
- The Popeye Turbo is normally reported to have a range at between 200 km and 350 km, and to be a turbo-jet powered cruise missile that may incorporate avionics and other components developed for the Popeye family of missiles. The Popeye Turbo missile is probably similar to if not identical with the Israeli submarine-launced cruise missile carried on the *Dolphin*-class submarines. The baseline Popeye missile with a range of 45 miles has a diameter of 21 inches, and is nearly 16 feet long.
- The reported range of 1,500 km for the SLCM tested in May 2000 is several times greater than the previously reported range for the Popeye Turbo. However, open literature provides little information. There is no particular reason to doubt that Israel could develop a variant of the Popeye Turbo with a range of 1,500 km, simply by lengthening the fuel tank associated with a 300-350 km variant reported by US intelligence. The longer range reported in June 2000 would suit with Israeli targetting requirements.
- The submarines have six 533-millimeter torpedo tubes suitable for the 21-inch torpedoes that are normally used on most submarines, including those of the United States. Some reports suggest that the submarines have a total of ten torpedo tubes -- six 533-millimeter and four 650-millimeter. The four larger 25.5 inch diameter torpedo tubes could be used to launch a long-range nuclear-capable submarine-launched cruise missile (SLCM). For comparison, the American MK-48 heavy torpedo is 21 inches in diameter, and 19 feet long, while the BGM-109 Tomahawk SLCM is 20.4 inches in diameter and 20.5 feet long [including the booster motor], and the Russian SS-N-21 SLCM is similar in configuration and dimensions to the American Tomahawk.
- The FAS reports that Israeli is considering a system of rotation where two of the vessels would remain at sea: one in the Red Sea and Persian Gulf, the other in the Mediterranean. A third would remain on standby

Chemical Weapons

- Israeli has signed the CWC, but not ratified it.
- Reports of mustard and nerve gas production facility established in 1982 in the restricted area in the Sinai near Dimona seem incorrect. May have additional facilities. May have capacity to produce other gases. Probable stocks of bombs, rockets, and artillery.
- Extensive laboratory research into gas warfare and defense.
- According to some reports, Israel revitalized its chemical warfare facilities south of Dimona in the mid-1980s, after Syria deployed chemical weapons and Iraq began to use these weapons in the Iran-Iraq War.
- An El Al 747-200 cargo plane crashed in southern Amsterdam on October 4, 1992, killing 43 people in the apartment complex it hit. This led to extensive examination of the crash and the plane was found to be carrying 50 gallons on dimethyl methylphosphonate, a chemical used to make Sarin nerve gas. The chemical had been purchased from Solkatronic Chemicals in the US and was being shipped to the Israel Institute for Biological Research. It was part of an order of 480 pounds worth of the chemical. Two of the three other chemicals used in making Sarin were shipped on the same flight. Israel at first denied this and then claimed it was only being imported to test gas masks.[xxiii]
- Israel may have the contingency capability to produce at least two types of chemical weapons and has certainly studied biological weapons as well as chemical ones. According to one interview with an Israeli source of unknown reliability, Israel has mustard gas, persistent and non-persistent nerve gas, and may have at least one additional agent.
- Development of defensive systems includes Shalon Chemical Industries protection gear, Elbit Computer gas detectors, and Bezal R&D air crew protection system.
- Extensive field exercises in chemical defense.
- Gas masks stockpiled, and distributed to population with other civil defense instructions during Gulf War.
- Warhead delivery capability for bombs, rockets, and missiles, but none now believed to be equipped with chemical agents.

Biological Weapons

- Israel has not signed the BWC.
- Extensive research into weapons and defense.
- Ready to quickly produce biological weapons, but no reports of active production effort.

- Israel has at least one major research facility with sufficient security and capacity to produce both chemical and biological weapons.[xxiv] There are extensive reports that Israel has a biological weapons research facility at the Israel Institute for Biological Research at Nes Tona, about 12 miles south of Tel Aviv, and that this same facility also has worked on the development and testing of nerve gas. This facility has created enough public concern in Israel so that the mayor of Nes Tona has asked that it be moved away from populated areas. The facility is reported to have stockpiled Anthrax and to have provided toxins to Israeli intelligence for use in covert operations and assassinations like the attempt on a Hamas leader in Jordan in 1997.[xxv]
    - The Israel Institute for Biological Research is located in a 14 acre compound. It has high walls and exceptional security, and is believed to have a staff of around 300, including 120 scientists. A former deputy head, Marcus Kingberg, served 16 years in prison for spying for the FSU.
- US experts privately state that Israel is one of the nations included in US lists of nations with biological and chemical weapons. They believe that Israel has at least some stocks of weaponized nerve gas, although they may be stored in forms that require binary agents to be loaded into binary weapons.
    - They believe that Israel has fully developed bombs and warheads capable of effectively disseminating dry, storable biological agents in micropowder form and has agents considerable more advanced than anthrax. Opinion differs over whether such weapons are actively loaded and deployed. Unconfirmed reports by the British *Sunday Times* claimed that IAF F-16s are equipped for strikes using both these weapons and chemical weapons.[xxvi]

Nuclear Weapons

- Israel has signed the CTBT, but not the NPT. It has, however, supported a WMD free zone. Gideon Frank stated at the 43rd General Conference of the IAEA that he was reaffirming Israel's commitment "in due course and in the proper context, to establishing the Middle East as a zone free of WMD and missiles."
- Israel has significant nuclear facilities:
    - Two significant reactor projects: the 5 megawatt HEU light-water IRR I reactor at Nahal Soreq; and the 40-150 megawatt heavy water, IRR-2 natural uranium reactor used for the production of fissile material at Dimona. Only the IRR-1 is under IAEA safeguards.
    - Dimona has conducted experiments in pilot scale laser and centrifuge enrichment, purifies UO_2, converts UF_6 and fabricates fuel for weapons purpose.
    - Uranium phosphate mining in Negev, near Beersheba, and yellow cake is produced at two plants in the Haifa area and one in southern Israel.
    - Pilot-scale heavy water plant operating at Rehovot.
    - Major weapons facilities include production of weapons grade Plutonium at Dimona, nuclear weapons design facility at Nahal Soreq (south of Tel Aviv), missile test facility at Palmikim, nuclear armed missile storage facility at Kefar Zekharya, nuclear weapons assembly facility at Yodefat, and tactical nuclear weapons storage facility at Eilabun in eastern Galilee.
    - Views differ over the history of the Israeli nuclear weapons effort. On outline of its history based on work by the Federation of American Scientists indiates that:
    - The project began in the late 1940s when HEMED GIMMEL a special unit of the IDF's Science Corps, began a two-year geological survey of the Negev desert in 1949 that include the search uranium reserves. No significant sources of uranium were found, but recoverable amounts were located in phosphate deposits.
    - The Israel Atomic Energy Commission (IAEC) was created in 1952. Its chairman, Ernst David Bergmann, had long advocated an Israeli bomb as the best way to ensure "that we shall never again be led as lambs to the slaughter." Bergmann was also head of the Ministry of Defense's Research and Infrastructure Division (known by its Hebrew acronym, EMET), which had taken over the HEMED research centers (HEMED GIMMEL among them, now renamed Machon 4) as part of a reorganization.
    - Under Bergmann, the line between the IAEC and EMET blurred to the point that Machon 4 functioned essentially as the chief laboratory for the IAEC. By 1953, Machon 4 had not only perfected a process for extracting the uranium found in the Negev, but had also developed a new method of producing heavy water, providing Israel with an indigenous capability to produce some of the most important nuclear materials.
- In the fall of 1956, France agreed to provide Israel with an 18 MWt research reactor. The Suez Crisis then led the Soviet Union made a thinly veiled threat of a nuclear attack against Israel while the United States stood idly by. This convinced Israeli leaders that an independent nuclear capability was needed to prevent reliance on potentially unreliable allies, and the

collapse of the Anglo-French attack led to a French willininges to provide weapons technology. French premier Guy Mollet is even quoted as saying privately that France "owed" the bomb to Israel.

- France and Israel signed a revised agreement on 3 October 1957 for France to build what was said to bea 24 MWt reactor. In fact, the cooling systems and waste facilities were designed to handle three times that power) and a secret protocol to provide a chemical reprocessing plant. This complex was secretly constructed at Dimona, in the Negev desert under the leadership of Col. Manes Pratt of the IDF Ordinance Corps. The effort was not reported to the IAEA.
- The United States became aware of Dimona's existence after U-2 overflights in 1958, but it was not identified as a nuclear site until two years later. Israel stated that Dimona was a textile plant, an agricultural station, and a metallurgical research facility, until December 1960.
- The CIA issued a report on December 8 1960 outlining Dimona's implications for nuclear proliferation, United States inspectors visited Dimona several times during the 1960s, but they were unable to obtain an accurate picture of Israeli activities because of Israeli control over the timing and agenda of the visit, and deceptions like a false control room panels and the bricking over of elevators and hallways to secret areas of the facility..
- A new Israeli intelligence agency, the Office of Special Tasks, was created to provide security for the nuclear weapons project which, at its height, employed 1,500 Israeli scientists, many with doctorates, and included a community of French workers and their families consisting of over 2,500 people. In addition, France bought heavy water from Norway on the condition that it not be transferred to a third country, and the French Air Force secretly flew as much as four tons to Israel.
- President de Gaulle altered Franco-Israeli cooperation even before the 1967 war. In May 1960, France began to pressure Israel to make the project public and to submit to international inspections of the site, and threatened to withhold the reactor fuel. The FAS reports that de Gaulle met with Ben-Gurion and offered to sell Israel fighter aircraft in exchange for stopping work on the reprocessing plant. Israel the worked out a compromise. France would supply the uranium and components already placed on order and would not insist on international inspections. In return, Israel would assure France that they had no intention of making atomic weapons, would not reprocess any plutonium, and would reveal the existence of the reactor, which would be completed without French assistance. In reality, nothing changed - French contractors finished work on the reactor and reprocessing plant, uranium fuel was delivered and the reactor went critical in 1963-64.
    - In addition to the enriched uranium from the Pennsylvania facility, 200 tons of uranium ore that disappeared from a ship in the Mediterranean in 1968 probably were also diverted to Israel.
- There is a long history of uncertain estimates the numbers and kinds of weapons Israel posseses:
    - The CIA station in Tel Aviv estimated in the mid-1960s that the Israeli nuclear weapons program was an established fact, but US analyses of Israel's nuclear program then suffered from reliance on the assumptions - that Israel would need US assistance to successfully build a bomb, and that Israel would let its nuclear capability be publicly known.
    - Some type of non-nuclear test, perhaps a zero yield or implosion test, occurred on 2 November 1966 [possibly at Al-Naqab in the Negev].
    - The CIA reported in early 1968 that Israel had successfully produced four nuclear weapons. The FAS says, however, that this estimate was based on an informal conversation between Carl Duckett, head of the CIA's Office of Science and Technology, and Edward Teller, father of the hydrogen bomb. Teller said that, based on conversations with friends in the Israeli scientific and defense establishment, he had concluded that Israel was capable of building the bomb, and that the CIA should not wait for an Israeli test to make a final assessment because that test would never be carried out. The figure of four devices was based on the assumption that 100 kg of enriched uranium - enough for four crude weapons - missing from a facility at Apollo, Pennsylvania, but much of the missing material was eventually recovered from the floors and ventilation ducts of the plant when it was decommissioned in the 1980s).
    - In 1974, the CIA estimated that Israel had between ten and twenty nuclear weapons. The FAS reports that this estimate was based on the assumption that Israel could have separated enough plutonium for at least six bombs since 1970, in addition to those made with the allegedly stolen uranium. The upper bound was derived from CIA speculation regarding the number of possible Israeli targets, and not from any specific intelligence. Because this target list was presumed to be relatively static, this remained the official American estimate until the early 1980s.
    - Some feel a suspected nuclear explosion in the southern Indian Ocean in 1979 was a joint South African-Israeli test.
    - Director of CIA indicated in May 1989, that Israel might be seeking to construct a thermonuclear weapon.
    - *Jane's Intelligence Review* published an article in September 1997 which refers to nuclear weapons bunkers at the Jericho 2 missile base at Zachariah (God remembers with a vengeance) several miles southeast of Tel Aviv and at Tel Nof airbase, a few kilometers to the northwest. The author concludes that the large number of bunkers indicates that

Israel may have substantially more nuclear bombers than is normally estimated – perhaps up to 400 weapons with a total yield of 50 megatons. [xxvii]

- Estimates of Israel's numbers and types of weapons differ sharply.
  - Stockpile of at least 60-80 plutonium weapons.
  - May have well over 100 nuclear weapons assemblies, with some weapons with yields over 100 Kilotons.
  - US experts belief Israel has highly advanced implosion weapons. Known to have produced Lithium-6, allowing production of both tritium and lithium deuteride at Dimona. Facility no longer believed to be operating.
  - Some weapons may be ER variants or have variable yields.
  - Stockpile of up to 200-300 weapons is possible.
  - The FAS estimate is as follows: "The actual size and composition of Israel's nuclear stockpile is uncertain, and is the subject of various estimates and reports. It is widely reported that Israel had two bombs in 1967, and that Prime Minister Eshkol ordered them armed in Israel's first nuclear alert during the Six-Day War. It is also reported that, fearing defeat in the October 1973 Yom Kippur War, the Israelis assembled 13 twenty-kiloton atomic bombs. Israel could potentially have produced around 20 nuclear warheads in the period 1970-1980, and from 100 to 200 warheads by the mid-1990s. In 1986 descriptions and photographs were published in the London Sunday Times of a purported underground bomb factory. The photographs were taken by Mordechai Vanunu, a dismissed Israeli nuclear technician. His information led experts to conclude that Israel had a stockpile of 100 to 200 nuclear devices. As of the late 1990s Israel's nuclear arsenal was thought to consist of from 75-130 weapons, based on plutonium production estimates. The stockpile would certainly include warheads for mobile Jericho-1 and Jericho-2 missiles, as well as bombs for Israeli aircraft, and may include other tactical nuclear weapons of various types.
  - The FAS estimates that the upper and lower limits on Israel's stockpile may be limited by considering several variables. The current thermal power of the Dimona reactor is variously reported at between 100 MWt and 200 MWt. The reactor may have operated an average of between 250 and 300 days annually, and produced approximately 0.9 to 1.0 grams of plutonium for each thermal megawatt day. This would suggest an annual production rate of plutonium of between 20 and 60 kilograms, compared to the 40 kilograms annually reported by Vanunu. Israel may use between 4 and 5 kilograms of plutonium per weapon [5 kilograms is a conservative estimate, and Vanunu reported that Israeli weapons used 4 kg]. Given this range of uncertainty, as of 2000 the Israeli stockpile almost certainly consists of at least 125 weapons and probably no more than about 425 weapons.
- Israel's position on nuclear weapons may be changing:
  - Several reports indicate that Israel's strategic review during 1997-1998 involved a review of Israeli nuclear strategy that included Prime Minster Netanyahu's Office, the Ministry of Defense, and Foreign Ministry. This effort seems to have decided that Israel should keep the nature of its weapons of mass destruction and missiles secret, strengthen its missile defenses, and reduce the vulnerability of its nuclear strike forces.[xxviii]
  - The Israeli paper Yedioth Ahronoth, was allowed to print excerpts from the classified positions of the trial of Mordecai Vanunu, a former technician at Dimona, in November 1999.
  - Israel held its first parliamentary debate on nuclear weapons on February 2 2000, at the request of Issam Mahoul, a member of the Knesset from the largely Arab Hadash party.[xxix] Mahoul provided the first statistics and description of Israel's nuclear program ever mentioned in the Knesset, although the government rejected the numbers and the debate rapidly turned into an Arab-Israeli shouting match.[xxx]
  - Israel seems to be considering ways to reduce the vulnerability of its nuclear strike force, and to reduce the incentive for any strike on its delivery system. These seem to include new forms of dispersal, hardening some facilities, and the possible use of Israel's new Dolphin submarines to deliver cruise missiles.
- Israel still refuses to openly discuss its deterrent or the nuclear issue in various regional arms control talks, although it has increasingly supported arms control measures that do not force it to declare its nuclear capability.
  - It has agreed to abide by the terms of the Missile Technology Control Regime (MTCR), it signed the Chemical Weapons Convention (CWC) in January 1993, and the Comprehensive Test Ban Treaty in September 1996.[xxxi]
  - In May 1997, Israel also carefully leaked an interview given by Gideon Frank, the former head of the Atomic Energy Commission in the Prime Minister's office. frank that said Israel could only give up its nuclear weapons when it reached a peace with Egypt, Syria, and other states similar to the one reached between Argentina and Brazil. Frank said that it would require a proven framework for mutual cooperation, particularly in the economic area, a "process of democratization" in the Arab world, and "a long, phased confidence-building process."[xxxii]

- Israeli Foreign Minister David Levy stated on May 11, 2000 that Israel could not sign the Nuclear Non-Proliferation Treaty because Iran and Iraq posed too great a threat to be ignored. "WE have not reached the stage where the friends of Israel can guarantee the future."

Missile Defenses

- Israel has developed a comprehensive missile defense plan, including a 10-year funding plan. The Arrow missile defense program forms the core of this plan, but it involves layered defense, a possible boost-phase interceptor, new battle management systems and sensors, and close cooperation with the US. It also involves consideration of extending the defense umbrella to cover Jordan, reducing the vulnerability of Israeli missile and nuclear forces, and possible cooperation with Turkey.[xxxiii]

- The resulting Homa (barrier) project now calls for both tactical and theater defenses to be overlayed in ways that combine Israeli systems with US reinforcements. Israel recognizes, however, that any program must be technology and threat driven and respond to new developments and events. It also recognizes that effective defense against long-range missiles involves terminal velocities that severely limit the effectiveness of the anti-tactical ballistic missiles it can afford to develop. As a result, Israel is faced with the challenge of either finding either some form of boost phase defense or an "upper tier" wide-area threat defense with a high intercept capability even against missiles closing from ranges in excess of 1,000 kilometers. (Missile launch ranges from Iraq, Libya and Syria are under 1,000 kilometers and have closing velocities suited to lower tier theater missile defenses and which still give tactical ballistic missile defenses some effectiveness in point defense over a reasonably wide range of deployment locations. Iran must generally launch from ranges in excess of 1,000 kilometers, and the closing speeds of more modern and longer-range missiles like the Shahab are faster and present much more serious intercept problems.)

- *The Tactical High Energy Laser (THEL) or Nautilus*

  - The Tactical High Energy Laser or THEL program was originally a $100 million program, with the US paying $70 million and Israel paying $30 million. At present it is primarily a defense against unguided rockets, rather than guided missiles. It is far from clear that it will work, since current versions need to hold a rocket in flight for nearly 15 seconds, and the average flight time of an 80-240 mm rocket is generally less than 30 seconds. They are also dependent on a clear line of sight, so haze and smoke present major problems.[xxxiv]

  - Nevertheless, tests at White Sands in February 1996 proved that a laser could track a missile for the required time, and that a deuterium fluoride laser beam could destroy a missile in flight. The concept is still being pushed forward, largely in an effort to provide defenses against Hizbollah rocket attacks on northern Israel. Rockets can also be used to launch large numbers of biological and chemical weapons, however, and THEL provides a tactical layer of defense.[xxxv]

  - The THEL program ran into trouble in 1999 when a series of technical difficulties encountered during initial tests and chemical leaks caused by faulty valves delayed the project by up to a year.[xxxvi] The delays resulted in cost overruns totaling $30-50 million over the $130.8 million ceiling. The cost overruns jeopardized the future of the project as the contractor and the US government argued over who was responsible for the extra cost.[xxxvii] THEL was saved when the Israeli Ministry of Defense and the US Army agreed to each pay a quarter of the overruns while the contractor is still responsible for the other half.[xxxviii]

  - The THEL deuterium fluoride laser has since been successful in tests against incoming Kathusha rockets, and the demonstrator may be dismantled and shipped to Israel for operational testing. The creation and deployment of an operational test bed is unlikely to be complete before early 2001, however, and the cost-effectiveness of the program remains uncertain.[xxxix]

- *The Patriot and PAC-3*

  - Israel currently deploys three Patriot batteries using systems and missiles whose anti-tactical ballistic missile (ATBM) defenses have been upgraded since the Gulf War. They now have software that allows them to distinguish between the missile booster and warhead far more accurately, and they have a much greater kill probability against an oncoming warhead. Each battery has three missile launch vehicles. It is receiving new equipment with a value estimated at $73 million, which was approved by the US Department of Defense in June 1998. This equipment includes three AN/MPQ-53 radar sets, three AN/MSQ-104 engagement control stations, three M-983 tractors, nine M931A2 trucks and other equipment. It is also developing its own ATBM defenses.

  - The Patriot is an air defense system with moderate capabilities in a largely point defense mode as a tactical ballistic missile defense system. It also provides considerable defense against cruise missiles, adding a key layer to Israeli defenses, and is being steadily improved to widen its coverage against Scud-type threats. Its speed and range are limited, however, and cannot be particularly effective against IRBM-type threats like the Shahab-3 which have closing velocities that limited the Patriot's defense area coverage to a much narrower radius near the missile launcher.

- The Patriot's capability will be further enhanced by the PAC-3 upgrade. The PAC 3 upgrade expands the area from which Patriot can intercept a missile, reduces the risk of "leakage" against ballistic missiles, introduces a superior direct hit to kill system, and improves defense against cruise missiles. The system has had major development problems and cost overruns, but did have a successful hit-to-kill intercept in March 1999.[xl] The US Department of Defense licensed the new Patriot technology for export in November 1999.[xli]

- *The Arrow*

  - The Arrow missile is an anti-tactical ballistic missile defense with limited area coverage that is tailored to Israel's needs and limited geographic area. The Arrow-2 is supposed to intercept incoming missile warheads at ranges, which have been variously reported as being from 10-40 kilometers or 33,000-131,000 feet. The missile is a two-stage, hypersonic, solid-fuel missile with a fragmentation warhead. Each Arrow-2 battery has four missile launchers with six missile tubes each, and will normally be equipped with at least 50 missiles. The system uses a Green Pine search and track radar, a Citron Tree fire control center, a Hazelnut Tree launch control center, and the Arrow 2 launcher. Its manning requires about 100 personnel.

  - Plans call for three batteries, although only two are fully funded. Israeli calculates that two batteries can defend "most populated areas in Israel." The official program cost is often said to be around $1.6 billion, although some Israelis feel the true total system-related cost will be in excess of $3 billion.[xlii]

  - The program is constantly evolving to respond to changes in technology, the development and test program, and changes in the threat. As of March 1999, it was a three-phase program with the following features:

    - Phase I: Validate Defense Concept and Demonstrate Pre-prototype Missile
    - Fixed price contract: $158 million
    - The US pays 80%; Israel pays 20%.
    - Completed in December 1982.
    - Phase II: Demonstrate Lethality, develop and demonstrate tactical interceptor and launcher.
    - Fixed price contract: $330 million.
    - The US pays 72%; Israel pays 28%.
    - Began in July 1991.
    - Successfully completed.
    - Phase III: Develop and integrate tactical system, conduct weapon system tests, and develop and implement interoperability.
    - Program cost estimated at: $616 million.
    - The US pays 48%; Israel pays 52%.
    - Began in March 1996.
    - System integration in progress.

  - Israel originally planned to deploy the Arrow in two sites near Tel Aviv and Haifa which could cover up to 85% of Israel's population. It expanded this plan to include a third site in June 1998, with an additional $57 million allocated to this battery. Partly because of the increasing pace of the threat from Iran and Syria, Israel accelerated work on the Arrow. It then planned to deploy the system in mid-1998. However, a fire at a plant near Tel Aviv caused an estimated $30 million in damage and delayed the program. As a result, the first Arrow 2 missile battery was activated on November 29, 1998, and began training in December 1998. [xliii] In 1999 Israel urged the US to consider expanding the Arrow system into a regional defense by including additional batteries in Jordan and Turkey. With additional batteries, the Arrow would protect all of Turkey, Jordan, and Israel against attacks from a country such as Iran. However, it is unlikely that the US will agree to this and it is unclear that Jordan even wants the Arrow.[xliv]

  - It is difficult to put the Arrow 2 into technical perspective. Like all systems this complex, it has had a troubled life in terms of its original technical design, management and system integration problems. It has had some successful tests, notably in an integrated weapon system test and fly out against a simulated target on September 14, 1998. It also destroyed an Israeli seal-launch TM-91 missile, which was simulating an Iraq Al Hussein missile, during its first comprehensive system test in November 1999. However, the Arrow has also had test failures and severe management and development problems. It had had only seven firing tests as of the end of 1999, and its current test program calls for less than one-fifth of the tests necessary to fully validate its reliability and effectiveness.[xlv]

- The development schedule that Israel has adopted is a high-risk program with limited testing that raises serious questions about the extent to which even successful follow-up tests will provide high reliable data on its operational probability of intercept, particularly under real-world conditions against different types of missiles and different types of "volleys." It seems possible that it may prove highly effective against Scud type missiles. However, it clearly has only limited capability against newer systems like the Iranian Shihab series, which is already forcing Israel to develop a follow-on version of the Arrow 2. Occasional Israeli claims that Arrow can provide a reliable defense capability against the regional missile threat seem to be be designed to deter possible enemies from launching, rather than claims that even the Isrfael advocates of the Arrow feel are technically credible.[xlvi]

- The Arrow 2's growth capability to deal with missiles like the No Dong, Shahab 3, Taepo Dong-1, CSS-4, and Shahab-4 is also questionable. Under these conditions, the launch footprint – or defensive area -- the Arrow can cover with a high probability of intercept might well be so restricted in area that Israel would have to rely primarily on other layers of its missile defense system.[xlvii]

- *The Integrated Boost-Phase Intercept System and Moab*

  - Israel is examining a number of options for an integrated boost-phase intercept system and gave such programs a high priority in its security talks with the US in 1999. Israel is closely studying the US airborne laser program, but its leading candidate for an Israeli system is the Moab. The Moab is a missile that can be carried on an F-15 or UAV, and that is designed to engage theater ballistic missiles at ranges of around 100 kilometers soon after launch. The Moabs would be a modified form of the Python 4 with a new booster to accelerate the missile to speeds of 1.5-2 kilometers per second. Maximum firing range is stated to be 80 kilometers from a firing altitude of 30,000 feet and up to 100 kilometers from 50,000 feet.[xlviii]

  - The Moab would initially be deployed on the IAF's F-15Is, but would eventually use a high altitude UAV that would loiter at 60-66,000 feet. Israel is looking at possible use of its Hermes UAV or some form of the Teledyne Ryan Global Hawk UAV, which can loiter for 42 hours at 40,000 feet or beyond. Conceptual pictures of the UAV show some stealth characteristics. The UAVs would be flown in launch zone constellations, nominally of four UAVs. They would be controlled by a mobile command center which would use a data link with a low data rate of less than 1 kilobit per second and which would control flight and operations. The system would be integrated into the overall IAF BM/C^{4}I theater air defense network. [xlix]

  - Cost and technical feasibility present major problems. The system is being designed by Rafael, and two cost-driven design characteristics include the use of engagement speeds below the aeroheating threshold of the missile to avoid cooling the infrared seeker, dome cooling, and a protective cap. The missile also locks on at launch to avoid an expensive data link. This design places considerable stress on the ability to design a missile with the required performance and the associated search/track systems and command and control capabilities. Much also depends on the threat being suitably close to Israel or an Israeli area of operations, the ability of Israeli intelligence to predict a narrow launch area for enemy missiles and the probable time of launch, since Israel may not be able to react to previous missile launches without risking the successful penetration of a first round or volley of enemy missiles.

- *Warning and Command and Control*

  - Israel receives spaced-based warning, tracking, and point of impact data from the US as part of an agreement signed in April 1996. It also receives warning data, and substantial information on Iranian, Iraqi, Libyan, and Syrian programs. Much of these same data are also, in fact, provided to Egypt, Jordan, and the Southern Gulf states.

  - Israel is, however, studying the possibility of creating its own space-based system and a space-based queuing system for intercept purposes. Such a system hardly seems cost-effective, given Israel's financial constraints, but the Technion Space Research Institute in Haifa has carried out studies of such options.[l] Israel began to acquire the capability to launch satellites with electro-optical sensors and digital down-links. The Shavit I launched Israel's satellite payload on September 19, 1989. It used a three stage booster system capable of launching a 4,000 pound payload over 1,200 miles or a 2,000 pound payload over 1,800 miles. It is doubtful that it had a payload capable of intelligence missions and seems to have been launched, in part, to offset the psychological impact of Iraq's missile launches.

  - This seems to be equally true of the Ofeq 2 launched in April 1990, one day after Saddam Hussein threatened to destroy Israel with chemical weapons if it should attack Baghdad. Israel used its three-stage Shavit launch vehicle to launch the Ofeq-3 from a secret launch site at the Palmachim test range near the coast south of Tel Aviv on April 5, 1995. Israeli radio almost certainly exaggerated in claiming that that the satellite could transmit imagery "that allows identification of license numbers in downtown Baghdad." In fact some reports indicate that only about 36 kilograms of its 225 kilogram weight was payload and the rest was structure. Nevertheless, the Ofeq 3 had a much larger payload than the Ofeq 2, and the IDF spokesman confirmed that the 495 pound satellite was in a low orbit that circled the earth every 90 minutes and covered Syria, Iran, and Iraq. It is scarcely coincidental that the Ofeq 3's orbit takes it almost directly over the Golan and Damascus, about 90 miles north of Teheran and 240 miles north of Baghdad.[li]

- Since that time, other launches of Israel's Ofeq and Amos series of satellites have demonstrated Israel's technical capability to launch sophisticated satellites. The Ofeq 3 launch in April 1995 seems to have been of a more capable photo reconnaissance satellite, although it evidently did not include advanced all-weather coverage and real time data processing and transmission capability.[lii] but there have been important technical failures like the failure to launch the Ofeq 4 intelligence satellite on February 4, 1998.[liii] The Ofeq 4 was intended to be an all-weather photo reconnaissance satellite with real-time capability. It is unclear whether it was intended to replace the Ofeq 3 or work together with it. Changes in the orbit of the Ofeq 3 after the Ofeq 4 failed to reach orbit might suggest the latter.[liv]
- The IDF has concluded that its own warning system would require three or four satellites flying in a low earth orbit to provide continuous coverage of the most likely 1000 by 1000 kilometer launch area.[lv] Israel's current space budget is only about $50 million a year and an effective program would cost hundreds of millions of dollars and provide less coverage and information than the US system. As a result, Israel may choose to rely on US capabilities. However, Israel may soon have another option. West Indian Space Ltd., a joint venture between US and Israeli companies, is trying to become the first commercial provider of high-resolution satellite images. It plans to operate eight small satellites based on the Ofeq design. Israel is believed to be the company's first customer.[lvi]

Advanced Intelligence Systems

- The Shavit I launched Israel's satellite payload on September 19, 1989. It used a three stage booster system capable of launching a 4,000 pound payload over 1,200 miles or a 2,000 pound payload over 1,800 miles. It is doubtful that it had a payload capable of intelligence missions and seems to have been launched, in part, to offset the psychological impact of Iraq's missile launches.
- Ofeq 2 launched in April, 1990 -- one day after Saddam Hussein threatens to destroy Israel with chemical weapons if it should attack Baghdad.
- Launched first intelligence satellite on April 5, 1995, covering Syria, Iran, and Iraq in orbit every 90 minutes. The Ofeq 3 satellite is a 495-pound system launched using the Shavit launch rocket, and is believed to carry an imagery system. Its orbit passes over or near Damascus, Tehran, and Baghdad.
- Agreement signed with the US in April 1996 to provide Israel with missile early warning, launch point, vector, and point of impact data.

Part Ten

Nuclear Arms Control Trends

SALT & START: Strategic Nuclear Arms Control

- SALT I/II: The warning:
  - Cosmetic agreement with delivery system limited ceilings that exceeded US and FSU build rate.
  - Led to MIRVing, record numbers of new warheads.
  - Technology increased first strike risk even under SALT II.
  - Russia deployed biological ICBM warheads, and massive new INF force.
  - Break out of INF systems like SS-20 led to new Eurocentric arms race.
- START I:
  - Controls deployed nuclear weapons and active delivery systems.
  - Deployed warheads will massively exceed key countervalue targets.
  - Smaller warhead numbers tend to drive out of counterforce (military) to countervalue (cities) targeting.
  - But, secure systems remove first strike incentives, and hope a “two person. zero sum, game” can be avoided.
  - US and Russia becoming steadily more “fragile,” losing post strike recovery capability.
- ABM Treaty/TMD/SDI Paradox.
- Zero Options versus Extended Deterrence Paradox.

STARTS I, II, and III: An Overview

- **START I:**
  - **6000 accountable warheads on 1,600 offensive strategic delivery vehicles.**
  - **Only 4,900 warheads on ballistic missiles**
  - **Limit of 1,540 warheads on heavy ICBMs.**
  - **Limit of 1,100 warheads on mobile ICBMs.**
  - **Downloading permitted**
  - **Verification through JCIC (Joint Compliance and Inspection Committee), unimpeded NTM (National Technical Means) and SCC, unencrypted telemetry, OSI(On-site Inspection), NRRC**
- **START II:**
  - **3,000 to 3,500 accountable warheads on offensive strategic delivery vehicles..**
  - **Limit of 1,750 warheads on SLBMs**
  - **No multiple warheads on ICBMs.**
  - **Can download maximum of 4 warheads, except for 6 warheads in case of SS-19.**
  - **This means all SS-18s and Peacekeepers must be destroyed.**
  - **Verification through JCIC, unimpeded NTM and SCC, unencrypted telemetry, OSI, NRRC, plus OSI**
- **START III:**
  - **Limit of 2,000-2,500 accountable warheads on offensive strategic delivery vehicles.**
  - **Possible cuts to 1,500 warheads. (Russian proposal)**
  - **Destruction of warheads with transparency.**
  - **Explore limits on nuclear armed, sea-launched cruise missiles. (US withdrew from service in 1991).**
  - **Explore limits and/or destruction of theater nuclear weapons.**

START I: Aggregate Numbers of Strategic Offensive Arms in July, 2001

Category of Date	Belarus	Kazakhstan	Russia	Ukraine	Total FSU	USA
Deployed ICBMs and their Associated launchers, Deployed SLBMs and Their Associated Launchers and Deployed Heavy Bombers	0	0	1,198	13	1,211	1,299
Warheads Attributed to Deployed ICBMs, SLBMs, and Heavy Bombers	0	0	5,858	130	5,988	7,013
Warheads Attributed to Deployed ICBMs, SLBMs	0	0	5,232	130	5,362	5,695
Throw-weight of Deployed ICBMs And SLBMs in megatons	0	0	3563.6	52.65	3616.25	1795.20

Source: US State Department, Bureau of Arms Control, as of July 31, 2001

U.S. Strategic Nuclear Warheads: Past, Present and Projected

	September 1990 [1]	July 1998 [2]	April 2000	October 2000	July 2001	December 2007 [3]	December 2007 [4]	
MX	500	500	500	500	500	0	0	
Minuteman III	1,500	1,950	1,908	1,824	1578		500	300[6]
Minuteman II	450	1	1	1	1	0	0	
Subtotal	2,450	2,451	2409	2325	2079	500	300	
Poseidon (C-3)	1,920	320	320	160	160	0	0	
Trident I (C-4)	3,072	1,536	1,536	1,536	1536	0	0	
Trident II (D-5)	768	1,920	1,920	1,920	1920	1,680[7]	1,008[8]	
Subtotal	5,760	3,776	3,776	3,616	3616	1,680	1,008	
B-52	2,258	1,644	1,467	1,467	1270	980[9]	364[10]	
B-1	95	91	91	91	91	0	0	
B-2	0	20	20	20	20	336	336	
Subtotal	2,353	1,755	1,578	1,578	1,381	1,316	700	
TOTAL	10,563	7,982	7,763	7,519	7,076	~3,500	~2,000	

Source: Arms Control Association, Fact Sheet January 1999 an US State Department, Bureau of Arms Control, April 4, 2000, October 1, 2000, and July 31, 2001

Notes:

1. Warhead numbers are based on START I counting rules. This results in bombers having fewer warheads attributed to them than they actually carry. On the other hand, even though all Poseidon submarines have been decommissioned, their C-3 SLBMs and associated warheads remain START-accountable until the delivery systems have been destroyed.
2. Same as above.
3. Assumes that START II enters into force, but that START III is not successfully negotiated. Figures are based on START II counting rules. This means that the number of weapons counted for heavy bombers will be the number they are actually equipped to carry.
4. Assumes that START III is successfully negotiated. Under this treaty, the United States and Russia will be permitted to deploy 2,000-2,500 strategic warheads each.
5. Assumes 500 Minuteman IIIs, with each missile carrying one warhead.
6. Assumes 300 Minuteman IIIs, with each missile carrying one warhead.
7. Assumes 14 Ohio-class submarines carrying 24 Trident II (D-5) missiles each, with all D-5s carrying five warheads.
8. Assumes 14 Ohio-class submarines carrying 24 Trident II (D-5) missiles each, with all D-5s carrying three warheads.
9. Assumes that the United States maintains its entire fleet of 71 B-52 bombers, but reduces their cruise-missile carrying capacity.
10. Assumes that the United States maintains its entire fleet of 71 B-52 bombers, but reduces their cruise-missile carrying capacity.

Strategic Nuclear Forces of the Former Soviet Union: Past, Present and Projected

	September 1990[1]	July 1998[2]	April 2000	October 2000	July 2001	December 2007[3]	December 2007[4]
SS-11	326	0	0	0	0	0	0
RS-12M	-	-	20	20	24	-	-
Road mobile	-	-	-	-	0	0	0
Silo	-	-	(20)	(20)	24	-	-
SS-13	40	0	0	0	0	0	0
SS-17	188	0	0	0	0	0	0
SS-18	3,080	1,800	1,800	1,800	1660	0	0
SS-19	1,800	1,062	900	900	900	105[5]	105[6]
SS-24	890	920	460	460	420	0	0
Silo	-	-	(100)	(100)	60	-	-
Rail mobile	-	-	(360)	(360)	360	-	-
SS-25	288	360	360	360	360	250	100
SS-27	0	2	0	0	-	180[7]	180[8]
Subtotal	6,612	4,144	3,540	3,540	3364	535	385
SS-N-6	192	16	0	0	0	0	0
SS-N-8	280	192	64	48	36	0	0
SS-N-17	12	0	0	0	0	0	0
SS-N-18	672	624	624	576	384	0	0
SS-N-20	1,200	1,200	1,200	1,200	1,000	1,000	600
SS-N-23	448	448	448	448	448	448	320
SS-NX-28	0	0	0	0	0	96?[9]	96?[10]
Subtotal	2,804	2,480	2,336	2,272	1,868	1,544	1,016
Bear	735	716	532	532	506	532	532
ALCM	-	-	(528)	(528)	504	-	-
Non-ALCM	-	-	(4)	(4)	2	-	-
Blackjack ALCM	120	200	120	120	120	64	64
Subtotal	855	916	648	648	626	800	568
TOTAL	10,271	7,540	6,524	6,464	5,858	~3,000[11]	~2,000[12]

Source: Arms Control Association, Fact Sheet January 1999 an US State Department, Bureau of Arms Control, April 4, 2000, October 1, 2000 and July 31, 2001.

Notes:

1. Warhead numbers are based on START I counting rules. Figures include weapons in Belarus, Kazakhstan, Russia and Ukraine. From 2000 on, warheads are only held in Russia.
2. Warhead numbers are based on START I counting rules. Figures include weapons in Russia and Ukraine only. Although Ukraine returned the last of its strategic nuclear warheads to Russia in 1996, they remain START-accountable until the delivery systems have been destroyed. The July 1998 START I MOU lists Ukraine as possessing 54 warheads on SS-19s, 460 warheads on SS-24s, 200 warheads on Bear bombers and 152 warheads on Blackjack bombers. Belarus and Kazakhstan have returned all of their nuclear warheads to Russia and have completed the destruction of their delivery vehicles, thereby removing them from START accountability.
3. Assumes that START II enters into force, but that START III is not successfully negotiated. Figures include weapons in Russia only and are based on START II counting rules. This means that the number of weapons counted for heavy bombers will be the number they are actually equipped to carry.
4. Assumes that START III is successfully negotiated. Under this treaty, the United States and Russia will be permitted to deploy 2,000-2,500 strategic warheads each.
5. START II permits Russia to download 105 SS-19s from six warheads each to one.
6. Assumes that Russia keeps these forces under START III.
7. Assumes that Russia will achieve and is able to sustain a production rate of about 20 SS-27s per year.
8. *ibid*.
9. Russia laid the keel for a new class of ballistic missile submarines (known as the Borey) in November 1996. According to the Office of Naval Intelligence, the submarines will be fitted with a new SLBM, possibly the SS-NX-28. Borey-class submarines are expected to carry at least 12 SLBMs. It is assumed that each SS-NX-28 will carry four warheads. The first of the Borey-class submarines may be operational around 2005, depending on financial circumstances.
10. *ibid.*
11. This outcome largely depends on Russia's economic situation. Under some scenarios, Russia would deploy significantly fewer warheads.
12. *ibid.*

The Agreed Terms of the START I Reductions

Reductions to equal aggregate levels in strategic offensive arms, carried out in three phases over seven years from the date the treaty enters into force. (Now extended to 2007

Specific, equal interim levels for agreed categories of strategic offensive arms by the end of each phase.

Central limits include:

- 1,600 Strategic Nuclear Delivery Vehicles (SNDVs).
- 6,000 accountable warheads.
- 4,900 ballistic missile warheads.
- 1,540 warheads on 154 heavy intercontinental ballistic missiles (ICBMs) for the Soviet side. The Soviets also agreed in a side letter to eliminate 22 SS-18 launchers every year for seven years to achieve this level.
- 1,100 warheads on deployed mobile ICBMs.
- Throw-weight ceiling of 3,600 metric tons.

DELIVERY VEHICLES

- 1,600 ceiling on the number of SNDVs, comprising deployed ICBMs and their associated launchers, deployed submarine-launched ballistic missiles (SLBMs) and their associated launchers, and deployed heavy bombers.

WARHEADS

- 6,000 accountable warhead ceiling, comprising the number of warheads attributed to deployed ICBMs and SLBMs, the number of long-range, nuclear-armed air-launched cruise missiles (LRNA) attributed to heavy bombers equipped for LRNA (see LRNA), and one warhead attributed to each heavy bomber equipped only for nuclear-armed gravity bombs and short-range attack missiles (SRAMs).

BALLISTIC MISSILE WARHEADS

- Each ballistic missile warhead attributed to a missile counts as one under the 6,000 warhead ceiling.
- No flight testing of missiles with RVs in excess of attributed number.
- A quota of on-site inspections to verify that deployed ballistic missiles contain no more RVs than the number of warheads attributed to them.
- Ban on new types of ICBMs and SLBMs with more than 10 warheads.
- Ban on increasing warhead attribution on future types of ICBMs and SLBMs.

DOWNLOADING

- The number of warheads on up to three existing types of ballistic missiles and their attribution under START may be reduced ("downloaded") up to a total of 1,250 RVs.
- Each Soviet SS-N-18 may be attributed with 3 RVs; a total of 896 SS-N-18 warheads count toward downloading limit.
- US Minuteman III may be reduced by 1 or 2 RVs.
- Insofar as permitted by the 1,250 limit, up to 500 RVs may be downloaded on two other existing ballistic missile types (up to 4 RVs per missile).
- Ban on downloading of new types. Ban on deploying a new type with more warheads than on a downloaded type (except for the Minuteman III and the SS-N-18). Ban on downloading of heavy ICBMs.
- If an ICBM is downloaded by more than two RVs, it must be equipped with a new front section platform, and all old platforms destroyed.

HEAVY ICBMs

- In addition to the requirement to reduce deployed heavy ICBMs and their warheads by 50 percent, other constraints on heavy missiles include: no downloading; no increase in launch weight or throw-weight; no mobile launchers for heavy ICBMs; ban on new types of heavy missiles. New heavy ICBM silo construction allowed, but only in exceptional cases for

relocation or to replace eliminated heavy ICBM silos in extraordinary circumstances; never to exceed 154 such silos. Modernization and testing of existing heavy ICBM's can continue.

NEW TYPES OF ICBMs AND SLBMs

- An ICBM or SLBM will be considered a new type of ICBM or SLBM if it meets any of the following criteria: change in number of stages; change in type of propellant; 10 percent change in missile or first stage length; 10 percent change in missile launch weight; 5 percent change in diameter; 5 percent change in first stage length combined with 21 percent increase in throw-weight.
- Ceiling of 21 percent on permitted increases to throw-weight of existing types of ICBMs or SLBMs.
- Warhead attribution for future types of ICBMs and SLBMs will be the maximum number of RVs tested and simulated, but no less than the number derived by dividing 40 percent of missile throw-weight by weight of the lightest RV tested on that type of ICBM or SLBM. Application of the 40 percent rule to new systems with unconventional front ends will be discussed at the JCIC.

HEAVY BOMBERS

- Each heavy bomber counts as one SNDV. Each heavy bomber equipped only for nuclear weapons other than long-range nuclear air-launched cruise missiles (i.e., only for gravity bombs and SRAMs), counts 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 non-nuclear capability. Heavy bombers equipped for long-range nuclear ALCMs (LRNA), will be distinguishable from other heavy bombers.
- In exchange for not including the Tupolev 22-M (Backfire) bomber in START, the Soviet Union will make a politically-binding declaration that it will not deploy more than 300 air force and 200 naval Backfires and that these bombers will not be given intercontinental capability.

LONG-RANGE NUCLEAR AIR-LAUNCHED CRUISE MISSILES (LRNA)

- Nuclear-armed ALCMs with a range in excess of 600 kilometers (LRNA) will be affected under START. New long-range conventionally-armed ALCMs that are distinguishable from nuclear-armed ALCMs are not limited in START and may be deployed on any aircraft.
- For the purpose of counting against the 6,000 warhead limit, accountable warheads will be attributed to heavy bombers equipped for LRNA as follows: each current and future US heavy bomber equipped for LRNA will count as 10 warheads (except as noted below) but may actually be equipped for up to 20 LRNA. Each current and future Soviet heavy bomber equipped for LRNA will count as 8 warheads (except as noted below) but may actually be equipped for up to 16 LRNA.
- The United States may apply the above counting rule to 150 heavy bombers equipped for LRNA; the Soviet Union may apply the above counting rule to 180 heavy bombers equipped for LRNA. For any heavy bombers equipped for LRNA in excess of these levels, the number of attributable warheads will be the number of LRNA for which the bombers are actually equipped.
- Multiple-warhead long-range nuclear ALCMs are banned.

MOBILE ICBMs

- Categories of permitted movements and associated notifications have been agreed.
- Non-deployed mobile ICBMs and launchers will be limited numerically and geographically (see NON-DEPLOYED MISSILES below).
- Soviet mobiles are: SS-24 and SS-25. For purposes of reciprocity the US Peacekeeper will be treated as mobile although it has never been tested as a mobile ICBM.

NON-DEPLOYED MISSILES

- There will be a numerical limit of 250 on non-deployed ballistic missiles for all ICBMs of a type that has been flight tested from a mobile launcher; of those, no more than 125 may be non-deployed missiles for rail-mobile launchers. There also will be a numerical limit of 110 on non-deployed launchers for mobiles of which no more than 18 may be non-deployed launchers for rail-mobile ICBMs.
- Other non-deployed ballistic missiles will not be subject to numerical limits, but there will be restrictions on their location and movement and they will be subject to data exchange requirements.
- Various provisions are also agreed to inhibit rapid reload of ICBM launchers.

- The sides have also agreed there will be no restrictions on the number of cruise missiles and other heavy bomber weapons. There will be limited restrictions on the location of LRNA.

EXEMPTIONS FROM TREATY LIMITS

- 75 non-modern heavy bombers equipped for non-nuclear arms, former heavy bombers, and training heavy bombers.
- 20 test heavy bombers.
- 25 test silo launchers and 20 test mobile launchers at test ranges.

SLCMS

- Sea-launched cruise missiles (SLCMs) will not be constrained in the START Treaty. However, each side will provide the other with a politically-binding declaration concerning long-range nuclear SLCMs, i.e., those nuclear SLCMs whose range is over 600 kilometers. In annual declarations, the planned maximum number of these deployed nuclear SLCMs for each of the following five Treaty years will be specified. The planned maximum number will not exceed 880 long-range nuclear SLCMs. Nuclear-armed SLCMs with a range of 300-600 kilometers will be the subject of confidential annual data exchanges. The sides will not produce or deploy multiple warhead nuclear SLCMs.

VERIFICATION

The Strategic Arms Reduction Treaty (START) was designed with verification in mind, and verification measures were negotiated in parallel with other aspects. Thus, the basic structure of the Treaty is designed to facilitate verification by national technical means (NTM). The START Treaty contains detailed, interlocking and mutually reinforcing provisions, which supplement national technical means to establish an effective verification regime. This regime provides for data exchanges and notifications on strategic systems and facilities covered by the Treaty, a ban on the denial of data from telemetry, twelve types of on-site inspection and exhibitions, continuous monitoring at mobile ICBM final assembly facilities, and cooperative measures. These elements are outlined below.

- NATIONAL TECHNICAL MEANS (NTM) - START provides for the use of, and non-interference with, national technical means of verification, e.g. satellites. There are explicit provisions prohibiting interference with NTM, or use of concealment measures that impede verification by NTM.
- TELEMETRY - Parties are prohibited from engaging in any practice that denies full access to telemetric information during missile flight tests, with certain limited exceptions. Moreover, Parties are obligated to exchange telemetry tapes, interpretative data and acceleration profiles for every test flight.
- DATA EXCHANGE AND NOTIFICATIONS - Prior to Treaty signature, the sides will exchange data on numbers, locations, and the technical characteristics of START-accountable weapons systems and facilities and will provide regular notifications and data updates thereafter.
- COOPERATIVE MEASURES - Seven times a year, either party may request the other to display in the open road-mobile launchers, rail mobile launchers and heavy bombers at bases specified by the inspecting Party. Additional cooperative measures may be requested following an operational dispersal.
- CONTINUOUS MONITORING ACTIVITIES - START establishes continuous monitoring at the perimeter and portals of each side's mobile ICBM assembly facilities. The US has the right to establish a monitoring facility at Votkinsk, which is the final assembly facility for the SS-25, and at Pavlograd, which is the final assembly facility for the SS-24. The Soviet side has the right to monitor the Thiokol Strategic Operations facility at Promontory, Utah, the final assembly facility for the accountable stage of the Peacekeeper. Such monitoring would also be established at any future facilities at which mobile ICBM assembly takes place.
- ON-SITE INSPECTIONS (OSI) - There are twelve types of OSI and exhibitions. These are: baseline data inspections, data update inspections, new facility inspections, suspect site inspections, reentry vehicle inspections, post-exercise dispersal inspections, conversion or elimination inspections, close-out inspections, formerly declared facility inspections, technical characteristics exhibitions, distinguishability exhibitions and heavy bomber baseline exhibitions.
- COMPLIANCE - Compliance concerns may be raised by either side in the Joint Compliance and Inspection Commission (JCIC) or any other appropriate forum.

DATA DENIAL

- Agreement to broadcast all telemetric information from test flights of ICBMs and SLBMs and to ban any practice (including encryption, encapsulation and jamming) that denies full access to telemetric information, with certain limited exceptions.
- Requirement to provide full telemetry tapes, acceleration profiles, and certain specified interpretive information after each test flight of an ICBM or SLBM.

- As a goodwill gesture, the sides agreed not to engage in encryption or jamming beginning 120 days after Treaty signature.

TREATY DURATION

- Treaty will have a duration of 15 years, unless superseded earlier by a subsequent agreement.
- If the sides agree, treaty may be extended for successive five year periods.

NON-CIRCUMVENTION/THIRD COUNTRY ISSUES

- No transfer of strategic offensive arms (SOA) to third countries, except that there will be no interference with existing patterns of cooperation.
- There will be no permanent basing of SOA outside national territory and no inspections outside national territory. Temporary stationing of heavy bombers overseas permitted, but certain notifications may apply. Port calls for SSBNs permitted.

START I: Status in 2000

- **Signed July 31, 1991:**
  - **May 1992 protocol has Ukraine, Belarus, Kazakhstan agree to become non-nuclear weapons states, and members of the NNPT, Return warheads to Russia**
  - **US ratifies on October 1, 1992**
  - **Duma approves on November 4, 1992.**
  - **Resolve Ukrainian issue on December 5, 1994**
- **Status of US Forces: (7/2001)**
  - **7,013 remaining warheads on 1,299 delivery vehicles.**
  - **All Minuteman IIs out of silos, 449 of 450 silos converted.**
  - **All Poseidon missiles out of service, all but 2 of 31 Poseidon submarines eliminated**
- **Status of FSU Forces: (7/2001)**
  - **10,000+ warheads reduced to 5,858.**
  - **2,500 delivery vehicles down to 1,198.**
  - **Eliminate several hundred Russian ICBMs, 50 bombers, and nearly 350 SLBM launchers.**
  - **All nuclear weapons out of Kazakhstan by May 1995.**
  - **All 81 SS-25s in Belarus returned to Russia as of late November 1996.**
  - **All nuclear weapons out of Ukraine by June 1, 1996; eliminate all SS-19 silos and 12 of 56 SS-24 silos.**
- **Compliance Issues:**
  - **Russian conversion of SS-25s to SDLVs. (Resolved in November 1997).**
  - **British tests of Trident with 10-12 warheads while US is only permitted 8. (Not covered by START I).**
  - **US modifications of B-1 to ease carrying of cruise missiles (permitted).**

START Treaty Final Reductions: Status as of December 5, 2001

December 5, 2001, marks the successful completion of the third and final phase of reductions in strategic offensive arms required by the Strategic Arms Reduction Treaty (START Treaty). The United States and Russia each now maintain fewer than the Treaty's mandated limits of 1,600 deployed strategic delivery vehicles and 6,000 accountable warheads, a reduction of some 30 to 40 percent of aggregate levels since 1994, when the Treaty entered into force. In addition, all nuclear warheads and strategic offensive arms have been removed from Belarus, Kazakhstan, and Ukraine.

The START Treaty reductions, inspection regime, notifications and telemetry exchanges have produced stabilizing changes that have contributed to international security and strategic stability.

The START Treaty was signed in Moscow on July 31, 1991, by President George H. W. Bush, for the United States, and President Mikhail Gorbachev, for the Soviet Union. The instruments of ratification of the START Treaty were exchanged in Budapest, Hungary, in December 1994, after several years of sustained effort to adapt the Treaty's original bilateral implementation regime to a new multilateral context that established Belarus, Kazakhstan, Russia, and Ukraine as the legal successors to the Soviet Union for the purposes of the START Treaty.

Although the START Treaty's required reductions have been met within the required seven years, the Treaty, including its inspection and verification provisions, remains in force. The Treaty's fifteen-year duration may be extended by agreement among the Parties for successive five-year periods.

A significant aspect of the START Treaty's regime lies in its use of rigorous, equitable and verifiable methods to monitor its implementation. The right to perform on-site inspections and other verification measures will continue for the duration of the Treaty, in order to verify compliance. In addition, data exchanges and notifications on each side's strategic systems and facilities as well as exchanges of telemetry data from missile flight tests will help to maintain confidence in the status and level of the Parties' strategic forces. The Parties will also continue to meet as necessary within the framework of the Treaty's implementing body, the Joint Compliance and Inspection Commission, which the Treaty established to ensure continued effective implementation of the Treaty and to seek resolution of compliance and implementation issues.

START has achieved significant reductions from Cold War nuclear force levels. President George W. Bush is committed to achieve significant additional cuts in offensive nuclear forces to the lowest possible number of nuclear weapons consistent with our national security needs and our obligations to friends and allies. The United States seeks to create a new strategic framework with Russia based on a broad array of cooperation on political, economic, and security issues, including substantial reductions in the number of operationally deployed nuclear forces and measures to promote confidence and transparency. Thus, during the November 2001 Washington/Crawford Summit, President Bush announced that the United States will further reduce the number of operationally deployed warheads to between 1,700 and 2,200 over the next ten years, a level consistent with American security.

FINAL START I TREATY STRATEGIC OFFENSIVE ARMS LEVELS

AS OF DECEMBER 5, 2001

Category of Data and Central Limit	United States		Former Soviet Union	
	12-5-94	**12-5-01**	**12-5-94**	**Proj 12-5-01**
Deployed ICBMs and Their Associated Launchers, Deployed SLBMs and Their Associated Launchers, and Deployed Heavy Bombers – New Limit: 1,600	1,838	1,238	1,956	~ 1,140
Warheads Attributed to Deployed ICBMs, Deployed SLBMs, and Deployed Heavy Bombers: New Limit 6,000	8,824	5,949	9,568	~ 5,520
Warheads Attributed to Deployed ICBMs and Deployed SLBMs: New Limit 4,900	6,793	4,821	8,638	~ 4,900
Throw-weight of Deployed ,ICBMs and Deployed SLBMs: New Limit 3,600 metric tons	2,176.5	1,732.5	5,930.4	~ 3,320

* The Parties will exchange formal force data in January 2002. The START I Treaty prohibits the U.S. Government from releasing the other Parties' final Phase III data until April 2002.

START II Protocol and Letters on Early Deactivation

- Formal title: Protocol to the Treaty Between the United States of America and the Russian Federation on Further Reductions and Limitations of Strategic Offensive Arms of January 3, 1993.
- The Protocol extends the date by which the START II limitations and reductions must be completed from January 1, 2003 to December 31, 2007.
- Extends the date by which the interim limitations and reductions of the START II Treaty must be carried out from seven years after entry into force of the START Treaty (December 5, 2001) to December 31, 2004.
- States that the Parties may conclude an agreement on a program of assistance for the purposes of facilitating and accelerating implementation of the START II reductions and limitations. This provision replaces the START II provision that required early implementation of the START II reductions if the Parties concluded, within one year of START II entry-into-force, an agreement on a program of assistance is subject to ratification by each Party and will enter into force on the date when the instruments of ratification are exchanged.
- Joint Agreed Statement
- Records the agreement between the United States and the Russian Federation that henceforth Minuteman III ICBM downloading under START II can be carried out at any time before December 31, 2007, the deadline for completing all Treaty-mandated reductions. This ensures that deMIRVing under START II will take place in a stable and equivalent manner. This Joint Agreed Statement has no effect on the downloading provisions of the START I Treaty, which remain unchanged.
- Exchange of Letters on Early Deactivation
- Legally codifies the commitment made at Helsinki that the United States and the Russian Federation will deactivate by December 31, 2003 all strategic nuclear delivery vehicles which, under the START II Treaty, will be eliminated by December 31, 2007.
- Deactivation will be achieved by removing the nuclear reentry vehicles from the missiles, or by taking other jointly agreed steps.
- The letters on deactivation will enter into force when START II enters into force.
- Immediately upon entry into force of START II, U.S. and Russian experts will begin work on understandings concerning methods of deactivation and on parameters of a U.S. program of assistance to Russia for implementation of deactivation.
- The Russian letter contains a unilateral statement: "Taking into account the supreme national interests of the country, the Russian Federation proceeds from the understanding that well in advance of the above deactivation deadline the START III Treaty will be achieved and will enter into force." The U.S. letter takes note of this Russian statement.
- Relevant Dates
- The START I Treaty entered into force on December 5, 1994; it was signed on July 31, 1991.
- The U.S. Senate gave its advice and consent to ratification of the START II Treaty on January 26, 1996. The START II Treaty was signed on January 3, 1993.
- The Clinton-Yeltsin Helsinki Summit took place on March 20-21, 1997.

START II: Status in 2000

- **<u>Signed January 3, 1993</u>:**
  - **SFRC ratifies on December 2, 1995, US Senate approves 87-4 on January 26, 1996.**
  - **Duma hearings in 1995, 1996, 1997, and 1998. Vote delayed on April 2, 1999 because of Kosovo.**
  - **September 26, 1997: US and Russia sign protocol extending deadlines from 2003 to 2007.**
  - **March, 1997: US and Russia agree to link START II to START III by setting goal of cutting attributable warheads to 2,000-2,500 to eliminate Russian need to modernize to level of 3,500 warheads.**

- **<u>Issues</u>**
  - **Russian ability to raise number of single warhead systems (Topol M or SS-27) to 3,500 warheads if START III is not accelerated.**
  - **Russian complaint that US can keep half of its MIRV'd SLBMs but Russia cannot keep any of its MIRV'd ICBMs.**
  - **US desired to renegotiate ABM Treaty threatens Russian ability to maintain strategic parity and gives US "break out capability" to achieve damage-limiting national missile defense capability.**
  - **Russian indication might accept ABM revision for limited 3 warhead MIRVing of SS-27.**

START III: Status in 2000

- **Proposed by Clinton and Yeltsin during summit meeting on March 20-21, 1997.**
  - **Goal is reductions by December 31, 2007**

- **Issues**
  - **Some Russians want maximum level of 1,500 warheads; Some US experts feel cuts are too deep and too fast, raise issue of Chinese missile modernization.**
  - **Negotiations to start after START II enters into force.**
  - **Explore limits on nuclear armed sea-launched cruise missiles. (US withdrew all such missiles from deployment in 1991.**
  - **Explore limits on tactical and theater nuclear weapons.**
  - **Call for added transparency.**
  - **Destruction of nuclear warheads and weapons.**
  - **August 17-19, 1999: Russia calls for limit of 1,500 warheads, says no negotiations unless US agrees not to modify the ABM Treaty.**

Other US-Russian Measures

- **Aid Russia in Dismantling Nuclear Weapons; Securing Nuclear Systems:**
  - **Dismantle labs,**
  - **Destroy weapons (currently Russia can destroy a maximum of 2000 a year.**
  - **Nunn-Lugar Cooperative Threat Reduction Program**
    - **Safeguard, storage, and destruction of NBC Weapons.**
    - **Halt proliferation.**
    - **Prevent dispersion of weapons-related expertise.**
    - **Have been 6-8 incidents involving significant transfer of nuclear material.**
  - **Nuclear Cities Initiative.**
  - **Duma approves on November 4, 1992.**
  - **Resolve Ukrainian issue on December 5, 1994**
- **Proposed De-alterting**
  - **Take warheads off weapons, move to secure locations..**
- **Common Early Warning**
  - **Help Russia with information and sensors. Russia has EW radar problem, lost geostationary early-warning satellites in June and July 1998, and must rely on older systems.**
  - **September 1998: Proposed shared early-warning agreement.**
  - **Man Y2K Center from December 1999 to January 2000 at Colorado Springs.**

Bush-Putin Meetings: November 2001

Strategic Nuclear Weapons Reductions:

- **President Bush offered to make a unilateral reduction of between 1,700 and 2,200 warheads.**
- **U.S. reduction would include the 500 warheads deployed on the MX Peacekeeper missiles.**
- **President Putin also announced proposed reductions in the Russian nuclear arsenal. Although no exact figure was given, Putin has in the past used 1,500 warheads as a goal by the end of the decade.**
  - **Given Russia's economic difficulties, 1,000 warheads may be a more realistic estimate.**
- **These reductions are similar in size to those proposed by Presidents Clinton and Yeltsin as a basis for the START III agreement.**
- **If put into effect these measures would bring the Start II agreement to an end.**
  - **This would allow for the use of MIRVs on land-based ICBMs.**

Modernization:

- **Both sides will continue to modernize the nuclear weapons that they will retain.**
- **Russia is building new warheads for existing missiles.**
- **Russian SS-27 production will continue at a reduced pace of 10 missiles a year, due largely to economic difficulties.**

NNPT: Nuclear Proliferation

- NNPT Regime:
  - Most effective regime because requires massive production assets or transfer of fissile material.
  - Inspection regime can work if ruthlessly enforced.
  - IAEA did not enforce in Iran or Iraq.
  - Many nations are not members.
- The Technology
  - No major breakthroughs in enrichment: Cascade, centrifuge, or LIS.
  - FSU loose nuclear material is a risk: Estimate 30,000 weapons and 70,000 weapons equivalents in HEU and Plutonium.
  - Technology for fission weapons now well known. Major problem is to reduce size and boost yield.
  - Improved accuracy reducing need for thermonuclear and/or boosted weapons.
  - Critical uncertainties in terms of “point one safety,” PAL systems, Fusing and height of burst, employment doctrine.

Other Agreements Impacting on Nuclear Proliferation

- Statute of the International Atomic Energy Agency (IAEA): July 29, 1957.
- Zanger Committee (Nuclear Exporters Committee): Nuclear suppliers committee dating back to 1970s.
- Nuclear Suppliers Group (NSG or London Group): Formed in 1975.
- Convention on Protection of Nuclear Material): February 8, 1987.
- Treaty for the Prohibition of Nuclear Weapons in Latin America (Tlatelolco): April 22, 1968, Argentina, Brazil, and Chile join in 1994, Cuba in 1995.
- South Pacific Nuclear Weapons Free Zone (Rarotonga): December 11, 1986. Does not prohibit nuclear transit. US, France, and Britain sign in 1996.
- African Nuclear Weapons Free Zone (Pelindaba): April, 1996.
- Southeast Asia Nuclear Weapons Free Zone (Bangkok): December 1995. (US says inconsistent with the law of the sea.
- US-North Korean Agreed Framework, October, 1994.

Test Ban Treaties

- 1963 - Limited Test Ban Treaty:
  - Bans air, space, and underwater tests. *

- 1974 – Threshold Test Ban Treaty:
  - Bans any weapons tests of more than 150 kilotons. *

- 1976 – Peaceful Nuclear Explosion Treaty:
  - Extends 150 kiloton limit to peaceful explosions. *

- September 1996 – Comprehensive Test Ban Treaty:
  - Bans all nuclear tests in perpetuity.

* Ratified by the US.

CTBT: Nuclear Testing

- **Comprehensive Test Ban Regime:**
  - **1 KT may be limit of reliability.**
  - **Seismic data may, however, by able to locate down to the level of about 1/20th of a KT in a coupled explosion.**
  - **Problem is may be able to violate to several KT in a decoupled explosion.**
  - **Inspection regime can work if enforced.**
- **The Technology**
  - **321 planned monitoring stations; 170 (50 primary, 120 secondary) for underground shock waves, 80 radio nuclide to monitor atmosphere, 60 infrasound sonic, and 11 hydroacoustic (6 primary, 5 auxiliary) to monitor undersea booms.**
  - **Major debates over detectability and need for small tests for point one safety, and stockpile modernization and maintenance.**
  - **Masking (muffling) and decoupling seem possible ways to hide tests.**
  - **No longer need testing for fission weapons, and mini explosions are extremely wasteful of material with limited result.**
  - **Tests of even 4 pounds may affect some aspects of hydronuclear yield, reliability of fission weapons of a few to 10s of kilotons, and point one (1 in 1 million chance of 4 lb. yield) safety.**
    - **But, fission weapons tend to be solid pack, levitated designs that no longer need testing.**
  - **Tests around 10 ton threshold have serious value in reducing warhead size, efficient use of fissile material, and moving towards boosted weapons deuterium and tritium).**
    - **Value of ultra-low yield testing in verifying and modifying existing boosted designs still to be tested.**
    - **Indian tests ambiguous: In tests on May 11, 1999, experts rate at 15 KT to 25 KT, Do not detect two claimed tests, possibly because below 1 KT threshold.**
    - **Pakistan claims carried out 5 tests on May 28, 1999. Claims one is 30-35 KT. Tests indicate one is 8-15 KT. Cannot detect or characterize others. Another test two days later is claimed to be 18 KT. US feels is less than 2 KT, probably 1 KT.**
    - **An earthquake or trembler near Novaya Zemlya in Russia was characterized as a possible nuclear event until examination located it 100 kilometers away from the test site in the Kara Sea.**

CTBT Background

- The Comprehensive Test Ban Treaty (CTBT) was opened for signature on September 24, 1996. President Clinton was the first to sign the Treaty. As of December 4, 2001, 164 nations have signed, including all five nuclear-weapon states, and 89, including France and the United Kingdom, have deposited their instruments of ratification. The Treaty names 44 states that must deposit their instruments of ratification for it to enter into force. Of these, 31 have now ratified.

- The CTBT was negotiated over a period of two-and-a-half years in the Conference on Disarmament (CD) in Geneva. However, the CD was not able to reach a consensus decision to forward the text to the United Nations. On August 22, 1996, Australia requested the Secretary General of the United Nations to reconvene the 50th United Nations General Assembly (UNGA) for the purpose of receiving and acting on the Treaty. On September 10, 1996, the UNGA adopted the CTBT by a vote of 158 to 3, with 5 abstentions.

- On November 19, 1996, the signatories adopted a resolution establishing the Preparatory Commission (Prepcom) for the CTBT Organization (CTBTO). The CTBTO Prepcom consists of all signatory states, and meets in Vienna. It has established two working groups, on verification and administration, and a Provisional Technical Secretariat (PTS). Under Prepcom direction the PTS is working to establish the verification regime required by the Treaty. This includes the International Monitoring System, with global monitoring capabilities in four technologies -- seismic, hydroacoustic, radionuclide, and infrasound; the International Data Center, for receiving and processing data from the monitoring stations; and capabilities for carrying out on-site inspections, once the Treaty enters into force.

- The President transmitted the CTBT to the Senate in September 1997 for its advice and consent to ratification. In his January 19 State of the Union address, President Clinton called on the Senate to approve the Treaty this year, asking the Senate to "take this vital step, approve the Treaty now to make it harder for other nations to develop nuclear arms, and to make sure we can end nuclear testing forever."

CTBT Treaty Signatories and Ratifiers as of December 4, 2001

Bold: One of 44 countries whose ratification is required for Entry-Into-Force.
A total of 164 had signed and 89 had ratified as of 12-4-2001

Participant	Signature	Ratification
Albania	9/27/96	
Algeria	**10/15/96**	
Andorra	9/24/96	
Angola	9/27/96	
Antigua and Barbuda	4/16/97	
Argentina	**9/24/96**	**12/4/98**
Armenia	10/1/96	
Australia	**9/24/96**	**7/9/98**
Austria	**9/24/96**	**3/13/98**
Azerbaijan	7/28/97	2/2/99
Bahrain	9/24/96	
Bangladesh	**10/24/96**	**3/8/00**
Belarus	9/24/96	9/13/00
Belgium	**9/24/96**	**6/29/99**
Belize	11/14/01	
Benin	9/27/96	3/6/01
Bolivia	9/24/96	10/4/99
Bosnia and Herzegovina	9/24/96	
Brazil	**9/24/96**	**7/24/98**
Brunei Darussalam	1/22/97	
Bulgaria	**9/24/96**	**9/29/99**
Burkina Faso	9/27/96	
Burundi	9/24/96	
Cambodia	9/26/96	11/10/00
Cameroon	11/16/01	
Canada	**9/24/96**	**12/18/98**
Cape Verde	10/1/96	
Chad	10/8/96	
Chile	**9/24/96**	**7/12/00**
China	**9/24/96**	
Colombia	**9/24/96**	
Comoros	12/12/96	
Congo, Republic of (Brazzaville)	10/4/96	
Congo, Democratic Republic of (Kinshasa)	**10/4/96**	
Cook Islands	12/5/97	
Costa Rica	9/24/96	9/25/01
Cote d'Ivoire	9/25/96	
Croatia	9/24/96	3/2/01
Cyprus	9/24/96	
Czech Republic	11/12/96	9/8/97
Denmark	9/24/96	12/21/98
Djibouti	10/21/96	
Dominican Republic	10/3/96	
Ecuador	9/24/96	11/12/01
Egypt	**10/14/96**	
El Salvador	9/24/96	9/14/98
Equatorial Guinea	10/9/96	
Estonia	11/20/96	8/13/99
Ethiopia	9/25/96	
Fiji	9/24/96	10/10/96
Finland	**9/24/96**	**1/15/99**
France	**9/24/96**	**4/6/98**
Gabon	10/7/96	9/20/00
Georgia	9/24/96	
Germany	**9/24/96**	**8/20/98**
Ghana	10/3/96	
Greece	9/24/96	4/21/99
Grenada	10/10/96	8/19/98
Guatemala	9/20/99	
Guinea	10/3/96	

Guinea-Bissau	4/11/97	
Guyana	9/7/00	3/7/01
Haiti	9/24/96	
Holy See	9/24/96	7/18/01
Honduras	9/25/96	
Hungary	**9/25/96**	**7/13/99**
Iceland	9/24/96	6/26/00
India		
Indonesia	**9/24/96**	
Iran (Islamic Rep. of)	**9/24/96**	
Ireland	9/24/96	7/15/99
Israel	**9/25/96**	
Italy	**9/24/96**	**2/1/99**
Jamaica	11/11/96	11/13/01
Japan	**9/24/96**	**7/8/97**
Jordan	9/26/96	8/25/98
Kazakhstan	9/30/96	
Kenya	11/14/96	11/30/00
Kiribati	9/7/00	9/7/00
Kuwait	9/24/96	
Kyrgyzstan	10/8/96	
Lao People's Democratic Republic	7/30/97	10/5/00
Latvia	9/24/96	11/20/01
Lesotho	9/30/96	9/14/99
Liberia	10/1/96	
Libyan Arab Jamahiriya	11/13/01	
Liechtenstein	9/27/96	
Lithuania	10/7/96	2/7/00
Luxembourg	9/24/96	5/26/99
Madagascar	10/9/96	
Malawi	10/9/96	
Malaysia	7/23/98	
Maldives	10/1/97	9/7/00
Mali	2/18/97	8/4/99
Malta	9/24/96	7/23/01
Marshall Islands	9/24/96	
Mauritania	9/24/96	
Mexico	**9/24/96**	**10/5/99**
Micronesia (Federated States of)	9/24/96	7/25/97
Moldova	9/24/97	
Monaco	10/1/96	12/18/98
Mongolia	10/1/96	8/8/97
Morocco	9/24/96	4/17/00
Mozambique	9/26/97	
Myanmar	11/25/96	
Namibia	9/24/96	6/29/01
Nauru	9/8/00	11/12/01
Nepal	10/8/96	
Netherlands	**9/24/96**	**3/23/99**
New Zealand	9/27/96	3/19/99
Nicaragua	9/24/96	12/5/00
Niger	10/3/96	
Nigeria	9/8/00	9/27/01
North Korea		
Norway	**9/24/96**	**7/15/99**
Oman	9/23/99	
Pakistan		
Panama	9/24/96	3/23/99
Papua New Guinea	9/25/96	
Paraguay	9/25/96	10/4/01
Peru	**9/25/96**	**11/12/97**
Philippines	9/24/96	2/23/01
Poland	**9/24/96**	**5/25/99**
Portugal	9/24/96	6/26/00
Qatar	9/24/96	3/3/97
Republic of Korea	**9/24/96**	**9/24/99**
Republic of Moldova	9/24/97	
Romania	**9/24/96**	**10/5/99**
Russian Federation	**9/24/96**	**6/30/00**
Saint Lucia	10/4/96	4/5/01

Samoa	10/9/96	
San Marino	10/7/96	
Sao Tome and Principe	9/26/96	
Senegal	9/26/96	6/9/99
Seychelles	9/24/96	
Sierra Leone	9/8/00	9/17/01
Singapore	1/14/99	11/10/01
Slovakia	**9/30/96**	**3/3/98**
Slovenia	9/24/96	8/31/99
Solomon Islands	10/3/96	
South Africa	**9/24/96**	**3/30/99**
Spain	**9/24/96**	**7/31/98**
Sri Lanka	10/24/96	
Suriname	1/14/97	
Swaziland	9/24/96	
Sweden	**9/24/96**	**12/2/98**
Switzerland	**9/24/96**	**10/1/99**
Tajikistan	10/7/96	6/10/98
Thailand	11/12/96	
The Former Yugoslav Republic of Macedonia	10/29/98	3/14/00
Togo	10/2/96	
Tunisia	10/16/96	
Turkey	**9/24/96**	**2/16/00**
Turkmenistan	9/24/96	2/20/98
Uganda	11/7/96	3/14/01
Ukraine	**9/27/96**	**2/23/01**
United Arab Emirates	9/25/96	9/18/00
United Kingdom	**9/24/96**	**4/6/98**
United States	**9/24/96**	
Uruguay	9/24/96	9/21/01
Uzbekistan	10/3/97	5/29/97
Vanuatu	9/24/96	
Venezuela	10/3/97	
Vietnam	**9/24/96**	
Yemen	9/30/96	
Yugoslavia	6/8/01	
Zambia	12/3/96	
Zimbabwe	10/13/99	

US Nuclear Testing and Reliability Problems

The Pentagon and the Energy Department must annually certify to the president that the nuclear weapons stockpile is safe and reliable and that there is no need to resume tests involving the detonation of nuclear warheads and bombs. This was done in underground caverns until 1992.

- Inspector General Gregory H. Friedman reported to Energy Secretary Spencer Abraham on his review of nuclear weapons safety and reliability on December 21, 2001. The report noted backlogs in flight and laboratory test schedules for five of nine nuclear missile warheads and bombs in the operational stockpile. The results were made public on January 2, 2001.

- The inspector general determined that the problems associated with the safety and reliability of US nuclear weapons have become a "most serious challenge area" for the National Nuclear Security Agency that runs the weapons complex unless nuclear testing takes place..

- Another review was completed in December 2001 and showed backlogs of more than 18 months in correcting defects or malfunctions that were discovered in testing of older weapons systems.

- The inspector general reported that, "Without a robust and complete surveillance testing program, the department's ability to assess the reliability of some nuclear weapons is at risk."

Sen. John W. Warner (Va.), ranking Republican on the Senate Armed Services Committee, stated that some lawmakers and senior officials inside the nuclear weapons complex and the Pentagon have been talking about the need to resume underground testing, said "If the surveillance program can't do the job, we will have to resume testing to make sure our [nuclear] weapons work."

The Washington Post reported on January 3, 2002, that the US government's process of certifying "high confidence" in the nuclear stockpile involves randomly selecting for testing about 11 units from each of the nine deployed nuclear warheads on land- and submarine-based intercontinental missiles and bombs on aircraft. Nuclear warheads, missiles and bombs are flight-tested by being launched or dropped to see if the propellants and guidance systems work.

The Inspector General 's report showed that, over the past four years:

- There were delays in five of 16 tests scheduled for the W-80 warhead used on cruise missiles and in three of 12 tests scheduled for the W-88, which is carried by the sub-launched Trident II missiles.

- Laboratory tests to see whether handling, aging or manufacturing problems have developed in components such as radars showed delays in eight of 30 tests related to the B-61 nuclear bombs and in eight of 31 tests planned for the W-76 warhead used on sub-launched Trident I missiles.

- Component tests -- which include looking at "pits," or nuclear triggers and detonators -- are also running behind, with four pit tests delayed out of 13 that were scheduled for the four-year period.

- The Inspector General Reported the successful testing over four years fell below 75 percent of planned tests, and that this means that "there is significant concern that anomalies or defects in the stockpile might have been missed,".

When testing shows a defect or malfunction, DOE procedures require immediate notification of the nuclear weapons lab that developed the weapon.

- The lab involved is supposed to determine whether the problem is significant within five days of notification.

- If it is, the lab has 45 days to determine through tests whether a major investigation should be initiated since the reliability and performance of the weapon could be involved.

- The Inspector General reported that about 10 percent of He also found, however, that the 45-day period for determining the significance of problems had grown, in some instances, to 300 days.

- "Over two-thirds of the 64 active investigations remained unresolved beyond the department's one-year benchmark for completion."

- As of March 2001, 18 of 24 such investigations remained unresolved after 18 or more months at Los Alamos National Laboratory, which spent the past two years adapting to tighter security rules in the wake of allegations of Chinese espionage. "If these delays continue, the department may not be in a position to unconditionally certify the aging nuclear weapons stockpile."

Based on a repoirt by *By Walter Pincus*, Washington Post, January 3, 2002; Page A15

INF Treaty: Intermediate Range Nuclear Forces Treaty

- **Signed in 1987.**
- **Affects all land-based ballistic missiles and cruise missiles with ranges of 300-3,400 miles.**
- **Exempts UK and France.**
- **Exempts land and sea-based aircraft and sea-based missiles.**
- **Physical destruction of missiles with joint teams. No physical destruction of warheads.**
- **START III calls for first serious effort to reexamine theater nuclear forces since signing of INF Treaty and end of Cold War.**

NATO/Warsaw Pact Nuclear Delivery Means in 1989-1990
(Excludes Artillery and Land-Based Aircraft)

Category and Type	Countries Deploying	NATO Guidelines Area		Atlantic to Urals		Global	
		NATO	WP	NATO	WP		NATO
WP							
IRBM							
SS-20	USSR	-	-	-	N.K	-	318
SSBS-S3	France	-	-	18	-	18	-
GLGM							
BGM-109G	US	n.k.	-	n.k.	-	98	-
SS-C-1b	USSR	-	-	-	-	-	43
MRBM							
Pershing II	US	n.k.	-	n.k.	-	109	-
SS-4	USSR	-	-	-	43	-	43
SRBM							
Pershing 1A	FRG	72	-	72	-	72	-
Pluton	France	-	-	32	-	32	-
Lance	US	36	-	36	-	65	-
Lance	Other NATO	52	-	58	-	58	-
SS-23	USSR	-	-	-	n.k.	-	76
Scud B	USSR	-	150	-	510	-	630
Scud A/B	Other WP	-	88	-	151	-	151
FROG/SS-21	USSR	-	104	-	713	-	930
FROG/SS-21	Other WP	-	294	-	717	-	717
SLBM LAUNCHERS							
	France	-	-	96	-	96	-
	UK	-	-	64	-	64	-
	USSR	-	-	-	18	-	36
NUCLEAR ARMED SHIPS							
SLCM							
Land Attack Sub	US	-	-	29	-	45	-
	USSR	-	-	-	6	-	10
Land Attack Surf	US	-	-	16	-	19	-
Anti-Ship Sub	USSR	-	-	-	21	-	26
Anti-Ship Surf	USSR	-	-	-	40	-	66
ASW							
SUBROC	US	-	-	12	-	16	-
SS-N-15	USSR	-	-	-	-	-	35
ASROC	US	-	-	71	-	132	-
SS-N-14	USSR	-	-	-	43	-	65
TORPEDOES	USSR	-	-	-	337	-	536
MARITIME AIRCRAFT							
Carrier Based	US	-	-	470	-	1,291	-
	France	-	-	64	-	64	-
	UK	-	-	46	-	46	-
Land-Based Bomber	USSR	-	-	-	260	-	355
Land-Based ASW	US	-	-	27	-	488	-
	Other NATO	-	-	150	-	150	-
	USSR	-	-	-	120	-	195

Part Eleven

Other Arms Control Issues: ABM Treaty, CWC, BWC, and MTCR

The Nature of the ABM Treaty

Basic Framework of the ABM Treaty

- The ABM Treaty, which was signed in 1972 by the United States and the Soviet Union, prohibits deployment of a nationwide defense against strategic ballistic missile attack. In the Treaty, the United States and the Soviet Union agreed that each may have two precisely limited ABM deployment areas (later limited by mutual agreement to one): to protect its capital or to protect an ICBM launch area.
- To promote the objectives and implementation of the Treaty, the Parties established the Standing Consultative Commission (SCC), which meets at least twice a year. Also the terms of the Treaty specify that a review of the Treaty shall be conducted every five years.
- In 1974, the Parties to the Treaty agreed by means of a Protocol to reduce the number of permitted ABM deployment areas to one for each side. The Soviet Union chose to maintain (and Russia continues to maintain) an ABM defense of its national capital, Moscow. The United States chose Lose to complete its Safeguard ABM system designed to defend its ICBM silo launcher area near Grand Forks, North Dakota; however, this system was operational for a very short time and has been inactive since 1976.

t ABM Treaty Developments Under Clinton

- In 1993, the Clinton Administration conducted a review of U.S. policy towards Ballistic Missile Defense and the Future of the ABM Treaty The Administration made a determination that the "traditional" or "narrow" interpretation of the Treaty is the correct one. The Administration therefore reaffirmed that the ABM Treaty prohibits the development, testing, and deployment of sea-based, air-based, space-based, and mobile land-based ABM systems and components without regard to the technology utilized.
- With the dissolution of the Soviet Union, the question of treaty succession arose. The United States has made clear its position that it is willing to accept as Treaty Parties any of the New Independent States (NIS) that want to be Party to the Treaty.
- At the same time, the growing threat posed by theater ballistic missiles, and the need to combine effective protection against such threats while avoiding development of an ABM capability, has prompted the U.S. to propose that the demarcation between ABM and non-ABM defenses be clarified. The ABM Treaty itself does not provide clear guidance on this question. This clarification is being negotiated in the Treaty's implementing forum, the Standing Consultative Commission.
- Memorandum of succession of September 1997 names Russia, Belarus, Ukraine, and Kazakhstan as successors to FSU and limits all four states to one location with 100 launchers/interceptors.
- Agreed statement of September 26, 1997 says
    - Interceptors can only be tested at speeds greater than 3 kilometers per second if target has speed of less than 5 kilometers per second and range of less than 3,500 kilometers.
    - Allows systems to be tested at speeds of less than 3 kilometers per second at targets with closing speeds of less than 5 kilometers per second and ranges less than 3,500 kilometers.
    - Bans space-based TMD systems.

ABM Treaty: Anti-Ballistic Missile Treaty

- **Signed before proliferation, SDI, NMD, and TMD became key issues.**
- **Key provisions are:**
  - **No development and testing of space, air, or sea-based ABM system or mobile land-based system.**
  - **Initially permitted two fixed land sites, one near capital and one near ICBM silo area.**
  - **Limits on EW radars to periphery of national territory, must look outwards.**
  - **Each site limited to a maximum of 100 ABM launchers and interceptors.**
  - **Protocol in 1974 limited to one site near capital or near ICBM silos.**
  - **Russia deployed system around Moscow, US did not.**
  - **In March 1997, agree that:**
    - **Theater systems can only be tested at speeds greater than 3 kilometers per second if target has speed of less than 5 kilometers per second and range of less than 3,500 kilometers.**
    - **Allows systems to be tested at speeds of less than 3 kilometers per second at targets with closing speeds of less than 5 kilometers per second and ranges less than 3,500 kilometers.**
    - **Bans space-based TMD systems.**

ABM Treaty Status and Issues

- **Treaty is verifiable in terms of both quantity and quality, but Russians feel break out is an issue: Cannot tell if US will suddenly transform a limited NMD system into a national defense system.**
  - **START II and III have become a hostage.**
  - **Some Russians feel could solve with a limited MIRVing (3 warheads) of Topol M (SS-27) ICBM.**
- **Advocates of a US NMD system to deal with rogue threats feel:**
  - **Need different locations from capital and missile silos: Alaska and central US?**
  - **Want two sites and not one.**
  - **Want more advanced radars and space-based sensor systems.**
- **Can deploy tactical and theater missile defense systems, but can't have strategic intercept capability or be tested in ABM mode.**
  - **Prevents national coverage by TMD systems against lose nukes, limited rogue threats.**
  - **May indirectly prevent theater missile defense against threats more sophisticated than Scud.**
  - **Russia and China see such a system as threat to MAD, own status and capabilities.**
- **Any withdrawal from ABM Treaty could drive Russia and China into new arms race or countervalue targeting**
- **Iran/North Korea probably cannot safely saturate US NMD system in near to mid-term; PRC can.**

ABM/TMD Technology

- **Can probably deploy effective limited NMD systems to deal with a rogue state threat like North Korea or Iran in 2008-2020 time frame.**
  - **Costs, performance, technology now unknown.**
  - **Spent $52.5 billion through end of 1999.**
  - **Felt test in September 1999 resulted in intercept but of missile with GPS guidance and interceptor with GPS guidance.**
  - **Supposed to decide in June 2000 whether technology is ready for deployment in 2005.**
  - **Three Integrated Flight Tests were successful on June 24, 1997, January 15, 1998, and October 2, 1999. A fourth test failed to intercept on January 18, 2000.**
  - **December 3, 2001 marks third successful intercept test of the Ground-based Midcourse Defense system. This is the third successful test in the five attempts.**
- **SDI-like system may be impractical and unaffordable in near to mid term as either damage-limiting or leak-proof system for US versus Russia threat at levels about 500-1,000 deployed systems.**
- **Patriot PAC-3 offers limited TMD point defense capability.**
- **Aegis and THAAD offer improved area defenses against Scud-like threats**
- **Wide area theater system like THAAD or AEGIS needed to deal with Shihab 3 and similar threats. (Can close at speeds greater than 5 kilometers per second.)**
- **Post-Patriot/S-300/S-400 systems have no air or cruise missile defense capability.**

ABM Treaty versus NMD Issues

- **Range of US positions.**
  - **Deploy treaty-compliant site (Nunn)**
  - **Withdraw from ABM Treaty and deploy NMD (Helms/Kyl)**
  - **Negotiate NMD with Russia and get agreement to change ABM Treaty (Weldon)**
  - **No funds for SCC (House 4276, August 5, 1998)**
- **Evolution**
  - **1996: Clinton pledges the 3+3 program for NMD: Active R&D during 1997-2000, deploy during 2001-2003.**
  - **January 1998: Clinton adds $6.6 billion to FY1999-2005 defense budget, delays deployment of NMD to 2003-2005 because of R&D risk.**
  - **April 21, 1999: Senate approves American Missile Protection Act of 1998, calling for deployment as soon as system is ready. Fails in September vote, 59:41.**
  - **Senate and House approve similar bill in 1999, after language is adopted calling for negotiations with Russians to amend ABM Treaty, etc. Senate accepts House version on March 18, 1999, signed July 23, 1999 (97:3, 317:105.**
  - **January 1999: Clinton announces will seek renegotiation of ABM Treaty under Article XIII, which says can do so in response to changes "in the strategic situation." Yeltsin agrees renegotiation is possible. Some Russians do not.**
  - **June 1999 Summit: Agree to negotiation in late summer.**
  - **When meet during August 17-19, 1999 Russians say cannot renegotiate. (Kosovo may be a key factor as is Russian fear of loss of nuclear status and parity. Some Russians begin to raise the idea of MIRVing the SS-27/Topol M to three warheads to compensate for US NMD.**
  - **Fall 1999: US offers aid on Russian EW radar sites in Siberia.**

US Announcement of Withdrawal from the ABM Treaty December 13, 2001

Statement by the White House Press Secretary

The circumstances affecting U.S. national security have changed fundamentally since the signing of the ABM Treaty in 1972. The attacks against the U.S. homeland on September 11 vividly demonstrate that the threats we face today are far different from those of the Cold War. During that era, now fortunately in the past, the United States and the Soviet Union were locked in an implacably hostile relationship. Each side deployed thousands of nuclear weapons pointed at the other. Our ultimate security rested largely on the grim premise that neither side would launch a nuclear attack because doing so would result in a counter-attack ensuring the total destruction of both nations.

Today, our security environment is profoundly different. The Cold War is over. The Soviet Union no longer exists. Russia is not an enemy, but in fact is increasingly allied with us on a growing number of critically important issues. The depth of United States-Russian cooperation in counterterrorism is both a model of the new strategic relationship we seek to establish and a foundation on which to build further cooperation across the broad spectrum of political, economic and security issues of mutual interest.

Today, the United States and Russia face new threats to their security. Principal among these threats are weapons of mass destruction and their delivery means wielded by terrorists and rogue states. A number of such states are acquiring increasingly longer-range ballistic missiles as instruments of blackmail and coercion against the United States and its friends and allies. The United States must defend its homeland, its forces and its friends and allies against these threats. We must develop and deploy the means to deter and protect against them, including through limited missile defense of our territory.

Under the terms of the ABM Treaty, the United States is prohibited from defending its homeland against ballistic missile attack. We are also prohibited from cooperating in developing missile defenses against long-range threats with our friends and allies. Given the emergence of these new threats to our national security and the imperative of defending against them, the United States is today providing formal notification of its withdrawal from the ABM Treaty. As provided in Article XV of that Treaty, the effective date of withdrawal will be six months from today.

At the same time, the United States looks forward to moving ahead with Russia in developing elements of a new strategic relationship.

- In the inter-related area of offensive nuclear forces, we welcome President Putin's commitment to deep cuts in Russian nuclear forces, and reaffirm our own commitment to reduce U.S. nuclear forces significantly.

- We look forward to continued consultations on how to achieve increased transparency and predictability regarding reductions in offensive nuclear forces.

- We also look forward to continued consultations on transparency, confidence building, and cooperation on missile defenses, such as joint exercises and potential joint development programs.

- The United States also plans to discuss with Russia ways to establish regular defense planning talks to exchange information on strategic force issues, and to deepen cooperation on efforts to prevent and deal with the effects of the spread of weapons of mass destruction and their means of delivery.

The United States intends to expand cooperation in each of these areas and to work intensively with Russia to further develop and formalize the new strategic relationship between the two countries.

The United States believes that moving beyond the ABM Treaty will contribute to international peace and security. We stand ready to continue our active dialogue with allies, China, and other interested states on all issues associated with strategic stability and how we can best cooperate to meet the threats of the 21st century. We believe such a dialogue is in the interest of all states.

CIA Summary Estimate of Missile Threat: January 2002

Most Intelligence Community agencies project that before 2015 the United States most likely will face ICBM threats from North Korea and Iran, and possibly from Iraq—barring significant changes in their political orientations—in addition to the longstanding missile forces of Russia and China. One agency assesses that the United States is unlikely to face an ICBM threat from Iran before 2015.

- Short- and medium-range ballistic missiles already pose a significant threat overseas to US interests, military forces, and allies.
- Emerging ballistic missile states continue to increase the range, reliability, and accuracy of the missile systems in their inventories—posing ever greater risks to US forces, interests, and allies throughout the world.
- Proliferation of ballistic missile-related technologies, materials, and expertise—especially by Russian, Chinese, and North Korean entities—has enabled emerging missile states to accelerate missile development, acquire new capabilities, and potentially develop even more capable and longer range future systems.
- Several countries *could* develop a mechanism to launch SRBMs, MRBMs, or land-attack cruise missiles from forward-based ships or other platforms; a few are *likely* to do so—more likely for cruise missiles—before 2015.
- Nonmissile means for delivering weapons of mass destruction do not provide the same prestige, deterrence, and coercive diplomacy as ICBMs; but they are less expensive, more reliable and accurate, more effective for disseminating biological warfare agents, can be used without attribution, and would avoid missile defenses.
- Foreign nonstate actors—including terrorist, insurgent, or extremist groups that have threatened or have the ability to attack the United States or its interests—have expressed an interest in chemical, biological, radiological, or nuclear (CBRN) materials.

The ballistic missile remains a central element in the military arsenals of nations around the globe and almost certainly will retain this status over the next fifteen years. States willingly devote often scarce resources in efforts to develop or acquire ballistic missiles; build the infrastructures necessary to sustain future development and production; and actively pursue technologies, materials, and personnel on the world market to compensate for domestic shortfalls, gain increased expertise, and potentially shorten development timelines.

Most US Intelligence Community agencies project that during the next 15 years the United States most likely will face ICBM threats from North Korea and Iran, and possibly Iraq—barring significant changes in their political orientations—in addition to the strategic forces of Russia and China. One agency assesses that the United States is unlikely to face an ICBM threat from Iran before 2015.

The threats to the US homeland, nevertheless, will consist of dramatically fewer warheads than today owing to significant reductions in Russian strategic forces. China has been modernizing its long-range strategic missile force since the mid-1980s, shifting from reliance primarily on silo-based liquid-propellant CSS-4s to mobile solid-propellant systems. The Intelligence Community projects that by

2015, the total number of Chinese strategic warheads will rise several-fold, though it will remain still well below the number of Russian or US forces.

North Korea has extended until 2003 the missile launch moratorium it announced late in 1999, although the North continues to work on the Taepo Dong-2 program. The Taepo Dong-2—capable of reaching parts of the United States with a nuclear weapon-sized payload—may be ready for flight-testing. The initial test likely would be conducted in a space launch configuration. Iran also is pursuing a longer range missile capability.

Short- and medium-range ballistic missiles, particularly if armed with WMD, already pose a significant threat overseas to US interests, military forces, and allies. Moreover, the proliferation of missile technology and components continues, contributing both to the production of SRBMs and MRBMs and to the development of even longer range systems.

The trend in ballistic missile development worldwide is toward a maturation process among existing ballistic missile programs rather than toward a large increase in the number of countries possessing ballistic missiles. Emerging ballistic missile states continue to increase the range, reliability, and accuracy of the missile systems in their inventories—posing ever greater risks to US forces, interests, and allies throughout the world. A decade ago, US

and allied forces abroad faced threats from SRBMs—primarily the Scud and its variants. Today, countries have deployed or are on the verge of deploying MRBMs, placing greater numbers of targets at risk.

Proliferation of ballistic missile-related technologies, materials, and expertise—especially by Russian, Chinese, and North Korean entities—has enabled emerging missile states to accelerate the development timelines for their existing programs, acquire turnkey systems to gain previously non-existent capabilities—in the case of the Chinese sale of the M-11 SRBM to Pakistan—and lay the groundwork for the expansion of domestic infrastructures to potentially accommodate even more capable and longer range future systems.

North Korea has assumed the role as the missile and manufacturing technology source for many programs. North Korean willingness to sell complete systems and components has enabled other states to acquire longer range capabilities earlier than otherwise would have been possible—notably the sale of the No Dong MRBM to Pakistan. The North also has helped countries to acquire technologies to serve as the basis for domestic development efforts—as with Iran's reverse-engineering of the No Dong in the Shahab-3 program. Meanwhile, Iran is expanding its efforts to sell missile technology.

States with emerging missile programs inevitably will run into problems that will delay and frustrate their desired development timelines. The impact of these problems increases with the lack of maturity of the program and depends on the level of foreign assistance. Most emerging missile states are highly dependent on foreign assistance at this stage of their development efforts, and disturbance of the technology and information flow to their programs will have discernible short-term effects. The ready availability of assistance from multiple sources, however, makes it likely that most emerging missile states will be able to resolve such problems and advance their missile programs, albeit with a slippage in development time.

Forward-Based Missile Threats to the United States

Several countries are technically capable of developing a missile launch mechanism to use from forward-based ships or other platforms to launch SRBMs and MRBMs, or land-attack cruise missiles (LACMs) against the United States. Some of these are likely to develop and deploy forward-based systems—more likely cruise missiles—during the period of this Estimate. Nevertheless, long-distance strikes against the United States probably would be operationally difficult. Other methods would be less complicated—CBRN terrorism, for example.

Ballistic Missile Threats

An SRBM or MRBM could be launched at the United States from a forward-based sea platform within a few hundred kilometers of US territory. Using such a sea platform would not pose major technical problems, but the accuracy of the missile probably would be reduced significantly because of the movement of the ocean. Still, the accuracy probably would be better than for some of the ICBMs discussed in this Estimate. The simplest method for launching a shipborne ballistic missile would be to secure a TEL onboard the ship and launch the missile from the TEL. Somewhat greater accuracy could be obtained by placing the TEL on a stabilization platform to compensate for wave movement. Another option would be to add satellite-aided (GPS or GLONASS) navigation to the missile.

The Land-Attack Cruise Missile Threat

One to two dozen countries probably will possess a land-attack cruise missile (LACM) capability by 2015 via indigenous development, acquisition, or modification of such other systems as antiship cruise missiles or unmanned aerial vehicles. Most LACMs will have a range of a few hundred km—posing primarily a theater-level threat—but with sufficient range to be forward-deployed on air- or sea-launch platforms.

Cruise Missile Threats

From a technical standpoint, cruise missiles are a better alternative than ballistic missiles in launching from forward areas. Many countries would therefore see these missiles as advantageous in attacking the United States. The most plausible alternative for a forward-based launch would be a covertly equipped commercial vessel.

Technically, cruise missiles can be launched from fighter, bomber, or even commercial transport aircraft outside US airspace. Both the perceived US capability to detect and track threats approaching the coast, and the limited range of most foreign fighter and bomber aircraft, however, tend to mitigate such a threat. Modifying a commercial aircraft to become a cruise missile platform would entail significant aerodynamic, structural, electrical, and possibly flight control system modifications. Cruise missile launches from a submarine would have the advantage of being relatively covert. The technical sophistication required to design or to modify a cruise missile for launch from

torpedo or missile tubes, however, almost certainly would require detailed assistance from the defense industry of a major naval power.

Nonmissile WMD Threats to the United States

Nonmissile means of delivering weapons of mass destruction do not provide the same prestige or degree of deterrence and coercive diplomacy associated with ICBMs. Nevertheless, concern remains about options for delivering WMD to the United States without missiles by state and nonstate actors. Ships, trucks, airplanes, and other means may be used. In fact, the Intelligence Community judges that US territory is more likely to be attacked with WMD using nonmissile means, primarily because such means:

- Are less expensive than developing and producing ICBMs.
- Can be covertly developed and employed; the source of the weapon could be masked in an attempt to evade retaliation.
- Probably would be more reliable than ICBMs that have not completed rigorous testing and validation programs.
- Probably would be much more accurate than emerging ICBMs over the next 15 years.
- Probably would be more effective for disseminating biological warfare agent than a ballistic missile.
- Would avoid missile defenses.

Terrorist Interest in CBRN

Foreign nonstate actors—including terrorist, insurgent, or extremist groups—have used, possessed, or expressed an interest in CBRN materials. Most of these groups have threatened the United States, and all of them have the ability to attack the United States or its interests. The events of September 11 and its aftermath have caused the Intelligence Community to focus significantly more resources on the threat from terrorism, and we are obtaining more information on potential terrorist actions.

Missile Technology Control Regime (MTCR)

- **US, Canada, France, FRG, Italy, Japan, and UK sign in April 1987.**
- **33 countries have signed as of December 4, 2001.**
- **China, Israel, Romania, and Ukraine have agreed to observe guidelines.**
- **Restraint on all sales of Category I equipment includes complete rocket, missile, and UAV systems capable of delivering 500 kilograms (1,100 pounds) payloads for 300 kilometers (186 miles) or more.**
- **Controls on components, equipment, material and technologies useful for missiles and UAVs, plus rocket systems and UAVs with shorter ranges and smaller payloads.**
- **Supported by wide range of US sanctions.**
- **Proposals for buyer's regimes – Zero Ballistic Missile (ZBM) treaties.**
- **Questions on what is a conventional arm: E.g. US ATACMS has a range of 250 kilometers. Russia has similar systems.**
- **Growing range of dual-use parts; problems with new suppliers, questions about relation to civilian space-launch vehicles.**

The Problem of Biological Weapons: US Position on Biological Weapons Convention

John R. Bolton, Under Secretary for Arms Control and International Security
Remarks to the 5th Biological Weapons Convention RevCon Meeting
Geneva, Switzerland
November 19, 2001

Mr. President, the United States congratulates you on your election, and pledges its cooperation in the vital work before us. We are here to review the functioning of the Biological Weapons Convention under circumstances none of us would have wished and none of us foresaw. Suddenly, all of us are engaged in a war -- a war that ignores national boundaries and threatens the very fiber of our societies.

President Bush warned in his recent address to the UN General Assembly that: "the world faces the horrifying prospect of terrorists searching for weapons of mass destruction, the tools to turn their hatred into holocaust. They can be expected to use chemical, biological, and nuclear weapons the moment they are capable of doing so." This conference is therefore unfortunately timely.

We, the parties to the Biological Weapons Convention, must demonstrate an unwavering commitment to fighting this undeniable threat. We must overcome years of talking past each other, and address the real issues. Will we be courageous, unflinching, and timely in our actions to develop effective tools to deal with the threat as it exists today, or will we merely defer to slow-moving multilateral mechanisms that are oblivious to what is happening in the real world?

The United States has repeatedly made clear why the arms control approaches of the past will not resolve our current problems. This is why we rejected the flawed mechanisms of the draft Protocol previously under consideration by the Ad Hoc Group. Countries that joined the BWC and then ignore their commitments and certain non-state actors would never have been hampered by the Protocol. They would not have declared their current covert offensive programs or the locations of their illegal work -- nor would the draft Protocol have required them to do so. Although the United States has been criticized publicly -- both in the media and by foreign governments -- for rejecting the draft Protocol, many of those same governments have told us privately that they shared America's reservations, describing the draft as "flawed" or "better than nothing." Do we really believe that a Protocol that would allow violators to conduct an offensive biological weapons program while publicly announcing their compliance with the agreement is "better than nothing?" We think not. We can -- and must -- do better.

Before we consider new ways to strengthen the Biological Weapons Convention, however, we must first confront the failure of many states to abide by that very document. Too many states are parties to the BWC but have not lived up to their commitments. Any nation ready to violate one agreement is perfectly capable of violating another, denying its actual behavior all the while. The United States will simply not enter into agreements that allow rogue states or others to develop and deploy biological weapons. We will continue to reject flawed texts like the BWC draft Protocol, recommended to us simply because they are the product of lengthy negotiations or arbitrary deadlines, if such texts are not in the best interests of the United States and many other countries represented here today.

Straight Talk About BWC Compliance

The most important reason we gather here is to assess compliance with the BWC provisions outlawing the development, production, acquisition, stockpiling, or retention of biological weapons and their delivery systems. While the vast majority of the BWC's parties have conscientiously met their commitments, the United States is extremely concerned that some states are engaged in biological weapons activities that violate the Convention. We also are concerned about potential use of biological weapons by terrorist groups, and states that support them. So I plan to name names. Prior to September 11, some would have avoided this approach. The world has changed, however, and so must our business-as-usual approach.

First, we are concerned by the stated intention of Usama bin Ladin and his al Qaeda terrorist organization to use biological weapons against the United States. While we do not yet know the source of the recent anthrax attacks against us, we do know that some of the September 11 terrorists made inquiries into renting crop dusters, almost certainly to attack our cities. We also know that Usama bin Ladin considers obtaining weapons of mass destruction to be a sacred duty, that he has claimed to possess such weapons, and that he has threatened to use them against us. We are concerned that he could have been trying to acquire a rudimentary biological weapons capability, possibly with support from a state. While the United States is not prepared, at this time, to comment on whether rogue states may have assisted a possible al Qaeda biological weapons program, rest assured that the United States will not rely alone on treaties or international organizations to deal with such terrorist groups or the states that

support them. Neither the Biological Weapons Convention nor the former draft BWC Protocol would stop biological terrorism by groups like al Qaeda or restrain their rogue-state patrons.

Beyond al Qaeda, the most serious concern is Iraq. Iraq's biological weapons program remains a serious threat to international security. After signing the BWC in 1972, Iraq developed, produced, and stockpiled biological warfare agents and weapons, and continued this activity even after ratifying the BWC in 1991. Despite the obligation to fully disclose and destroy its BW program which the UN Security Council required to conclude the Gulf War, Iraq denied having a BW program and pursued a policy of obstruction, denial and evasion to conceal its program. Only under increased pressure from UNSCOM and the looming defection of one of Iraq's weapons directors did Baghdad admit the existence of its offensive BW program. Baghdad unilaterally ended UNSCOM weapons inspections and monitoring in Iraq in December 1998. Even with unprecedented intrusiveness, UNSCOM, when faced with a nation dedicated to deception and concealment, unfortunately could not fully dismantle Iraq's BW program. Its successor, UNMOVIC, is prepared to resume on-site activities in Iraq, but Saddam Hussein's continued belligerence prevents it from so doing. The United States strongly suspects that Iraq has taken advantage of three years of no UN inspections to improve all phases of its offensive BW program. The existence of Iraq's program is beyond dispute, in complete contravention of the BWC. The BWC Protocol would have neither hindered nor stopped it.

Also extremely disturbing is North Korea's BW program. The United States believes North Korea has a dedicated, national-level effort to achieve a BW capability and that it has developed and produced, and may have weaponized, BW agents in violation of the Convention. North Korea likely has the capability to produce sufficient quantities of biological agents for military purposes within weeks of a decision to do so. While we are hopeful that Pyongyang will come into compliance with the BWC and end its program, the fact remains that the BWC has been ineffective in restraining North Korea. The draft BWC Protocol would have done no better.

We are also quite concerned about Iran, which the United States believes probably has produced and weaponized BW agents in violation of the Convention. The United States believes that Libya has an offensive BW program in the research and development stage, and it may be capable of producing small quantities of agent. We believe that Syria (which has not ratified the BWC) has an offensive BW program in the research and development stage, and it may be capable of producing small quantities of agent. Finally, we are concerned about the growing interest of Sudan (a non-BWC party) in developing a BW program. The BWC has not succeeded in dissuading these states from pursuing BW programs and we believe the draft BWC Protocol would have likewise failed to do so.

This list is not meant to be exhaustive, but to demonstrate real challenges left unaddressed by the Biological Weapons Convention. There are other states I could have named which the United States will be contacting privately concerning our belief that they are pursuing an offensive BW program. The United States calls upon all BWC parties and signatories that have not done so to immediately terminate their offensive biological weapons programs and comply fully with their obligations.

New Approaches to the BW Threat

In light of the September 11 terrorist attacks, widespread violations of the BWC, and the weaknesses of the draft BWC Protocol, which rendered it incapable of effectively addressing these serious threats, the United States has crafted alternative proposals. Just as we can no longer rely solely on traditional means to fight a war against terrorism, we need to look beyond traditional arms control measures to deal with the complex and dangerous threats posed by biological weapons. Countering these threats will require a full range of measures -- tightened export controls, an intensified non-proliferation dialogue, increased domestic preparedness and controls, enhanced biodefense and counter-bioterrorism capabilities, and innovative measures against disease outbreaks. Strict compliance by all Parties with the BWC is also critical.

The United States has a dedicated bio-defense program to ensure that Americans and our friends and allies are protected against bioweapons attacks. In light of the recent anthrax attacks, our efforts will increase. Robust biodefense efforts are necessary to combat known threats, and to ensure that we have the means to defeat those specific threats. U.S. bio-defense programs are a means to an end, to protect Americans and our friends and allies. An essential element in our strategy is to find agreement in this body on measures that countries can undertake immediately to strengthen the BWC. We strongly believe that the key is to broaden our understanding of the biological weapons threat and the types of measures that are potentially valuable in countering it.

U.S. Proposals for Strengthening the BWC

National Implementation (Article IV)

Let me begin with measures to strengthen National Implementation. The United States proposes that Parties agree to enact national criminal legislation to enhance their bilateral extradition agreements with respect to BW offenses and to make it a criminal offense for any person to engage in activities prohibited by the BWC. While Article IV permits the adoption of such legislation, it does not explicitly require it. This body must make clear that doing so is essential.

Further, Parties should have strict standards for the security of pathogenic microorganisms and: (a) adopt and implement strict regulations for access to particularly dangerous micro-organisms, including regulations governing domestic and international transfers; and (b) report internationally any releases or adverse events that could affect other countries. Sensitizing scientists to the risks of genetic engineering, and exploring national oversight of high-risk experiments, is critical and timely, as is a professional code of conduct for scientists working with pathogenic micro-organisms.

Such measures, if adopted and implemented, will contribute significantly to doing what none of the measures in the draft BWC Protocol would do: control access to dangerous pathogens, deter their misuse, punish those who misuse them, and alert states to their risks. Individually and collectively, they would establish powerful new tools to strengthen the BWC by enhancing our ability to prevent the development, production or acquisition of dangerous pathogens for illegal purposes. These benefits can be achieved quickly, since implementation does not depend on lengthy international negotiation.

Consultation and Cooperation (Article V)

The United States seeks to establish a mechanism for international investigations of suspicious disease outbreaks and/or alleged BW incidents. It would require Parties to accept international inspectors upon determination by the UN Secretary General that an inspection should take place. This would make investigations of such events more certain and timely. It would also allow us to acquire internationally what is likely to be the first hard evidence of either accidental or deliberate use of biological warfare agents and help ensure that any such event did not get covered up by the responsible parties.

We are also supportive of setting up a voluntary cooperative mechanism for clarifying and resolving compliance concerns by mutual consent, to include exchanges of information, voluntary visits, or other procedures to clarify and resolve doubts about compliance.

Assistance to Victims (Article VII) and Technical and Scientific Cooperation (Article X)

Enhanced cooperation with the World Health Organization would be in everyone’s interests. As we are aware, biosafety standards vary widely throughout the world. The United States strongly believes every country would benefit from adopting rigorous procedures, and therefore proposes that Parties adopt and implement strict biosafety procedures, based on WHO or equivalent national guidelines. Furthermore, we should enhance support of WHO's global disease surveillance and response capabilities. Parties could agree to provide rapid emergency medical and investigative assistance, if requested, in the event of a serious outbreak of infectious disease, and to indicate in advance what types of assistance they would be prepared to provide.

Restricting access and enhancing safety procedures for use of dangerous pathogens, strengthening international tools to detect serious illness and/or potential illegal use of biology and providing assurance of help in the event of a serious disease outbreak -- these measures all enhance collective security and collective well-being -- which is, after all, our ultimate objective. With the exception of the final measure, none of these measures was contemplated in the draft BWC Protocol.

The United States believes these proposals provide sound and effective ways to strengthen the Convention and the overall effort against biological weapons. These are measures State Parties can adopt now to make the world safer and proliferation more difficult. The choice is ours.

Review Conference Objectives

To preserve international unity in our efforts to fight against terrorism and WMD proliferation, we need to work together, and avoid procedural or tactical divisiveness during the Review Conference that may hinder reaching our mutual goal of combating the BW threat. We welcome all reactions to these ideas, and additional new ways to strengthen the BWC.

The time for "better than nothing" protocols is over. It is time for us to consider serious measures to address the BW threat. It is time to set aside years of diplomatic inertia. We will not be protected by a "Maginot treaty" approach to the BW threat. The United States asks the states assembled here to join us in forging a new and effective approach to combat the scourge of biological weapons. I have laid out serious proposals that the United States hopes will form the basis of this new approach. I ask that these proposals be endorsed in the Final Declaration.

By working together during this Review Conference, by exchanging ideas and proposals that will help us meet this critical challenge, I am confident this Convention can succeed in advancing the worldwide effort to reduce and ultimately eliminate the biological weapons threat.

Part Twelve

Arms Control, Deterrence, and Counterproliferation

Arms Control is Not Enough

- **There is no present prospect that any combination of arms control, deterrence, and active/passive counter proliferation can fully secure the region, any state in the region, or Western power projection forces.**
- **Creeping proliferation and violations will follow the line of least resistance:**
- **Theater missile defense will be meaningless without radical improvements in defense against air attacks, cruise missiles, and unconventional means of delivery.**
- **There is no present prospect that any combination of measures can defend against biological warfare, and many proposed forms of counter-proliferation act as incentive to develop biological weapons and use unconventional means of delivery.**
- **Arms control policies cannot work by enforcing restraint on moderates and nations at peace, not threatening and radical states.**

Arms Control, Deterrence, and Counterproliferation

- **However, a synergistic effort blending arms control, containment, preemptive options, deterrence, retaliation, and civil defense should offer significant stability.**
- **Stable deterrence is extremely hard to define and create.**
- **At the same time,**
  - **Reduces incentives to cheat.**
  - **Allows moderate and peace-oriented states to begin to take action even if all states in the region will not participate.**
  - **Focuses on avoiding war fighting rather than possession of weapons or technologies per se.**
- **There are uncertain prospects that such stability can be offered in ways that prohibit regional proliferation without at least a tacit US threat to retaliate with nuclear weapons.**

Stable Deterrence/Adequate Security

- **Advantages:**
  - **Focuses on defining a mix of force postures that provide mutual security, not elimination of or reductions in weapons per se.**
  - **Gives each nation considerably flexibility in picking different measures to create proper tradeoff between arms limits and reductions and security.**
  - **Allows for major asymmetries in forces.**
  - **Does not need full transparency.**
  - **Eases arms race without giving up ultimate deterrent.**
  - **Exact or detailed verification not needed. "Open skies, open access" can be provided on national terms.**
  - **Focuses on limiting risk and nature of war fighting, not abstract limits on weapons and technology.**
- **Disadvantages**
  - **Creates very complicated problems in trying to balance off different patterns of proliferation in different nations and in defining overall security situation.**
  - **Involves a major military dialogue and inevitably a willingness to accept uncertainty and some risks**
  - **Requires enough transparency to provide confidence.**
  - **May not halt arms race.**
  - **Exact verification is almost impossible.**
  - **Presents problems for Middle Eastern nations because of different security situations in Gulf, East Med, and North Africa .**

Extended Deterrence

- **Advantages:**
  - **Make the US or some combination of outside nations the guarantor of regional security and arms control by stating will retaliate against any use of weapons of mass destruction.**
  - **Gives each nation considerably flexibility in picking different measures to create proper tradeoff between arms limits and reductions and security.**
  - **Allows for major asymmetries in forces.**
  - **Does not need full transparency.**
  - **Eases arms race without giving up ultimate deterrent.**
  - **Focuses on limiting risk and nature of war fighting, not abstract limits on weapons and technology.**
- **Disadvantages**
  - **Credibility of guarantee.**
  - **Existential reliance on US or any other mix of powers.**
  - **In an adjunct to other arms control measures, not a solution in itself.**
  - **Probably unacceptable to nations hostile to the US.**
  - **Retaliate against whom for what? What triggers action? Punish people for their leaders' actions.**

Conventional Deterrence

- **Advantages:**
  - **Precision conventional weapons and advanced area weapons can produce major tactical and strategic damage.**
  - **Conventional deterrence can replace reliance on weapons of mass destruction.**
  - **Allows for asymmetries in forces.**
  - **Does not need full transparency.**
  - **Eases arms race without giving up substantial deterrent capability**
  - **Tends to encourage targeting military forces and facilities, and critical civilian facilities with limited collateral damage.**
- **Disadvantages**
  - **Cannot produce the damage effects or psychological impact of weapons of mass destruction.**
  - **Possible adjunct to arms control, not a form of arms control per se.**
  - **May only be credible if US or other powers provided extended deterrence.**
  - **Reinforces conventional arms race.**

Possible Counterproliferation Policy

- **Dissuasion to convince non-weapons of mass destruction states that their security interests are best served through not acquiring weapons of mass destruction.**

- **Denial to curtail access to technology and materials for weapons of mass destruction through export controls and other tools,**

- **Arms control efforts to reinforce the Nuclear Non-Proliferation Treaty, Biological and Chemical Weapons Conventions, nuclear free zones, conventional arms treaties that stabilize arms races, confidence and security building measures, and Anti-Ballistic Missile Treaty clarification efforts to allow US deployment of advanced theater ballistic missile defenses.**

- **Region-wide arms control agreements backed by intelligence sharing and ruthless, intrusive challenge inspection without regard for the niceties of sovereignty.**

- **International pressure to punish violators with trade sanctions to publicize and expose companies and countries that assist proliferators, and to share intelligence to heighten awareness of the proliferation problem.**

- **Defusing potentially dangerous situations by undertaking actions to reduce the threat from weapons of mass destruction already in the hands of selected countries -- such as agreements to destroy, inspect, convert, monitor, or even reverse their capabilities.**

- **Military capabilities to be prepared to seize, disable, or destroy weapons of mass destruction in time of conflict.**

- **Improve tracking and detection of sales, technology transfer, research efforts, extremist groups.**

- **Defensive capabilities, both active (theater missile defenses) and passive (protective gear and vaccines) that will mitigate or neutralize the effects of weapons of mass destruction and enable US forces to fight effectively even on a contaminated battlefield.**

- **Declared and convincing counterstrike options ranging from conventional strikes devastating a user nation's economy, political structure and military forces to the use of nuclear weapons against the population centers of user nations and groups.**

The US View of Key Force Improvements Affecting Counterproliferation Policy

- ***Detection and characterization of biological and chemical agents*. This initiative is intended to accelerate the fielding of stand-off and point detection and characterization systems by up to six years. It also addresses the integration of sensors into existing and planned carrier platforms, emphasizing man-portability and compatibility with UAVs.**

- ***Detection, characterization, and defeat of hard, underground targets*. The US is seeking new sensors, enhanced lethality, and penetrating weapons to increase the probability of defeating the target while minimizing the risk of collateral damage.**

- ***Detection, localization and neutralization of weapons of mass destruction inside and outside the US*. The US is seeking to identify and evaluate systems, force structures, and operational plans to protect key military facilities and logistic nodes, and conduct joint exercises to improve the capability to respond to potential biological and chemical threats.**

- ***Development and deployment of addition passive defense capabilities for US forces, including development and production of biological agent vaccines*. This program will develop and field improved protective suits, shelters, filter systems, and equipment two to five years faster than previously planned. It also restores funding to the development of improved decontamination methods.**

- ***Support for weapons of mass destruction related armed control measures include strengthening the NNPT, CTB, and BWC*. They include establishing a COCOM successor regime, and improving controls on exports and technology by strengthening the MTCR, Nuclear Suppliers Group and Australia Group.**

- ***Missile defense capabilities, with primary emphasis on theater ballistic missile defenses.* This activity involves improvements in active and passive defenses, attack operations, and improvements in BM/C4I as well as the deployment of theater missile defenses. The primary focus, however, is on anti-ballistic missile defenses, and in the near term, this involves the development of the Patriot Advanced Capability Level-3 (PAC-3/ERINT), Navy area theater missile defense (Aegis), and theater high altitude area defense (THAAD).**

- ***Publicized counterstrike options.* Options ranging from a convincing declared capability to conduct precision mass air and missile strikes with conventional weapons that can devastate user states to use of nuclear weapons escalating to the destruction of population centers.**

- ***New force tailored to dealing with terrorist and unconventional threats.* New intelligence and tracking systems dedicated to the prevention of mass terrorism, and tailored special forces to detect and attack terrorist groups and deal with unconventional uses of weapons of mass destruction.**

Part Thirteen

Defining Weapons of Mass Destruction

Weapons of Mass Destruction: What Are We Really Talking About?

- Differ radically in inherent lethality.
- Chemical weapons have marginal real-world status as weapon of mass destruction.
- Lethality models are terrible, both in terms of prompt and long-term effects.
- The actual process of weaponization is critical in determining effectiveness.
- Missiles are only one of many delivery systems and often not the best one.

The Comparative Effects of Biological, Chemical, and Nuclear Weapons Against a Typical Urban Target in the Middle East

Using missile warheads: Assumes one Scud sized warhead with a maximum payload of 1,000 kilograms. The study assumes that the biological agent would not make maximum use of this payload capability because this is inefficient. It is unclear this is realistic.

	Area Covered in Square Kilometers	Deaths Assuming 3,000-10,000 people Per Square Kilometer
Chemical: 300 kilograms of Sarin nerve gas with a density of 70 milligrams per cubic meter	0.22	60-200
Biological 30 kilograms of Anthrax spores with a density of 0.1 milligram per cubic meter	10	30,000-100,000
Nuclear:		
One 12.5 kiloton nuclear device achieving 5 pounds per cubic inch of over-pressure	7.8	23,000-80,000
One 1 megaton hydrogen bomb	190	570,000-1,900,000

Using one aircraft delivering 1,000 kilograms of Sarin nerve gas or 100 kilograms of anthrax spores: Assumes the aircraft flies in a straight line over the target at optimal altitude and dispensing the agent as an aerosol. The study assumes that the biological agent would not make maximum use of this payload capability because this is inefficient. It is unclear this is realistic.

	Area Covered in Square Kilometers	Deaths Assuming 3,000-10,000 people Per Square Kilometer
Clear sunny day, light breeze		
Sarin Nerve Gas	0.74	300-700
Anthrax Spores	46	130,000-460,000
Overcast day or night, moderate wind		
Sarin Nerve Gas	0.8	400-800
Anthrax Spores	140	420,000-1,400,000
Clear calm night		
Sarin Nerve Gas	7.8	3,000-8,000
Anthrax Spores	300	1,000,000-3,000,000

Source: Adapted by the Anthony H. Cordesman from Office of Technology Assessment, Proliferation of Weapons of Mass Destruction: Assessing the Risks, US Congress OTA-ISC-559, Washington, August, 1993, pp. 53-54.

The Thermal and Blast Effects of Nuclear Weapons: The US Department of Defense Estimates

Radii of Effects in Kilometers versus Weapons Yield

Effect	1 KT	20 KT	100 KT	1 MT	10 MT
Nuclear Radiation (1,000 cGY or lethal dose in open)	0.71	1.3	1.6	2.3	3.7
Blast: 50% incidence of translation with subsequent impact on a Non-yielding surface	0.28	1.0	1.4	3.8	11.7
Thermal: 50% incidence of 2nd degree burns to bare skin, Kilometer visibility	0.77	1.8	3.2	4.8	14.5
Duration of Thermal Pulse in Seconds	0.12	0.32	0.9	2.4	6.4

Ranges in Kilometers for Probabilities of Flying Debris

Yield in KT	Probability of Serious Injury		
	1%	50%	99%
1	0.28	0.22	0.17
10	0.73	0.57	0.44
20	0.98	0.76	0.58
50	1.4	1.1	0.84
100	1.9	1.5	1.1
200	2.5	1.9	1.5
500	3.6	2.7	2.1
1000	4.8	3.6	2.7

Ranges in Kilometers for Translational (Blast) Injuries

Yield in KT	Range for Probability Blunt Injuries & Fractures			Range for Probable Fatal Injuries	
	-1%	50%	99%	-1%	50%
1	0.38	0.27	0.19	0.27	0.19
10	1.0	0.75	0.53	0.75	0.53
20	1.3	0.99	0.71	0.99	0.71
50	1.9	1.4	1.0	1.4	1.0
100	2.5	1.9	1.4	1.9	1.4
200	3.2	2.5	1.9	2.5	1.9
500	4.6	3.6	2.7	3.6	2.7
1000	5.9	4.8	3.6	4.8	3.6

Source: Adapted from Table 2-1 and Table 2-7 of FM 8-10-7 and Table IV of FM-8-9, Part I, and USACHPPM, The Medical NBC Battlebook, USACHPPM Technical Guide 244, pp. 2-2 and 2-3.

The Thermal and Blast Effects of Nuclear Weapons - Part Two: The British RUSI Estimates

Radius of Effect in Kilometers

Yield in Kilotons	Metals Vaporize	Metals Melt	Wood Burns	3rd Degree Burns	5 psi/ 160 mph Winds	3 psi 116 mph Winds
10	0.337	0.675	1.3	1.9	1.3	1.6
20	0.477	0.954	1.9	2.7	1.6	2.0
50	0.754	1.5	3.0	4.3	2.0	2.7
100	1.0	2.0	4.3	5.7	2.7	3.5
200	1.5	2.8	5.7	8.0	3.5	4.5

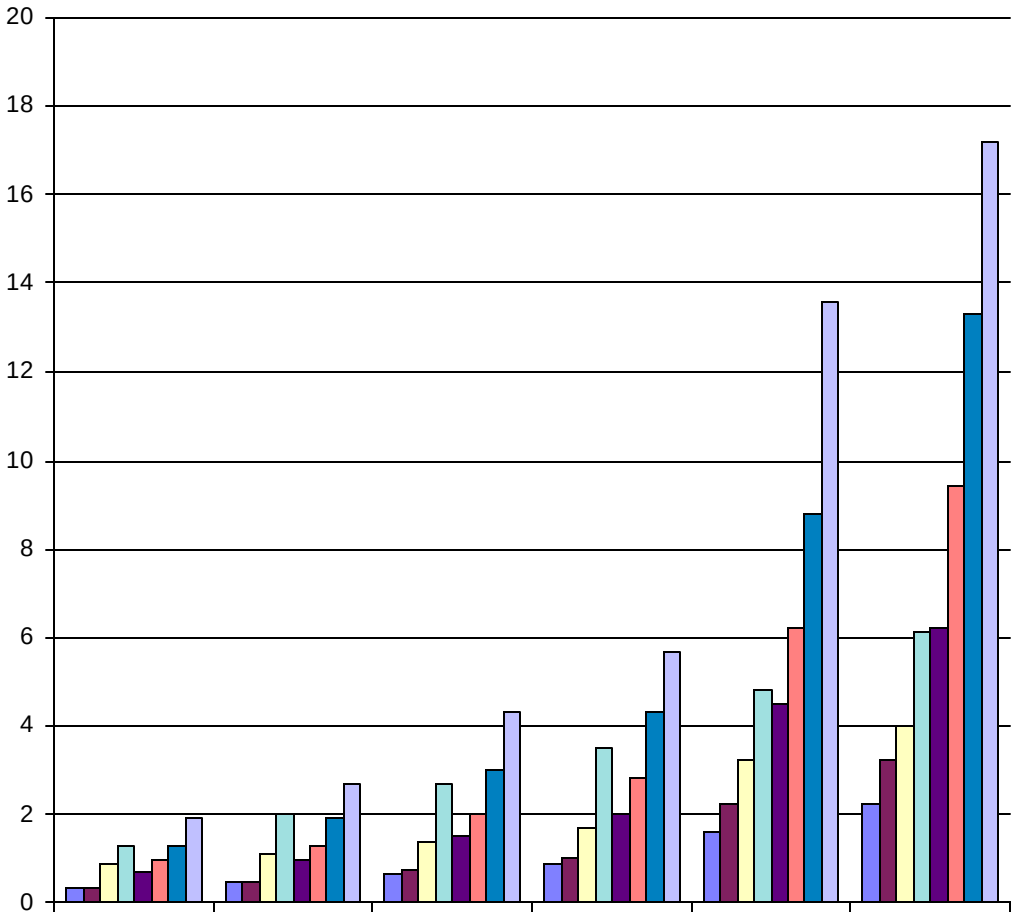
Impact of Killing Effects by Yield

Cause	Effect	Radius in Nautical Miles		
		40 KT	170 KT	1MT
Overpressure (crushing)	Lethality threshold	0.1	0.15	0.25
	Severe lung damage	0.7	1.1	2.1
	Broken eardrums	0.3	0.5	0.8
Translation	Personnel in open (1%)	0.9	1.6	3.3
	Personnel near structures (1%)	1.0	1.9	3.8
	Personnel near structures (50%)	0.6	1.0	2.1
Thermal	Third degree burn – 100%	1.5	2.6	5.2
	No burns – 100%	2.8	4.8	8.7
	Retinal burn – daytime safe distance	20.0	23.0	25.0
Radiation	Lethal does (1,000 rads)	0.7	0.8	0.9
	No immediate harm (100 rads or less)	1.0	1.1	1.2

Source: Adapted by Anthony H. Cordesman from the Royal United Services Institute, Nuclear Attack: Civil Defense, London, RUSI/Brassey's, 1982, pp. 30-36; and Office of Technology Assessment, "The Effects of Nuclear War," Washington, US Congress, OTA-NS-89, May 1979, pp. 43-46.

The Nominal Lethality of Different Nuclear Weapons

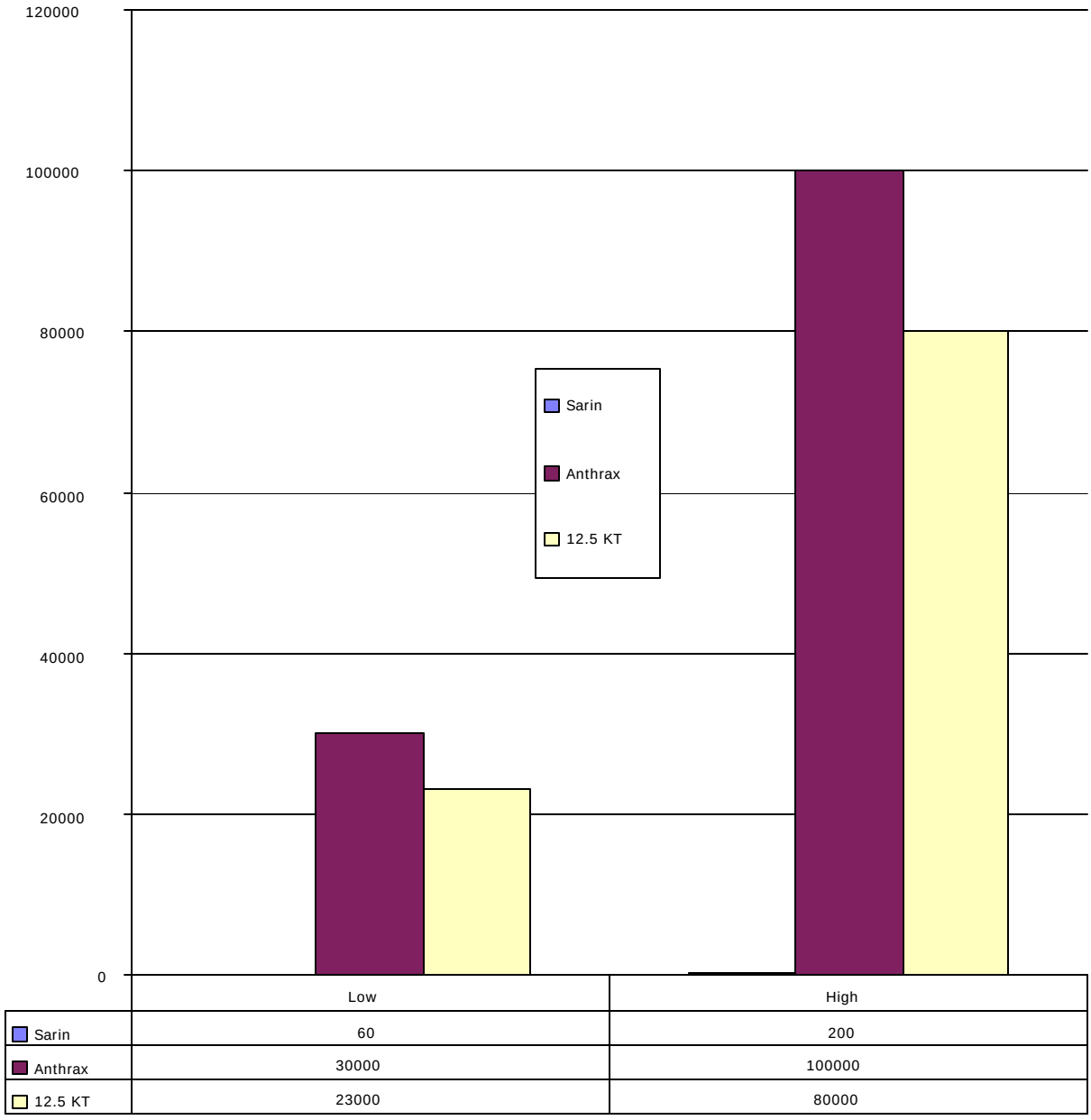
(Seriousness of Effect in Kilometers as a Function of Yield)



	10KT	20 KT	50 KT	100 KT	500 KT	1 MT
Fireball	0.352	0.464	0.67	0.884	1.6	2.2
Metals Vaporize	0.337	0.477	0.754	1	2.2	3.2
10-Psi	0.875	1.1	1.4	1.7	3.2	4
5-Psi	1.3	2	2.7	3.5	4.8	6.1
Metals Melt	0.675	0.954	1.5	2	4.5	6.2
Plastics Melt/Ignite	0.954	1.3	2	2.8	6.2	9.4
Wood chars/Burns	1.3	1.9	3	4.3	8.8	13.3
3rd Degree Burns	1.9	2.7	4.3	5.7	13.6	17.2

Source: Adapted by Anthony H. Cordesman from the Royal United Services Institute, Nuclear Attack: Civil Defense, London, RUSI/Brassey's, 1982, pp. 30-36

The Relative Killing Effect of Chemical vs. Biological vs. Nuclear Weapons



	Low	High
Sarin	60	200
Anthrax	30000	100000
12.5 KT	23000	80000

Source: Adapted by Anthony H. Cordesman from Victor A. Utgoff, The Challenge of Chemical Weapons, New York, St. Martin's, 1991, pp. 238-242 and Office of Technology Assessment, Proliferation of Weapons of Mass Destruction: Assessing the Risks, U.S. Congress OTA-ISC-559, Washington, August, 1993, pp. 56-57.

[i] National Intelligence Council, "Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015, (September 1999 (www.cia.gov/cia/publications/nie/nie99).

[ii] Department of Defense, "The Security Situation in the Taiwan Straits," Report to Congress Pursuant to the FY1999 Appropriations Bill, February 1999.

[iii] New York Times, August 5, 2000, p. A-1.

[iv] Douglas J. Gilbert,. "Missile Threats Growing as Nation Pursues Defense," American Forces Press Service, May 7, 1999.

[v] New York Times, p. A-10.

[vi] For further details, see Review of United States Policy Toward North Korea: Findings and Recommendations, Unclassified Report by Dr. William J. Perry, U.S. North Korea Policy Coordinator and Special Advisor to the President and the Secretary of State, Washington, DC, October 12, 1999; and Testimony Before the Senate Foreign Relations Committee, Subcommittee on East Asian and Pacific Affairs, Washington, DC, October 12, 1999.

[vii] CIA, August 10, 2000, Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 July Through 31 December 1999 internet edition.

[viii] National Intelligence Council, "Foreign Missile Developments and the Ballistic Missile Threat to the United States Through 2015, (September 1999 (www.cia.gov/cia/publications/nie/nie99). Also see the report of the Rumsfeld Commission, Commssion to Assess the Ballistic Missile Threat to the United States, Executive Summary, July 15, 1998, pp. 6-7.

[ix] Douglas J. Gilbert,. "Missile Threats Growing as Nation Pursues Defense," American Forces Press Service, May 7, 1999.

[x] New York Times, p. A-10.

[xi] For further details, see Review of United States Policy Toward North Korea: Findings and Recommendations, Unclassified Report by Dr. William J. Perry, U.S. North Korea Policy Coordinator and Special Advisor to the President and the Secretary of State, Washington, DC, October 12, 1999; and Testimony Before the Senate Foreign Relations Committee, Subcommittee on East Asian and Pacific Affairs, Washington, DC, October 12, 1999.

[xii] Some reports give the range as 500 kilometers; Jane's Defense Weekly, March 10, 1999, p. 50-64.

[xiii] Baltimore Sun, November 23, 1988; Washington Post, September 16, 1989.

[xiv] Tass International, 1216 GMT, September 15, 1989; Washington Post, September 16, 1989; Jane's Defense Weekly, November 19, 1988, September 23, 1989, p. 549; Washington Times, July 22, 1987, p. D-4; International Defense Review, 7/1987, p. 857, and New York Times, July 22, 1987, p. A-6, July 29, 1987; Mideast Markets, November 23, 1987, p. 11; in Harold Hough, "Israel's Nuclear Infrastructure, Jane's Intelligence Weekly, November, 1994, pp. 505-511.

[xv] BBC and ITV reporting efforts seem to give more credibility to the idea that Israel has some form of relatively short-range nuclear armed missile. Ranges of anywhere from 750-930 NM have been reported, with accuracy's of anywhere from 0.1 Km to radar correlator guidance packages capable of CEPs of 100 meters. Bulletin of Atomic Scientists, Vol. 46, Jan/Feb. 19980, p. 48; Washington Post, September 16, 1989, p. A-17, November 15, 1989, p. A-14; Economist, August 1, 1987, p. 41; Washington Times, July 22, 1987, p. D-4; July 24, 1987, p. A-9 and April 4, 1988, p. 17; International Defense Review, 7/1987, p. 857, and New York Times, July 29, 1987, p. A-10.

[xvi] Tass International, 1216 GMT, September 15, 1989; Washington Post, September 16, 1989; Jane's Defense Weekly, November 19, 1988, September 23, 1989, p. 549; Washington Times, July 22, 1987, p. D-4; International Defense Review, 7/1987, p. 857, and New York Times, July 22, 1987, p. A-6, July 29, 1987; Mideast Markets, November 23, 1987, p. 11; in Harold Hough, "Israel's Nuclear Infrastructure, Jane's Intelligence Weekly, November, 1994, pp. 505-511.

[xvii] Washington Post, October 26, 1989, p. A-36; Boston Globe, October 30, 1989, p. 2; Newsweek, November 6, 1989, p. 52.

[xviii] Jane's Intelligence Review, September, 1997, pp. 407-410; Jane's Defense Weekly, March 10, 1999, p. 50-64; International Defence Review, Extra, 2/1997, p. 2.

[xix] It is also possible that Israel may have deployed nuclear warheads for its MGM-55C Lance missiles. Israel has 12 Lance transporter-erector-launchers, and at least 36 missiles. The Lance is a stored liquid fueled missile with inertial guidance and a range of 5-125 kilometers. It has a warhead weight of 251 kilograms, and a CEP of 375 meters. It was

deployed in US forces with the W-70 nuclear warhead. International Defense Review, 7/1987, p. 857; Economist, May 4, 1968, pp. 67-68; New York Times, July 22, 1987, p. A-6; Washington Times, July 22, 1987, p. D-4; Defense and Foreign Affairs, June, 1985, p. 1; Aerospace Daily, May 1, 1985, p. 5 and May 17, 1985, p. 100; Aerospace Daily, May 1, 1985, May 7, 1985; Shuey, et al, Missile Proliferation: Survey of Emerging Missile Forces, p. 56; CIA, "Prospects for Further Proliferation of Nuclear Weapons, " DCI NIO 1945/74, September 4, 1974; NBC Nightly News, July 30, 1985; New York Times, April 1, 1986; US Arms Control and Disarmament Agency, World Military Expenditures and Arms Transfers, Washington, GPO, 1989, p. 18; Michael A. Ottenberg, "Israel and the Atom," American Sentinel, August 16, 1992, p. 1.

[xx] Harold Hough, "Could Israel's Nuclear Assets Survive a First Strike?," Jane's Intelligence Review, September, 1997, pp. 407-410.

[xxi] Harold Hough, "Could Israel's Nuclear Assets Survive a First Strike?," Jane's Intelligence Review, September, 1997, pp. 407-410.

[xxii] Harold Hough, "Could Israel's Nuclear Assets Survive a First Strike?," Jane's Intelligence Review, September, 1997, pp. 407-410.

[xxiii] Associated Press, October 5, 1998, 0316, October 8, 1998, 1350; Philadelphia Inquirer, November 1, 1998, p. A-7.

[xxiv] This information is unconfirmed, and based on only one source. Israel does, however, have excellent research facilities, laboratory production of poison gas is essential to test protection devices as is the production of biological weapons to test countermeasures and antidotes.

[xxv] Philadelphia Inquirer, November 1, 1998, p. A-7; Associated Press, October 8, 1998, 1350.

[xxvi] Washington Times, October 7, 1998, p. A-14.

[xxvii] Harold Hough, "Could Israel's Nuclear Assets Survive a First Strike?," Jane's Intelligence Review, September, 1997, pp. 407-410.

[xxviii] Defense News, June 29, 1998, p. 3; New York Times, June 21, 1998, p. A-6.

[xxix] January 21, 2000, 0645;

[xxx] Associated Press, February 2, 2000, 0834.

[xxxi] Strategic Assessment, Vol. 1, No. 1, p. 3, April, 1998.

[xxxii] Ha'aretz, May 22, 1997' Reuters, May 23, 1997, 0821, Washington Times, May 24, 1997, p. A-8

[xxxiii] Much of this analysis is based on interviews with US and Israeli officials. It includes data drawn from Jane's Defense Weekly, April 29, 1998 p. 3, June 3, 1998, p. 3, October 21, 1998, p. 4 December 9, 1998, p. 18; Defense News, June 8, 1998, p. 8; July 6, 1998, p. 3; Wall Street Journal, September 28, 1998, p. A-23.

[xxxiv] Jane's Defense Weekly, July 10, 1996, p. 3

[xxxv] David Martin, "Ballistic Missile Defense Overview," Washington, Ballistic Missile Defense Office, Department of Defense, March 3, 1999; Defense News, July 8, 1996, p. 4, July 6, 1998, p. 6.

[xxxvi] Lennox, Duncan and David Eshel, "Israeli high-energy laser project may face more delays," Jane's Defense Weekly, April 7, 1999, p. 21.

[xxxvii] Bender, Bryan, "Future of US-Israeli laser project in doubt," Jane's Defense Weekly, June 2, 1999, p. 6.

[xxxviii] Bender, Bryan, "US and Israeli governments to bail out THEL," Jane's Defense Weekly, June 16, 1999, p. 6.

[xxxix] Jane's International Defense Review, 2/2000, p. 4.

[xl] "US approves extra patriot sales to bolster Israeli defenses," Jane's Defence Weekly, June 24, 1998, p. 17, March 24, 1999, p. 3; Associated Press, December 10, 1998, 1704.

[xli] Jane's Defense Weekly, November 17, 1999, p. 3.

[xlii] Jane's Defence Weekly, May 6, 1995, p. 15, March 19, 1997, p. 19, August 27, 1997, p. 4, November 12, 1997, p. 29, January 14, 1998, p. 4, July 8, 1998, p. 17, September 23, 1998, p. 3, December 2, 1998, p 22, December 9, 1998, p. 18; Defense News, May 20, 1996, p. 33, July 22, 1996, p. 6; Washington Times, March 9, 1996, p., A-1 Aviation Week, June 21, 1993, p. 39; Reuters, March 27, 1998, 1733, September 15, 1998, 0528, November 29, 1998, 1044; Associated Press, August 3, 1998, 1125; Washington Post, September 16, 1998, p. A-37.

[xliii] Jane's Defence Weekly, May 6, 1995, p. 15, March 11, 1998, June 24, 1998, p. 17, p. 18 December 2, 1998, p 22, December 9, 1998, p. 18; Aviation Week, June 21, 1993, p. 39; Reuters, November 29, 1998, 1044; Jane's International Defense Review, 8/1999, p. 10.

[xliv] Opall-Rome, Barbara, "Israel Promotes Regional Arrow," Defense News, May 10, 1999, p. 3.

[xlv] Jane's Defense Weekly, January 14, 1998, February 4, 1998, p. 18, March 11, 1998, p. 18, November 10, 1999, p. 5; Reuters, February 26, 1998, 1409, November 1, 1999, 0914.

[xlvi] The program manager has referred to a 100% leak-proof system. Then Israeli Defense Minister Yitzhak Mordecai referred to it as, "an almost complete shield against the present and future threat," on November 29, 1998. Reuters, November 29, 1998, 1044; Jane's Defense Weekly, January 5, 2000, p. 15.

[xlvii] Jane's Defense Weekly, March 10, 1999, pp. 71-73, January 5, 2000, p. 15; Angelo M Codevilla, "Missiles, Defense, and Israel," Washington, IASP Papers in Strategy, No. 5, November 1997.

[xlviii] David Martin, "Ballistic Missile Defense Overview," Washington, Ballistic Missile Defense Office, Department of Defense, March 3, 1999; Jane's International Defense Review, 7/1996, p. 5, 9/1997, p. 9; Jane's Defense Weekly, March 10, 1999, pp. 71-73; Defense News, March 29, 1999, pp. 1 & 28..

[xlix] David Martin, "Ballistic Missile Defense Overview," Washington, Ballistic Missile Defense Office, Department of Defense, March 3, 1999; Jane's International Defense Review, 7/1996, p. 5, 9/1997, p. 9; Jane's Defense Weekly, March 10, 1999, pp. 71-73.

[l] Defense News, June 8, 1998, p. 8; May 6, 1996, p. 24; Jane's Defense Weekly, March 10, 1999, pp. 71-73.

[li] Israel launched the Ofeq 1 prototype on September 19, 1988. It has a satellite mass of 156 kilograms. It sent up the Ofeq 2 on April 3, 1990, one day after Saddam Hussein threatened to destroy half of Israel with chemical weapons if Israel attacked Baghdad. The Ofeq satellite has a mass of 160 kilograms. Washington Post, April 6, 1995, p. 1; Jane's Intelligence Review, Volume 7, Number 6, June, 1995, pp. 265-268; Washington Post, April 6, 1995, p. 1.

[lii] Jane's Pointer, August 1998, p. 7.

[liii] Jane's Defense Weekly, February 4 ,1996, p. 18; Jane's Pointer, August 1998, p. 7.

[liv] Clarke, Philip, "Another Israeli satellite fails," Jane's Intelligence Review, August 1998, p. 7; Jane's Pointer, August 1998, p. 7.

[lv] Jane's Defense Weekly, March 6 ,1996, p. 23.

[lvi] "US-Israeli venture aims to capture high-res satellite image market," Jane's Defense Weekly, March 31, 1999, p. 17.