SECTION 7
NUCLEAR WEAPONS INVENTORIES

7.1 NUCLEAR WEAPONS OF THE US

Nuclear weapons deployed by the US are relatively easy to determine because they are announced and observable. Nuclear weapons which have been removed from service and stored are not as easy to keep track of. For instance, the INF treaty specified that ground-launched cruise missiles and Pershing-2s removed from Europe were to be destroyed. But the nuclear warheads can be stored or recycled. There is no easy way to determine what warheads are still in the stockpile. In his September 1991 and January 1992 initiatives, President Bush ordered some weapons to stand down from "readiness," and others to be removed from "deployment." Some are to be destroyed and others stored. The status of these weapons is also indeterminable without some sort of civilian verification method. So this chapter will be a best-effort to outline the US nuclear potential. Further advice and input is welcome.

A. AMERICA'S STRATEGIC NUCLEAR TRIAD

The United States has since the outbreak of the cold war operated a strategic nuclear triad of weapons which can be launched from land, air, and sea. Today the land and air components of this triad have been ordered to stand down. The sea-based portion, however, remains virtually untouched.

1. ICBMs -- The Land Leg.

Silo-based inter-continental ballistic missiles (ICBMs) compose the land leg of the triad. They are broken down to 50 MX missiles (euphemistically dubbed "peacekeeper" by the Reagan administration) and 500 Minuteman-3 missiles.

a. Missile-X (MX). Fifty MX missiles have been deployed in converted Minuteman-3 silos. Each missile carries ten Mark-21 MIRVs. Each MIRV carries a 330-kiloton W-87 bomb. Under the START-2 Treaty, all of these MX missiles will be removed.

b. Minuteman-3. 200 Minuteman-3 ICBMs carry three Mark-12 MIRVs each. Each MIRV encases a 170-kiloton W-62 bomb. The other 300 Minuteman-3s have been refitted with three Mark-12A MIRVs each, and each of these MIRVs hold a 335-kiloton W-78 bomb.

Under START-2, all Minuteman-3 missiles will have their payload reduced to one warhead each. The 500 Mark-21/W-87 warheads removed from MX missiles will be used for this purpose on Minuteman-3, as they have advanced safety devices.

450 Minuteman-2 missiles have been removed from service and their silos will be destroyed by 1999, per START-2.

2. Bombers and Cruise Missiles -- The Air Wing.

Three types of heavy, long-range bombers make up the air wing of the triad -- B-52Hs, B-1Bs, and B-2s. These bombers can carry gravity bombs or air-launched cruise missiles (ALCMs). The new advanced cruise missile (ACM), of which some have been produced, is interchangeable with the older ALCMs.

Per the September 1991 initiatives, strategic bombers have been taken off 24-hour airstrip alert and their weapons stored. Under START-2, a substantial portion of the strategic bomber force will be converted to primarily conventional use.

a. B-52H High-Altitude Bombers. There are currently 94 B-52H bombers in the strategic forces -- all B-52G bombers not retired have been converted to carry conventional weapons.

B-52H bombers can carry 20 ALCMs each (12 externally under the wings and 8 internally on the rotary launcher). The internal load can be twelve B-53/B-61/B-83 bombs instead of ALCMs.

b. B-1 Supersonic Bombers. B-1B supersonic bombers now number 95. They carry weapons internally only, on three rotary launchers. Their capacity is 22 ALCMs or 36 B-61/B-83 nuclear bombs. B-1B bombers will be converted to carry only conventional bombs by 1998.

Five B-1As were once built and one crashed. These aircraft apparently never entered service.

c. B-2 Stealth Bombers. Original plans for 132 B-2 radar-evading bombers have been reduced to 20 plus one test aircraft (prototype). The B-2 does not fly faster than sound as many believe. It is a slow, lumbering aircraft which is a high-tech resurrection of the flying wing from the 1950s, built by the same company. The first operational B-2 was delivered to Whiteman Air Force Base, Missouri, on 17 December 1993. All 20 are to be operational by 1998.

B-2s will be able to carry 24 of the follow-on short-range attack missiles (SRAM-2) or 24 nuclear gravity bombs. SRAM-2s, of course, have now been cancelled. Also, in October 1992, the 4th B-2 made a practice drop of a Mark-4, 2,000 pound bomb -- the biggest used in the Persian Gulf war. So a conventional role is also possible for the B-2. Since the stealth fighter was reported as a success in Iraq, perhaps the Pentagon thinks a stealth bomber will be better.

3. SLBMs -- The Sea Leg.

The sea leg of the US strategic triad is now made up of Trident-1 (C-4) and Trident-2 (D-5) submarine-launched ballistic missiles (SLBMs) carried of 16 Trident submarines. Two more submarines to carry the D-5 missiles will be delivered by 1997. Navy plans are to reduce the strategic submarine force to 14 ships, all carrying D-5 missiles.

a. Trident-1 (C-4) SLBMs. There are currently 192 Trident-1 missiles deployed in eight Trident submarines (24 missiles each) based at Bangor, Washington on the west coast. Four of these submarines are to be deactivated and the remaining four converted to carry Trident-2 missiles. Plans are to then base seven of the 14 submarines on each coast.

A Trident-1 missile can carry up to eight Mark-4/W-76 warheads. Each has 100 kilotons yield. A lesser number can be installed to achieve a greater range.

b. Trident-2 (D-5) SLBMs. Only about 400 of the 475-kiloton Mark-5/W-88 warheads for Trident-2 missiles were produced before they were cancelled because of production and safety reasons. They are deployed on Trident-2 missiles along with 100-kiloton Mark-4/W-76 warheads, in four of the eight Trident submarines on the east coast -- the other subs carrying Trident-2 missiles are loaded with only Mark-4/W-76 warheads. Two more new Trident subs to carry Trident-2 missiles will be deliverd by 1997.

A Trident-2 missile can carry eight of the 475-kiloton Mark-5/W-88 warheads. It has the ability to carry 12 to 14 Mark-4/W-76 warheads but the START-1 Treaty restricts each missile to eight.

B. US TACTICAL NUCLEAR DELIVERY VEHICLES

Virtually every military fighter, or attack airplane can deliver nuclear bombs. Such short-range air-delivered nuclear weapons, operated by the US Air Force, have not been curtailed by any treaty or unilateral initiative. Land-based and sea-based tactical nukes, as they are called, have been removed by treaty mandate or unilateral initiative. Some have been destroyed and others stockpiled. Deployed tactical nuclear weapons are now restricted to the B-61 gravity, or free-fall, bomb, which has a tactiacal version. US aircraft capable of delivering this bomb are the A-4, A-6, A-7, AV-8B, F-4, F-15, F-16, FA-18, F-111, and presumably the new F-117 stealth fighter. NATO aircraft so capable are the F-4, F-100, F-104, and the Tornado.

C. US NUCLEAR BOMB STOCKPILE

This section has been compiled from public sources. It reflects the active stockpile only, and does not include weapons that are waiting for disassembly at Pantex. The bombs are listed numerically by DOE warhead designation.

B-53, Mod 1 strategic gravity bomb.

YIELD:	9.0 mt.
SAFETY:	OPS & partial ENDS
IOC:	1962, safety upgrade 1988
LABORATORY:	
QUANTITY:	50
CARRIER:	US B-52 bombers.
REMARKS:	No plans to retire last 50.

B-61, Mods 3 & 4 tactical bombs.

YIELD:	100-500 kt. selective yield.
SAFETY:	OPS, ENDS & IHE.
IOC:	1980
LABORATORY:	LANL
QUANTITY:	800 of Mods 3, 4 and 10 combined.
CARRIER:	US F-111, A-4, A-6, A-7, AV-8B, F-4, F-15, F-16, F-18
	NATO F-4, F-100, F-104 & Tornado.
REMARKS:	

B-61, Mod 7 strategic bomb.

YIELD:	10-300 kt.
SAFETY:	OPS, ENDS & IHE.
IOC:	1986
LABORATORY:	LANL
QUANTITY:	750
CARRIER:	US B-1, B-52
REMARKS:	

B-61, Mod 10 tactical bomb.

YIELD:	10-175 kt.
SAFETY:	OPS, ENDS & IHE.
IOC:	1990
LABORATORY:	LANL
QUANTITY:	800 of Mods 3, 4 and 10 combined.
CARRIER:	US F-111, A-4, A-6. A-7, AV-8B, F-4, F-15, F-16, FA-18.
	NATO F-4, F-100, F-104 & Tornado.
REMARKS:	Converted from W-85 Pershing-2 warhead.

W-62 warhead for Mark-12 reentry vehicle on Minuteman-3.

YIELD:	170 kt.
SAFETY:	No safety devices other than OPS.
IOC:	1970
LABORATORY:	LLNL
QUANTITY:	610
CARRIER:	Minuteman-3 ICBM.
REMARKS:	

W-76 warhead for Mark-4 reentry vehicle for Trident.

YIELD: 100 kt.
SAFETY: OPS & ENDS.
IOC: 1979
LABORATORY: LANL
QUANTITY: 2,480
CARRIER: Trident-1 and Trident-2 SLBMs.
REMARKS:

W-78 warhead for Mark-12A reentry body on Minuteman-3.

YIELD: 335 kt.
SAFETY: OPS & ENDS.
IOC: 1980
LABORATORY: LANL
QUANTITY: 920
CARRIER: Minuteman-3 ICBM.
REMARKS:

W-80, Mod 0 warhead for sea-launched cruise missile.

YIELD: 200 kt.
SAFETY: OPS, ENDS & IHE.
IOC: 1984
LABORATORY: LANL
QUANTITY: 350
CARRIER: For nuclear Tomahawk SLCMs.
REMARKS: All stored per September 1991 initiative.

W-80, Mod 1 for ALCM and ACM..

YIELD: 200 kt.
SAFETY: OPS, ENDS & IHE.
IOC: 1982
LABORATORY: LANL
QUANTITY: 1200
CARRIER: B-1 and B-52 bombers.
REMARKS:

B-83 strategic bomb.

YIELD: Low yield to 1.2 mt.
SAFETY: OPS, ENDS, IHE & FRP.
IOC: 1983
LABORATORY: LLNL
QUANTITY: 3000 produced as of December 1986.
CARRIER: US B-1, B-52, FB-111A, F-111, A-4, A-6, A-7, F-4, F-15, F-16 & F-18 aircraft.
NATO F-4 & F-104 aircraft.
REMARKS: Apparently two will replace one B-28 or B-43.

W-87, Mod 0 warhead for Mark-21 reentry vehicle on MX missile.

YIELD:	330 kt.
SAFETY:	OPS, ENDS, IHE & FRP.
IOC:	1986
LABORATORY:	LLNL
QUANTITY :	525
CARRIER:	MX ICBM.

W-88 warhead for Mark-5 reentry Vehicle on Trident-2.

YIELD:	475 kt.
SAFETY:	OPS & ENDS.
IOC:	1990
LABORATORY:	LANL
QUANTITY:	400
CARRIER:	Trident-2 SLBM.
REMARKS:	Production halted, partly because of safety problems.

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7.2 NUCLEAR WEAPONS OF BRITAIN

Britain, like the US, possesses both tactical and strategic nuclear weapons. Only Britain does not have near as many. The following is a summary of that country's nuclear capability.

A. BRITISH STRATEGIC NUCLEAR WEAPONS

Unlike the US, Britain does not have a strategic triad. Its strategic weapons are all based in submarines at sea. Britain's strategic nuclear role commenced with the 1962 Nassau Agreement between President John Kennedy and Prime Minister Harold Macmillan, when the US agreed to sell Polaris A-3 missiles to Britain. Britain built four *Resolution* class submarines to carry the missiles (*HMS Resolution, HMS Repulse, HMS Renown,* and *HMS Revenge*). The lead ship, *HMS Resolution,* entered service in October 1967 and the others followed at about one-year intervals. At first these subs probably carried warheads similar to the 200-kiloton Mark-2/W-58 warheads used on US Polaris A-3s. There were three of these on each missile and they all went to the same target -- exploding in a triangular pattern to create more widespread destruction. In the 1980s the British Polaris fleet was refitted with maneuvering Chevaline warheads. But even with these each missile could only attack one target.

1. Britain's Shrinking Polaris Fleet.

Today Britain has two Polaris submarines still operational -- *HMS Resolution* and *HMS Repulse.* These submarines hold 16 Polaris A-3 missiles each. It is believed that each Polaris SLBM carries two Chevaline warheads which are probably in the 75-100 kiloton range.

Targets would have to be within a range of 2,500 nautical miles because that is the reach of Polaris A-3 missiles. And because of the A-3's poor accuracy, the targets would have to be soft -- such as cities, which are sprawling and vulnerable.

2. Britain's Growing Trident Fleet.

During the 1990s, Britain plans to replace its Polaris fleet with four new *Vanguard* class Trident submarines. *HMS Vanguard* became operational on 13 December 1994, *HMS Victorious* on 7 January 1996. The last two ships, *HMS Vigilant* and *HMS Vengeance,* are expected to become operational in early 1998 and 2000 respectively. British Tridents carry 16 missiles each (not 24 as do US Trident ships) so the number of SLBMs deployed will remain at 64 -- the same as for four Polaris boats. But the comparison stops there.

The new submarines will carry US Trident-2 (D-5) missiles, each loaded with up to eight 100-kiloton warheads. These warheads will be MIRVs, which means they can be sent to separate targets. Thus, rather than each submarine being able to attack 16 targets, as was the case with Polaris, each of the new Trident boats will be able to attack up to 128.

The types of targets will also be different. The accuracy of Trident-2 SLBMs makes them "hard target killers." Hard targets are heavily fortified with concrete and steel and usually buried underground. The ability to threaten another country's command bunkers will significantly destabilize international relations.

More and harder targets is not the end of Trident's capability over Polaris. Trident will threaten such targets over a larger geographic area. Trident-2 missiles are designed to travel slightly over 4,000 nautical miles with eight 475-kiloton bombs. That in itself is a longer reach than Polaris. But the British Trident, carrying smaller and lighter 100-kiloton bombs, should have a range close to 6,000 nautical miles. From its home port on the Clyde, one of these submarines can threaten almost half the globe. Its missiles will reach all of Africa north of the equator except Kenya, Somalia, and part of Ethiopia. The missiles would also reach all of the Mid-East including Afghanistan and Pakistan, and all of the former Soviet Union except the very easternmost part. They would even reach Washington, D.C. and Sub-Base Kings Bay.

B. BRITISH TACTICAL NUCLEAR WEAPONS

In recent years Britain has had a Lance missile and nuclear artillery role. Nuclear warheads for these delivery vehicles were under US control during normal times. But in a crisis or combat the entire nuclear system would have to be under British control. The Lance and nuclear artillery role has now been given up and the units handling such weapons have been disbanded.

The other tactical nuclear weapon in the British arsenal is the WE-177 bomb.

1. Britain's WE-177 Bombs.

From 1966 until mid-1992 Britain had some 200 WE-177 free-fall (gravity) bombs and depth bombs in the Royal Air Force and Royal Navy. The WE-177 is believed to be a copy of the US B-57 gravity/depth bomb which was deployed two years earlier, in 1964. The WE-177 has three models. WE-177A and WE-177B are RAF free-fall bombs with yields of 400 and 200 kilotons respectively. The WE-177C is a Royal Navy free-fall/depth bomb with a yield of 10 kilotons.

On 15 June 1992, British Secretary of Defense Malcolm Rifkind announced that the WE-177 inventory would be approximately halved and they would no longer be deployed at sea under ordinary circumstances. He said WE-177s would be removed, by the end of 1992, from all RN ships, from all of the carrier-based Sea Harrier aircraft, and from RAF maritime patrol planes. That leaves up to 100 WE-177 free-fall bombs for RAF Tornado aircraft based in England and Germany. Plans are to progressively retire the W-177 after the year 2000.

2. Britain's Tactical Trident.

To replace the WE-177 bombs, Britain originally planned for a new nuclear air-launched standoff missile called the Tactical Air-to-Surface Missile (TASM). Those plans have now been abandoned in favor of a Tactical Trident.

When *HMS Victorious* left Faslane on 7 January 1996 for its first patrol, it was carrying the first Tactical Trident missiles. Presumably these missiles are loaded with a single warhead which can be used against any country which threatens to use weapons of mass destruction. That includes chamical and biological weapons as well as nuclear. In November 1993, then British Defence Secretary Malcolm Rifkind said the Tactical Trident would be used to give "an unmistalkeable message of our willingness to defend our vital interests to the utmost." [Cited in *Heddwch*] That is far from a "No First Use" pledge. Those vital interests that the Tactical Trident is to protect were spelled out in Britain's 1995 Defence White Paper: "We have global interests and responsibilities ... As a nation we live by trade and investment ... Our manufacturing industry is dependent on raw materials from overseas. Our global investments are estimated to be worth around $300 million." [Cited in *Heddwch*]

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7.3 NUCLEAR WEAPONS OF FRANCE

France has been described as a nuclear wild card in Europe. She emerged as the world's fourth nuclear power on 13 February 1960. Although a charter member of NATO, French President Charles de Gaulle in 1966 withdrew French armed forces from integration with NATO, and NATO bases were removed from French territory. De Gaulle started deploying France's own independent nuclear forces the following year, allegedly through dictatorial powers and without consultation with parliament.

Some observers say De Gaulle's action was in response to NATO abandoning "massive retaliation" as its nuclear policy, and shifting to the more-gradually-escalating "flexible response" doctrine. That may have been part of the reason, but competition with US dominance of NATO certainly figured into the picture. Whatever the reason, France's *force de frappe* then assumed the threat of immediate, massive retaliation against Soviet cities if Warsaw Pact troops set foot across the West German border.

Next to the United States and successors to the Soviet Union, France's nuclear arsenal has the widest spectrum of weapons for both strategic and tactical use. But that is changing. Modernizations taking place will reduce the variety and increase the aggressiveness. It is possible that the land leg of France's strategic nuclear triad may be abandoned. Nuclear spending declined from US$5.34 billion in 1990 to US$3.7 billion in 1994, then rose slightly to US$3.9 billion requested for 1995.

France became a party to the NPT on 3 August 1992. In early 1994 France conducted the first defense review in over 20 years. Its report (white paper) recommended that France restructure its armed forces to fight several small engagements of long duration relatively far from home. Six strategic scenarios considered include a major war in western Europe. Others ranged from international peacekeeping to protecting overseas territories and former colonies.

The white paper recommended that French armed forces be reorganized to address four major missions: **crisis prevention** (prepositioned forces, intelligence activities, spying sensors), **nuclear deterrence** (the SSBN force with improved and secure communication, plus a second nuclear component for diversification), **protection of national territory** (air defense and ballistic missile defense, as budget allows), and **military action** (military units with secure satellite communication and computerized command to conduct continuous and combined operations day or night).

France's military budget for 1994 was US$41.2 billion, or 3.3 percent of the gross domestic product. Requested military spending for 1995 is US$43.7 billion. France is the only major NATO member that is increasing its military budget. Weapons procurement alone (both nuclear and conventional) has planned increases of 0.5 percent annually during 1995-2000, and is expected to total US$107 billion during that six-year period.

A. FRANCE'S STRATEGIC NUCLEAR TRIAD

France, like the US, operates a triad to deliver strategic nuclear weapons by land, air, and sea. These strategic weapons could reach the former Soviet Union.

1. S-3D Land-Based Missiles.

A force of 18 S-3D intermediate-range ballistic missiles (IRBMs) -- each equipped with a single, one-megaton TN-60 warhead -- make up the land-base leg of the triad. They are deployed in fixed silos located at St. Christol Air Force Base on the Albion Plateau in southeastern France. The complex also contains two underground command posts. These two-stage, solid-propellant missiles became operational in 1980. They have a range of 1,890 nautical miles (3,500 kilometers). The accuracy is not known. The S-3D must be retired by 2003. It is likely that they will not be replaced.

2. Mirage-4P/Mirage-2000N Bombers with ASMP Missiles.

The air wing of the triad is comprised of land-based Mirage-4P bombers and Mirage-2000N strike aircraft.

a. Mirage-4P Bombers. Fifteen of these aircraft are deployed with another 13 in storage. Half are at Mont-de-Marson and the remainder at Cazaux. They have an unrefueled range of 500 nautical miles (930 kilometers) with speeds up to Mach 2.2 -- and can carry one Air-Sol Moyenne Portee (ASMP) missile.

b. Mirage-2000N strike aircraft. Plans are for 75 of these aircraft -- 30 at Luxeuil near the German-Swiss border and 45 at Istres near Marseille. Using drop tanks the Mirage-2000N can fly 970 nautical miles (1,800 kilometers) with terrain following sensors for low-altitude penetration. Their top speed is Mach 2.2. Currently only 45 Mirage-2000Ns are deployed in the nuclear role. Each aircraft can carry one ASMP missile.

c. Air-Sol Moyenne Portee (ASMP) missile. The ASMP, an air-to-surface medium-range cruise missile, delivers a 200-kiloton bomb over a standoff range of up to 160 nautical miles (300 kilometers). It uses a liquid-fuel ramjet engine with an integrated solid propellant booster rocket to reach speeds of Mach 2/Mach 3. Two warheads are used -- the TN-60 with Mirage-4P bombers, and the TN-81 with Mirage-2000N and Super Entendard strike fighters.

3. Submarines and Their Missiles.

France started building its *Le Redoubtable* class nuclear-powered, ballistic-missile submarines (SSBNs) during the 1960s. US President John Kennedy offered to sell Polaris missiles to France, as he did to Britain, but French President Charles de Gaulle preferred

to make his own. The lead ship, *Le Redoubtable*, became operational in December 1971. (By that time the United States had commissioned all 41 of its Polaris submarines, and was in the process of converting 31 of them to carry the new-generation Poseidon SLBMs.) Four more of the *Le Redoubtable* class followed -- *Le Tonnant*, *L'Indomptable*, *Le Terrible*, and *Le Foundroyant*. *L'Inflexible*, lead ship of a new class, brought the total to six. *Le Redoubtable* was retired at the end of 1991 so the total is presently five. The minimum number of submarines always at sea has been reduced from three to two.

The SSBN fleet is based at Brest and commanded from Houilles. They patrol in the Atlantic Ocean and the Norwegian and Mediterranean Seas. But they can fire from their home port and hit targets in Russia.

a. M-4 SLBMs.

The French Navy has 80 SLBMs deployed on its five submarines -- each submarine holds 16 of the three-stage M-4 SLBMs.

The M-4A SLBMs are fitted on the *L'Inflexible* and each carries six 150 kiloton MIRVed TN-70 warheads. Their range is 2,370-2,700 nautical miles (4,400-5,000 kilometers).

The M-4B SLBMs have been refitted on the four *Le Redoubtable* class submarines. They each carry six 150 kiloton MIRVed TN-71 warheads for a range of 2,700-3,240 nautical miles (5,000-6,000 kilometers).

b. M-45 SLBMs.

A version of the M-4 SLBM, designated M-45, started going into service, probably late in 1992. It uses the first and second stage from M-4 but has new electronics and reentry vehicles. It will probably carry six TN-75 MIRVed warheads for a range of 3,240 nautical miles (6,000 kilometers. It is scheduled to enter service in 1995 and will be on the entire French SLBM fleet by early in the next century.

B. FRANCE'S TACTICAL NUCLEAR WEAPONS

French tactical nuclear forces are composed of Hades short-range ballistic missiles (SRBMs) and ASMP missiles delivered by aircraft.

1. Hades SRBM.

The planned replacement for now-retired Pluton missiles were 120 slightly-longer-range Hades SRBMs, which would be mobile on the roads. But with the end of the Cold War that program was cancelled and the 30 missiles already produced are stored at Luneville. Hades was designed to carry the TN-90 warhead.

2. Super Etendard Strike Aircraft with ASMP Missiles.

ASMP missiles were described under strategic weapons above. 38 Super Etendard strike aircraft (plus 60 in storage) can each carry one ASMP missile. They are based on

the aircraft carriers *Clemenceau* (R98) and *Foch* (R99), which are home-ported at Toulon. Super Entendards have an unrefueled range of 810 nautical miles (1,500 kilometers) and fly at subsonic speeds. Only 20 Super Entendards are currently equipped to carry nuclear weapons.

C. FRANCE'S NUCLEAR MODERNIZATION PLANS

Like Britain, France's nuclear modernization plans address two types of missiles -- one launched from submarines and the other from airplanes. Unlike Britain, the SLBM can also be configured as an IRBM from land-based launchers.

1. M-5 SLBM/S-5 IRBM.

The M-5 SLBM is expected to enter into service around 2005. It will be able to carry twelve MIRVed TN-76 warheads which may have maneuvering and stealth characteristics. A more likely load, however, is 8 warheads. Its range could be as great as 5,900 nautical miles (11,000 kilometers). The development program for the M-5 is estimated to cost US$8.54 billion.

A land-based counterpart of the M-5, called the S-5, could be announced in 1995. It is assumed that the same launch tube would be used for both -- one in a submarine and the other in a silo or mobile launcher. However, it is also likely that new land-based missiles will not be pursued.

2. Le Triomphant *Class SSBNs.*

Four new missile-launching submarines are under construction. The lead ship, *Le Triomphant* is to be operational in 1995. The second is named *Le Temeraire*. They will displace 14,000 metric tons and will carry 16 missiles each. Initially they will be loaded with M-45 missiles fitted with improved penetration aids and lighter warheads. After the turn of the century, probably around 2005, they will start being backfitted with the new M-5 SLBM. Development and production of the four new submarines equipped with M-45 missiles is estimated at US$19.58 billion. All SSBNs except these four new ones will likely be retired shortly after the turn of the century.

3. Air-Sol Longue Portee (ASLP).

This is an air-to-surface long-range cruise missile with speeds up to Mach 3.5 to replace the ASMP. It increases the standoff range to 540-700 nautical miles (1,000-1300 kilometers). ASLP guidance will also be improved, it will have stealth characteristics to avoid detection by radar, and it will be maneuverable to evade interceptor missiles. Initial deployment is projected for 2005. Development costs are estimated at $5 Billion. Originally this was planned as a joint program with Britain. It put France in a financial bind when Britain cancelled out in late 1993.

4. Charles de Gaulle *Class Aircraft Carriers.*

The Charles de Gaulle is planned for operation in mid-1999. Decision to build a second carrier of this class at a cost of US$1.71 billion may be forthcoming in 1997. They will replace the *Clemenceau* and the *Foch.* Initially these new carriers will carry Super Entendards with ASMP as part of their compliment, but these will later be replaced with Rafale aircraft carrying ASLPs.

5. Rafale Strike Fighter.

Two versions are planned -- original numbers were 250 Rafale-C for the Air Force and 86 Rafale-M for the Navy. Some will be fitted with ASMP missiles but later backfitted with ASLP. First deliveries are expected in 1998 to replace the Navy crusader F-8Es. The Navy's Super Entendards will start being replaced in 2004, and Air Force deliveries will follow.

6. Palen Nuclear Test Simulation.

France is developing a computer simulation of nuclear testing (as is the US) which will make it unnecessary to conduct actual nuclear explosions to develop a new warhead. The name of this program is Palen. However, a few more nuclear tests are required to calibrate the computer model.

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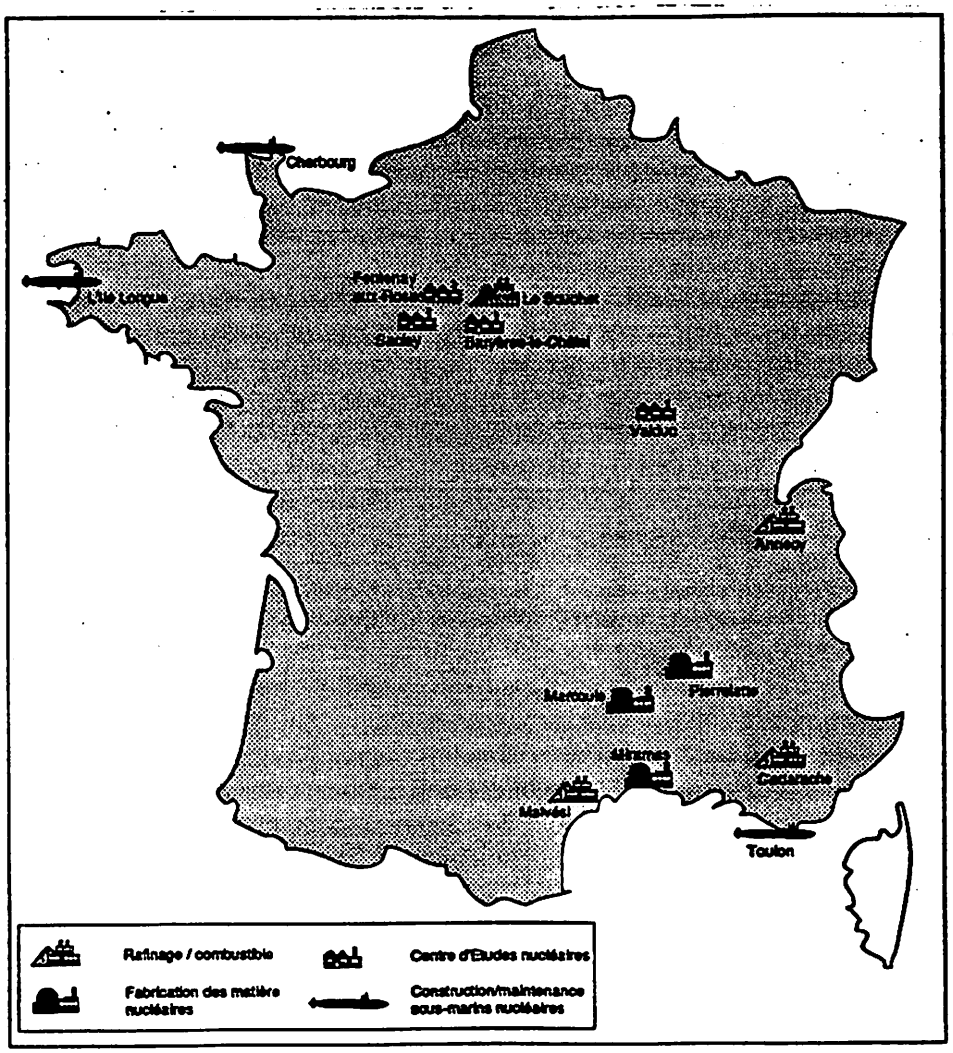

The principal French sites engaged in research on and manufacture of nuclear weapons

FIGURE 7.3-1
FRENCH NUCLEAR SITES
Source: *Democles in Brief*

7.4 NUCLEAR WEAPONS OF THE CIS

After the collapse of the Soviet Union, 11 of the 15 former republics formed the Commonwealth of Independent States (CIS). These newly-independent countries inherited the Soviet nuclear arsenal. Having a broad spectrum of strategic and tactical nuclear weapons, the inventory of the former USSR is not easy to define. And the location of these scattered weapons is even more difficult to determine. This chapter will be an attempt to give some idea of the situation which now exists in the CIS.

FIGURE 7.4-1
COMMONWEALTH OF INDEPENDENT STATES (CIS)
(Georgia is not a member of the CIS)
Source: *SJMN*

A. CIS STRATEGIC NUCLEAR WEAPONS

Like the US and France, the Soviets assembled a strategic triad of nuclear weapons launched from land, air and sea. The land leg was the strongest. Four of the CIS states inherited the strategic weapons -- Russia, Ukraine, Belarus (formerly Byelorussia), and Kazakhstan. Figure 7.4-2 depicts the distribution of strategic nuclear delivery vehicles (SNDVs) and warheads (w/h's) at the time the USSR broke up. They total to something like 2,402 SNDVs carrying some 10,053 warheads. Keep in mind that these are only deployed warheads. There are more bombs in the stockpile than are deployed.

FIGURE 7.4-2

DISTRIBUTION OF DEPLOYED SNDVs AND W/Hs IN THE CIS (JUNE 1992)

(Warheads Shown In Parentheses)

SNDV	QTY.IN RUSSIA	QTY. IN UKRAINE	QTY. IN BELARUS	QTY. IN KAZAKHSTAN	TOTAL EACH SNDV
SS-11 ICBM	280 (280)				280 (280)
SS-13 ICBM	40 (40)				40 (40)
SS-17 ICBM	40 (160)				40 (160)
SS-18 ICBM	204 (2040)			104 (1040)	308 (3080)
SS-19 ICBM	170 (1020)	130 (780)			300 (1800)
SS-24 ICBM	46 (460)	46 (460)			92 (920)
SS-25 ICBM	268 (268)		72 (72)		340 (340)
ICBM SUB-TOTAL	1048 (4268)	176 (1240)	72 (72)	104 (1040)	1400 (6620)
BLACKJACK BOMBER		20 (160)			20 (160)
BEAR B/G BOMBER	89 (89)				89 (89)
BEAR H BOMBER	7 (56)	14 (112)		40 (320)	61 (488)
BOMBER SUB-TOTAL	96 (145)	34 (272)		40 (320)	170 (737)
SS-N-6 SLBM	96 (96)				96 (96)
SS-N-8 SLBM	280 (280)				280 (280)
SS-N-18 SLBM	224 (672)				224 (672)
SS-N-20 SLBM	120 (1200)				120 (1200)
SS-N-23 SLBM	112 (448)				112 (448)
SLBM SUB-TOTAL	832 (2696)				832 (2696)
GRAND TOTAL	1976 (7109)	210 (1512)	72 (72)	144 (1360)	2402 (10053)

Source: *The Military Balance 1992-1993* for quantities, along with various other articles for distribution.

1. Land-Based ICBMs.

This section will be a more detailed description of each ICBM based in the CIS. As of June 1992, it had some 1,400 ICBMs carrying about 6,620 warheads. The SS-24 ICBM was replacing SS-17s, and the SS-25 was replacing SS-11s and SS-13s. Both of these new ICBMs were designed to be mobile (rail for the SS-24 and road for the SS-25) but many may have been deployed in fixed silos. Specifications for each type follow.

SS-11 Sego, Mods 2 & 3 ICBM

RANGE (nm):	7,000 (Mod 2); 5,700 (Mod 3)
NO. DEPLOYED:	280
RVs/MISSILE:	1 (Mod 2); 3 MRVs (Mod 3)
YIELD/RV (mt):	1.0 (Mod 2); 0.3 x 3 (Mod 3)
CEP (nm):	0.75 (Mod 2), 0.59 (Mod 3)
FUEL:	Liquid
IOC:	1973 (Mod 2); 1975 (Mod 3)

SS-13 Savage, Mod 2 ICBM

RANGE (nm):	5,000
NO. DEPLOYED:	40
RVs/MISSILE:	1
YIELD/RV (mt):	0.6
CEP (nm):	1.0
FUEL:	3 stage solid
LAUNCH:	Hot
IOC:	1968

SS-17 Spanker, Mods 3 & 4 ICBM

RANGE (nm):	5,400 (Mod 3)
NO. DEPLOYED:	40
RVs/MISSILE:	4 MIRVs
YIELD/RV (mt):	0.5 (Mod 3)
CEP (nm):	0.2 (Mod 3)
FUEL:	2 stage liquid
LAUNCH:	Cold
IOC:	1982 (Mod 3)

SS-18 Satan, Mod 4 ICBM

RANGE (nm):	5,900
NO. DEPLOYED:	308
RVs/MISSILE:	10 MIRVs
YIELD/RV (mt):	0.5
CEP (nm):	0.14
FUEL:	2 stage liquid
LAUNCH:	Cold
IOC:	1982

SS-19 Stiletto, Mod 3 ICBM

RANGE (nm):	5,400
NO. DEPLOYED:	300
RVs/MISSILE:	6 MIRVs
YIELD/RV (mt):	0.55
CEP (nm):	0.16
FUEL:	2 stage liquid
LAUNCH:	Hot
IOC:	1982

SS-24 Scalpel, Mods 1 & 2 ICBM

RANGE (nm):	5,400
NO. DEPLOYED:	56 in silos & 36 mobile
RVs/MISSILE:	10
YIELD/RV (mt):	0.1
CEP (nm):	0.1
FUEL:	Solid
LAUNCH:	Cold
IOC:	1987

SS-25 Sickle ICBM

RANGE (nm):	5,670
NO. DEPLOYED:	340
RVs/MISSILE:	1.0
YIELD/RV (mt):	0.75
CEP (nm):	0.1
FUEL:	Solid
LAUNCH:	Cold
IOC:	1985

2. Intercontinental Bombers.

Only two bombers left from the USSR are classified strategic because they are the only two with intercontinental range. Details on the bombers follow. For convenience, missiles and bombs will be described under tactical weapons.

TU-160 Blackjack Strategic Bomber.

RANGE (nm):	3,930
NO. DEPLOYED:	20
WEAPONS LOAD:	12 AS-15 ALCMs/24 AS-16 ALCMs
IOC:	1988
SPEED:	Mach 2.3
COMMENTS:	4 turbofan engines.

TU-95 Bear B/G Strategic Bomber.

RANGE (nm):	3,450
NO. DEPLOYED:	89
WEAPONS LOAD:	2 AS-4 ASMs/4 bombs
IOC:	1956
SPEED:	Mach 0.8
COMMENTS:	4 turbofan engines.

Tu-95 Bear H Strategic Bomber.

RANGE (nm):	3,720
NO. DEPLOYED:	61
WEAPONS LOAD:	10 AS-15 ALCMs,
IOC:	1984
SPEED:	Mach 0.8
COMMENTS:	4 turbofan engines.

3. Submarines and SLBMs.

This section will be a more detailed description of each SLBM based in the CIS. As of June 1992, the CIS had 55 strategic submarines loaded with 832 SLBMs carrying a total of some 2,696 warheads. All of these submarines are controlled by Russia. Before the USSR broke up, the SS-N-20 SLBM on Typhoon submarines and the SS-N-23 SLBM on Delta-4 submarines were replacing SS-N-6 SLBMs on Yankee-1 submarines. Specifications for each type follow.

SS-N-6 Serb, Mods 1, 2 & 3 SLBM

RANGE (nm):	1,300 (Mod-1); 1,600 (Mod-3)
NO. DEPLOYED:	96
RVs/MISSILE:	1 (Mod 1); 2 mrvs (Mod-3)
YIELD/RV (mt):	1.0 (Mod 1); 0.5 x 2 (Mod-3)
CEP (nm):	0.7
FUEL:	2 stage liquid
IOC:	1968 (Mod-1); 1974 (Mod-3)
DEPLOYMENT:	On 6 Yankee-1 submarines
COMMENT:	16 missiles per Yankee-1.

SS-N-8 Sawfly, Mods 1 & 2 SLBM

RANGE (nm):	4,200 (Mod-1); 4,900 (Mod-2)
NO. DEPLOYED:	280
RVs/MISSILE:	1
YIELD/RV (mt):	0.8 (Mod-1); 0.8 (Mod-2)
CEP (nm):	0.8 (Mod-1); 0.5 (Mod-2)
FUEL:	2 stage liquid
IOC:	1972 (Mod-1); 1973 (Mod-2)
DEPLOYMENT:	On 18 Delta-1 and 4 Delta-2 submarines
COMMENT:	12 missiles per Delta-1, 16 missiles per Delta-2.

SS-N-18 Stingray SLBM

RANGE (nm):	3,500 (Mods-1/3); 4,300 (Mod-2)
NO. DEPLOYED:	224
RVs/MISSILE:	3 MIRVs (Mods-1/3); 1 (Mod-2);
YIELD/RV (mt):	0.02 (Mods-1); 0.45 (Mod-2); 0.1 (Mod-3)
CEP (nm):	0.75 (Mod-1); 0.5 (Mods-2/3)
FUEL:	2 stage liquid
IOC:	1977 (Mods-1/2); 1978 Mod-3)
DEPLOYMENT:	On 14 Delta-3 submarines
COMMENT:	16 missiles per Delta-3.

SS-N-20 Sturgeon SLBM

RANGE (nm):	4,500
NO. DEPLOYED:	120
RVs/MISSILE:	10 MIRVs
YIELD/RV (mt):	0.1
CEP (nm):	0.25
FUEL:	Three stage solid
IOC:	1981
DEPLOYMENT:	On 6 Typhoon submarines
COMMENT:	20 missiles per Typhoon. Stellar Inertial guidance (SIG) for midcourse and terminal updates.

SS-N-23 Skiff SLBM

RANGE (nm):	4,500
NO. DEPLOYED:	112
RVs/MISSILE:	4 MIRVs
YIELD/RV (mt):	0.1
CEP (nm):	0.5
FUEL:	Three stage liquid
IOC:	1985
DEPLOYMENT:	On 7 Delta-4 submarines.
COMMENT:	16 missiles per Delta-4.

B. CIS TACTICAL NUCLEAR WEAPONS

Location of the tactical nuclear weapons the CIS inherited are harder for an observer to determine. Naval tactical nuclear weapons were distributed among three former

republics. Ground-force nuclear weapons were found in nine CIS states. And air-defense nuclear weapons were scattered among 12 former Soviet republics. All in all, some 3,000 of the CIS's tactical nuclear bombs lie outside Russia.

CIS leaders agreed to move all tactical nuclear weapons to Russia. Reports indicate that all theater nuclear weapons were moved to Russia by July 1992.

It will be assumed that weapons removal mandated by the INF Treaty has been completed, so land-based INF weapons will not be included.

Following is a listing of Russian tactical nuclear weapons as best they can be determined.

1. Air-to-Surface Missiles (ASMs).

AS-4 Kitchen ASM

NO. DEPLOYED:	1,000 estimated
IOC:	1962
YIELD:	1 megaton
RANGE (nm):	160
SPEED:	Mach 3.3
DEPLOYMENT:	Tu-22 Blinder, Tu-95 Bear-G, and Tu-26 Backfire.
PROPULSION:	Single stage liquid rocket.

AS-6 Kingfish ASM

NO. DEPLOYED:	820 estimated.
IOC:	1977
YIELD:	350 kilotons to 1 megaton
RANGE (nm):	160
SPEED:	Mach 3.0
DEPLOYMENT:	Tu-16 Badger
PROPULSION:	Single stage liquid rocket.

AS-15 Kent ALCM

NO. DEPLOYED:	300+ estimated
IOC:	1984
YIELD:	250 kilotons
RANGE (nm):	900
SPEED:	Mach 0.6
DEPLOYMENT:	Tu-95 Bear H, Tu-160 Blackjack, Tu-22M Backfire.
PROPULSION:	Turbojet

AS-16 Kickback ASM

NO. DEPLOYED:	Unknown
IOC:	1989
YIELD:	350 kilotons
RANGE (nm):	110
SPEED:	Unknown
DEPLOYMENT:	Unknown
PROPULSION:	Unknown

2. Anti-Ballistic Missiles (ABMs).

SH-08 Gazelle ABM

NO. DEPLOYED:	SH-08 + SH-11 = 100
IOC	1984
WARHEAD:	10 kiloton
RANGE:	Endo-atmospheric
DEPLOYMENT:	In silos around Moscow.
COMMENTS:	High acceleration/supersonic.

SH-11 Modified Galosh ABM

NO DEPLOYED:	SH-08 + SH-11 = 100
IOC	1983
WARHEAD:	Nuclear
RANGE:	Exo-atmospheric
DEPLOYMENT:	In silos around Moscow.

3. Anti-Aircraft Missiles.

SA-5 Gammon SAM

NO DEPLOYED:	1,800
IOC	1967
WARHEAD:	Dual capable
RANGE (nm):	160

SA-10 Grumble SAM

NO. DEPLOYED:	2,400
IOC	1981
WARHEAD:	Dual capable
RANGE (nm):	55

4. Surface-to-Surface Missiles (SSMs).

FROG-7 Luna SRBM

RANGE (nm):	40
NO. DEPLOYED:	300
YIELD:	200 kilotons
CEP (nm):	0.22
IOC:	1965
DEPLOYMENT:	Modernized wheel transporter.
PROPULSION:	Single stage rocket.

SS-1C Scud-D SRBM

RANGE (nm):	160
NO. DEPLOYED:	300
YIELD:	Kiloton range, dual capable
CEP (nm):	0.25
IOC:	1965
DEPLOYMENT:	Mobile
PROPULSION:	Two stage liquid rocket.

SS-21 Scarab SRBM

RANGE (nm):	65
NO. DEPLOYED:	300
YIELD:	100 kilotons
CEP (nm):	0.16
IOC:	1978
DEPLOYMENT:	Mobile
PROPULSION:	Two stage solid rocket.

SSC-1B Sepal GLCM

RANGE (nm):	250
NO. DEPLOYED:	40
YIELD:	350 kilotons
CEP	Unknown
IOC:	1962
DEPLOYMENT:	40 transporter/erector launchers
PROPULSION:	2 solid boosters, 1 air breathing sustainer.
COMMENTS:	Coast defense, nuclear doubtful

SS-N-3A/B Shaddock SLCM

RANGE (nm):	240
NO. DEPLOYED:	60
YIELD:	350 kilotons
IOC:	1962
DEPLOYMENT:	Echo-2 and Juliet submarines. Kynda and Kresta ships.
PROPULSION:	Cruise missile engine. Mach 0.9-1.4
COMMENTS:	Sub must surface to launch. Requires aircraft or satellite for midcourse guidance.

SS-N-7 Starbright SSM

RANGE (nm):	30
NO. DEPLOYED:	56 launchers
YIELD:	200 kilotons
IOC:	1968
DEPLOYMENT:	7 nuclear-powered submarines.
PROPULSION:	Single stage solid rocket.
COMMENTS:	Radar homing.

SS-N-9 Siren SSM

RANGE (nm):	60
NO. DEPLOYED:	256
YIELD:	200 kilotons
IOC:	1968/9
DEPLOYMENT:	5 submarines, 36 corvettes,
PROPULSION:	Single stage solid rocket Mach 1.4
COMMENTS:	Terminal infra red radar.

SS-N-12 Sandbox SSM

RANGE (nm):	300
NO. DEPLOYED:	164
YIELD:	350 kilotons
IOC:	1973
DEPLOYMENT:	4 carriers, 3 cruisers, 13 submarines.
PROPULSION:	Mach 2.5
COMMENTS:	Submarine must surface to launch. Aircraft/satellite guidance assist.

SS-N-19 Shipwreck SLCM

RANGE (nm):	300
NO. DEPLOYED:	288
YIELD:	500 kilotons
IOC:	1980
DEPLOYMENT:	9 submarines, 3 cruisers, 1 carrier
PROPULSION:	Supersonic
COMMENTS:	Anti-ship missile.

SS-N-21 Sampson SLCM

RANGE (nm):	1,620
NO. DEPLOYED:	104
YIELD:	200 kiloton
CEP	0.1
IOC:	1987
DEPLOYMENT:	14 submarines (Yankee-1, Akula, Sierra, and Mike).
PROPULSION:	Subsonic
COMMENTS:	Long-range, land-attack. Can be fired from submarine torpedo tubes.

SS-N-22 Sunburn SSM

RANGE (nm):	215
NO. DEPLOYED:	200
YIELD:	200 kilotons
IOC:	1981
DEPLOYMENT:	15 destroyers, 20 corvettes.
PROPULSION:	Unknown
COMMENTS:	Possibly an SS-N-9 improvement.

SS-NX-24 Sunburn SSM

RANGE (nm):	unknown
NO. DEPLOYED:	12
YIELD:	unknown
IOC:	None
DEPLOYMENT:	None
PROPULSION:	Unknown
COMMENTS:	In trials on submarine.

5. Artillery and Mortars.

152mm (6") Artillery Pieces

RANGE (nm):	10-15
NO. DEPLOYED:	2,100
YIELD:	2-5 kilotons, dual capable
IOC:	1955, 1972, 1978, 1980

203mm (8") Artillery Pieces

RANGE (nm):	10
NO. DEPLOYED:	240
YIELD:	2-5 kilotons, dual capable
IOC:	1975

240mm (9.45") Mortars

RANGE (nm):	7
NO. DEPLOYED:	120
YIELD:	Probably 1-5 kilotons, dual capable
IOC:	1975

6. Anti-Submarine Warfare (ASW) Weapons.

SS-N-14 Silex ASW Missile (ASROC type)

RANGE (nm):	30
NO. DEPLOYED:	306
YIELD:	1-5 kilotons
IOC:	1974
DEPLOYMENT:	26 cruisers, 32 frigates.
PROPULSION:	Unknown
COMMENTS:	Autopilot command override with acoustic homing torpedo.

SS-N-15 Starfish ASW Missile (SUBROC type)

RANGE (nm):	25
NO. DEPLOYED:	396 estimated
YIELD:	5 kilotons approximately
IOC:	1982
DEPLOYMENT:	35 submarines
PROPULSION:	Unknown
COMMENTS:	Launched from torpedo tube, reloadable.

SUW-N-1 (FRAS-1) ASW Missile (ASROC type)

RANGE (nm):	16
NO. DEPLOYED:	8
YIELD:	5 kilotons
IOC:	1975
DEPLOYMENT:	2 carriers, 2 cruisers
PROPULSION:	Unknown

Type 53-68 Heavyweight Torpedo

RANGE:	8
NO. DEPLOYED:	Unknown
YIELD:	20 kiloton
IOC:	1970
DEPLOYMENT:	Useable from all 533 mm torpedo tubes.

Type 65 Heavyweight Torpedo

RANGE:	27
NO. DEPLOYED:	Unknown
YIELD:	20 kiloton
IOC:	1981
DEPLOYMENT:	Useable from all 650 mm torpedo tubes.

Mines

NO. DEPLOYED:	Unknown
YIELD:	5-20 kiloton
IOC:	Unknown
COMMENT:	May be anti-ship as well as anti-submarine.

Depth Charges

NO. DEPLOYED:	Unknown
YIELD:	Unknown
IOC:	Unknown
COMMENT:	Known to exist, no details.

7. *Gravity Bombs.*

Strategic Bombs

NO. DEPLOYED:	Unknown
YIELD:	5, 20 & 50 megatons.

Tactical Bombs

NO. DEPLOYED:	Unknown
YIELD:	250 & 350 kilotons

* * * * *

ratification will be exchanged and the treaty will go into effect. Reductions must then take place within seven years.

Friction between Russia and Ukraine seems to spark the main threat to START. Because of concerns about Russia, the Ukranian legislature may not have enough votes to ratify the treaty. On 30 September 1992 the Ukrainian prime minister resigned and was succeeded by Leonid Kuchma. One month later Kuchma announced that Ukraine was unwilling to destroy its missile silos and turn the weapons over to Russia -- "As for the strategic weapons, we cannot give them up," he said. [*SJMN*, 1 November 1992, p. 7A] Kuchma said his country wanted to use the uranium in the weapons for nuclear power plants, and that destroying the silos would damage large areas of farmland. Ukraine leaders have shown interest in joining a defense alliance like NATO, or receiving a commitment from the US to insure Ukraine's security.

In a move to save the START Treaty, the US offered in November 1992 to pay the $100-150 million cost of destroying Ukranian nuclear weapons if that country ratifies the START Treaty. Senate Armed Services Committee Chairman Sam Nunn, after meeting with Ukranian President Leonid Kravchuk, said he believed the latter would stick to the plan of making Ukraine a nuclear-free state.

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7.5 NUCLEAR WEAPONS OF CHINA

The Peoples Republic of China (PRC) does not have a large number of nuclear delivery vehicles. What they do have seem to be classed either strategic or INF.

A. PRC STRATEGIC NUCLEAR WEAPONS

China operates strategic nuclear forces delivered by land and sea, and possibly by air.

1. Land-Based Missiles.

The land-based leg of the PRC strategic forces is composed of CSS-3 and CSS-4 ICBMs.

a. CSS-3 ICBMs. The liquid-fueled CSS-3 ICBMs are four-stage missiles with inertial guidance. Their range is 4,350 nautical miles (8,000 kilometers) with a single 3-megaton warhead. They are based in caves and rolled out prior to launching. Twenty have been deployed since 1980.

b. CSS-4 ICBMs. The liquid-fueled CSS-4 ICBMs are four-stage missiles with inertial guidance. They are silo-based. Their range is 6,200 nautical miles (11,490 kilometers) with a single 5-megaton warhead. They have been tested with MIRVs. Four have been deployed since 1981..

2. Sea-Based Missiles.

The PRC's sea-based strategic missiles are carried on one Xia-class, nuclear-powered submarine commissioned in 1988. Possibly a second SSBN of an improved class has also entered service. They each carry twelve CSS-N-3 missiles. China's SSBN construction has been proceeding extremely slowly because of problems with submarine reactor design and solid rocket fuel for the missiles. Some sources say that China plans as many as 12 SSBNs. [*Japan Times*, 27 December 1993]

a. CSS-N-3 SLBMs. The solid-fueled CSS-N-3 SLBMs are submarine-launched and have a range of 1,450 nautical miles (2,587 kilometers) with a single 250-kiloton warhead. An improved, solid-fuel SLBM with longer range may be deployed in the late 1990s.

3. Hong-7 Bombers.

A strategic Hong-7 bomber first flew in 1988 and they could be starting deployment in 1994.

B. PRC TACTICAL NUCLEAR WEAPONS

Tactical missiles of the PRC are launched from land, although it is possible that some could be launched at sea or from aircraft.

1. Land-Based Weapons.

The land-based missiles are the CSS-2 and CSS-6 IRBMs, classified as INF weapons.

a. **CSS-2 IRBMs.** The liquid-fueled CSS-2 IRBMs have an inertial guidance system and a range of 1,550 nautical miles (2,872 kilometers) with a single 2-megaton warhead. They are rolled out from a cave before being launched. Fifty have been deployed since 1971.

b. **CSS-6 IRBMs.** The solid-fueled CSS-6 IRBMs have an inertial guidance system and a range of 970 nautical miles (1,800 kilometers) with a single 250-kiloton warhead. They are mobile. Thirty six have been deployed since 1986.

2. Sea-Based Weapons.

There is one Soviet-built *Golf* submarine which the PRC Navy acquired in the 1960s. It can carry three missiles but the type is not known. This vessel may only be used for ICBM sea trials.

3. Hong-6 Bombers.

Up to 120 medium-range (1,670 nautical miles or 3,100 kilometers) Hong-6 bombers are deployed. They could carry two or three nuclear bombs.

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7.6 PROLIFERATION OF NUCLEAR WEAPONS

Now that the US and CIS seem to be taking steps to implement Article 6 of the NPT -- the "good faith clause" in which Washington and Moscow promised to negotiate an end to their arms race -- some aspiring nuclear states may feel less threatened. Others, however, have their own reasons for obtaining "the bomb."

Aspiring nuclear powers are usually competitively opposed to other aspiring nuclear powers, which is their excuse for being aspiring nuclear powers in the first place. These dangerous ideological-political-geographical confrontations could spark a nuclear war. Such countries are not deterred by any sophisticated nuclear arsenal -- superpower or otherwise.

To understand nuclear technology, it would be helpful to know that uranium bombs are the easiest to build although they are large, heavy and expensive. They are so simple they are guaranteed to work without testing. Many scientifically immature countries such as Iraq, Pakistan and South Africa were able to construct uranium bombs. China's first bomb was uranium. A large supply of uranium bombs also appear in the former Soviet Union's arsenal. Plutonium bombs, on the other hand, are more difficult to build, but once the technique is mastered the bomb can be better tailored for many needs, and they are cheaper. Plutonium bombs can be miniaturized in size and tuned to lower yields. It is interesting to note that all bombs except one that are currently in the US arsenal have a plutonium primary. That one exception is the W-33 warhead for 8-inch artillery, and a recent GAO report states that all of them have now been removed from the stockpile and disassembled. [GAO/RCED-94-9, p. 16] With that information in mind it is easier to understand the various nuances of nuclear weapons proliferation.

A. THE MID-EAST

One of the most volatile spots in the world is the Mid-East. Not only is Israel squared off against some nationalistic Arab nations, but fundamentalist Muslim states threaten their secular muslim counterparts.

1. Israel.

Israel has not signed the NPT so there is no legal restriction on that country's nuclear activities. Its nuclear program dates back to the late 1940s, from as long as Israel has existed. As early as 1947 it was discovered that recoverable traces of uranium existed in the Negev Desert.

Much of the information below is paraphrased from Seymour Hersh's *The Samson Option*, an excellent history of how the Israelis developed their nuclear arsenal and how the US was bribed and blackmailed to look the other way.

a. Israel's Nuclear Beginning. Israel's Atomic Energy Commission was established in 1952, under the military and unknown to the public. In 1955, under the Eisenhower's "Atoms for Peace" program, the Israelis obtained a small research reactor. It was installed at Nahal Soreq, south of Tel Aviv. But it was too small to produce enough plutonium for a bomb and too closely monitored for bomb-making activities to take place.

France and Israel agreed in 1953 to help each other in nuclear research. France was then striving to become a nuclear power. Israeli scientists worked closely with the French in designing the French bomb. They helped France build its elaborate reprocessing plant for plutonium. They also showed France a means they developed to make heavy water and better ways to mine uranium.

In return the French, starting in early 1958, helped Israel build its Dimona complex in the Negev Desert. France supplied an EL_{102} reactor and helped construct a reprocessing facility buried 40 meters (130 feet) below the surface. U-2 spy planes monitored this activity but the US did nothing to stop it.

Israeli scientists were trained at French plants and observed the first French nuclear explosion in February 1960. Later, Israel constructed a nuclear weapons assembly plant at Haifa, to the north, and heavily-fortified nuclear storage bunkers at its Tel Nof fighter base near Rehovot. Since there was so much internal opposition to an Israeli bomb, most of the work was accomplished by private funding from Jews living abroad.

b. The Yom Kippur War. By 1973 Israel had at least 20 nuclear weapons. Three or more missile launchers had been operationalized at Hirbat Zachariah and there were some mobile Jericho-1 missiles. A squadron of nuclear-capable F-4 fighter aircraft was in underground bunkers at Tel Nof Air Force Base near Rehovot. Data from US KH-11 spy satellites was shared with the Israelis and helped them to target their weapons. According to Seymour Hersh, US policy toward this amassing of Israeli nuclear weapons was "a conscious policy of ignoring reality." [Hersh, p. 319]

Egypt and Syria launched a surprise attack against Israel on 6 October 1973 -- on Yom Kippur, the most sacred day on the Jewish calendar. It took Israel three days to fully mobilize. On October 8th Israel called its first nuclear alert. All completed nuclear missile launchers at Hirbat Zachariah were armed. Eight of the special F-4s at Tel Nof Air Force Base were put on 24-hour alert. Initial targets included the Syrian and Egyptian military headquarters. Israel blackmailed the US for conventional arms replacement rather than escalate to nuclear.

At this time Dimona had mastered the miniaturization of nuclear bombs to fit into 175-mm and 203-mm artillery shells. After the Yom Kippur war, Israel formed at least three battalions of nuclear-capable artillery. Each battalion eventually contained a dozen 175-mm artillery pieces with three nuclear shells apiece. The 203-mm pieces were later introduced.

c. The South African Connection. On Saturday, 22 September 1979, a US Vela satellite passing over the southern Indian Ocean picked up the double-flash of a

nuclear explosion. At least two Israeli naval ships had sailed to that area previously. Israeli experts as well as South African scientists observed what is believed to be the third test of a low-yield nuclear artillery shell for the Israeli Defense Force. According to Seymour Hersh, Israel "signed an agreement before the 1979 test calling for the sale to South Africa of technology and equipment needed for the manufacture of low-yield 175-mm and 203-mm nuclear artillery shells." [Hersh, p. 276]

d. The Sixth Nuclear Power. Mordical Vannunu exposed the Israeli nuclear program in a 5 October 1986 London *Sunday Times* article, complete with photographs. Vannunu, a nuclear technician for nine years at the Dimona plant, indicated that Israel was producing about ten nuclear weapons a year, and had already stockpiled possibly 200.

Vannunu was kidnapped in Rome and taken back to Israel to stand trial for "collection and delivery of secret information, with the intent to impair the security of the state, and acts calculated to assist an enemy in war against Israel." [Farinella] He was convicted and sentenced to 18 years in prison. Vannunu stated before his abduction that, although he broke Israeli law, his was an act of conscience intended to serve the interests of Israeli democracy and world peace by bringing public knowledge and debate to bear on Israel's entry into the nuclear weapons club. Israel has never attempted to impeach Vannunu's integrity.

e. Israel's Present Nuclear Arsenal. Israel has steadily progressed as a nuclear-weapons state. Nuclear land mines were put in place in the Golan heights during the early 1980s. By the mid-1980s Dimona had made hundreds of low-yield neutron bombs. In September 1988 Israel put its first satellite into orbit as a step toward gathering its own intelligence. Israel can also produce lithium deuteride for thermonuclear hydrogen weapons and is negotiating for a waiver from US laws and international agreements so it can obtain extremely powerful computer technology. Israeli scientists are working at the cutting edge of nuclear technology and are involved with intensive research into the next generation of weaponry.

A Russian intelligence report asserts that Israel also has a store of chemical weapons. "At the present time Israel is capable of producing toxic substances of all types, including nerve-paralyzing, blister-producing and temporarily-incapacitating substances," said the report. [*AW&ST*, 8 November 1993, p. 29]

f. Israel's Delivery Systems. Israel is also improving the delivery systems for nuclear warheads. Air delivery could be made by a number of aircraft, including US-furnished fighters -- 112 F-4E, 51 F-15, and 145 F-16 aircraft. Another 25 longer-range and more-modern F-15I fighters are on order. These newer versions will be able to reach Iran and Libya. Even the F-15s sold to Saudi Arabia do not have the sophisticated radar and other systems that the F-15Is have.

Missiles for nuclear delivery are some 50 Jericho-1 SRBMs (250 nautical miles range), 50 Jericho-2 IRBMs (800 nautical miles range), and over 100 US-furnished Lance

missiles (62 nautical miles range). Some analysts believe the Lance missiles are in storage and that Jericho-1 missiles are being retired since Jericho-2s started becoming operational in 1989. During the 1991 war against Iraq, Israel moved mobile nuclear missile launchers into positions to target Iraq. A full-scale nuclear alert lasted for weeks.

2. Iraq.

Iraq is an Islamic Arab nation with a secular government under the firm control of Saddam Hussein. The orthodox Sunni (Sunnite) Muslims are slightly outnumbered by fundamentalist Shia (Shiite) Muslims. The latter, along with the Kurdish population, are kept repressed to prevent a fundamentalist upheaval of government, as happened in Iran. Saddam Hussein has encouraged a fierce Arab nationalism to (1) oppose Israel's expulsion of Palestinian Arabs in order to create a Jewish home state (Zionism), (2) to repress Iran's efforts to convert Iraq to a fundamentalist Muslim state, and (3) to win the centuries-old feud with Persian Iran over control of the Shatt-al-Arab River which is now Iraq's only access to the sea since the British carved Kuwait from Iraq. This is a simplified description but it illustrates the many facets which motivate Iraq to become more powerful.

a. The Futile Grasp for a Plutonium Bomb. In December 1959 ten Iraqi students started a four-year nuclear-physics course in Moscow. A year later an agreement was signed for the Soviet government to construct a small IRT-2000 research reactor at Tuwaitha, about twelve miles southeast of Baghdad. In the meantime, gifted Iraqi students were also enrolling in Western universities to study nuclear science. The Soviet 2-megawatt reactor was completed on 6 January 1968 and was eventually upgraded to 5-megawatts. But that was still too slow for a crash nuclear program and Soviet surveillance made the accumulation of plutonium from such a program impossible.

In 1969 Iraq ratified the NPT, making its nuclear activities subject to International Atomic Energy Agency (IAEA) inspections. This made Iraq look less-ominous in its pursuit of the atom. Saddam knew that he need only give three months notice to withdraw from the treaty after the reactor and high-grade uranium fuel had been obtained.

Following the 1967 Arab-Israeli Six-Day War it became obvious that Israel was fast approaching a nuclear capability. This put new urgency behind Iraq's program. France was the most receptive to Iraq's courtship, with oil as a dowry. In December 1974 French Premier Jacques Chirac accepted then Vice President Saddam's invitation to Baghdad. There followed a series of closely-guarded secret negotiations in which Saddam got everything he wanted. The Osiris material-test reactor -- named after the ancient Egyptian god of hell and death -- surfaced as the only one available with the capacity for plutonium production suitable for an atomic bomb program. Construction began near Tuwaitha after the final agreement was signed in August 1976. Completion of this dual reactor, called Osirak, was slated for 1981. [For a well-written description of how this program evolved, and the secrecy surrounding it, see Nakdimon in the bibliography.]

Immediately after the deal with France was finalized, Saddam started negotiations with Italy to obtain "hot cell" laboratories for extract weapons-grade plutonium. They played an important function in allowing Iraq to accommodate IAEA inspections. With several weeks notice, Iraq could move all evidence of bomb-making from the reactor site to the hot cell laboratory. By some quirk, such laboratories escaped inspection requirements.

In a surprise attack on 7 June 1981, using 14 US-made F-15 and F-16 aircraft, Israel bombed the nearly-complete Osirak reactor. Israel contended that the French-supplied plant was to produce atomic bombs for use against Israel. Many nations denounced this act but took no stronger measures against Israel, a US ally. The UN Security Council added its condemnation on June 19th. After the attack Saddam dispersed his nuclear-research facilities throughout the country and fortified them.

Destruction of the Osirak reactor set Iraq back. It appears that Osirak was never rebuilt. According to a LLNL scientist, Iraqi weapons scientists began giving more attention to developing the technology for extracting weapons-grade Uranium-235 from Iraq's natural uranium supply, and from what had already been stockpiled for reactor fuel. [DeWitt, p. 6]

b. Iraq's Helpers. The *Washington Post* reported on 5 May 1989 that the US Commerce Department had stopped an Iraq-bound shipment from CVC Products, Inc. of Rochester, New York of vacuum tubes which could be used in the production of nuclear fuel. CONSARC, a New Jersey company, wanted to ship high-temperature furnaces to Iraq to melt the zirconium used to clad nuclear fuel rods, but the White House stopped it. US and British officials in late-March 1990 broke up a smuggling ring by which Iraq could obtain US-made electronic devices to trigger nuclear bombs. A British company, Euromac, Inc. with offices just outside London, was involved. Euromac in September 1988 had contacted CSI Technologies, Inc. of San Marcos, California about purchasing custom-made capacitors. CSI became wary when the specifications were exactly as required for atom bomb triggers, and informed customs officials.

According to the *Financial Times*, Euromac is part of a wide network of shadowy front companies in Europe set up for the purpose of obtaining sensitive Western technology for Iraq's various nuclear/chemical/biological programs. This network was supposed to have been funded by $1 billion of the $2.867 billion in unauthorized loans to Iraq by the Atlanta, Georgia branch of Banca Nationale de Lavoro (BNL -- Italy's largest state-owned bank).

Hewlett Packard in 1985-86 sold computers to a German company but allegedly knew the ultimate destination was Iraq. Hewlett Packard also sold some computer equipment directly to Iraq. Tektronix of Beaverton, Oregon, sold graphics design terminals and other equipment to Iraq.

Iraq also owns part interest in a Swiss company which is suspected of having shipped to Baghdad parts which can be used for processing nuclear materials. At least four locations are pursuing plutonium extraction and/or uranium enrichment. Iraq is a striking example that ratifying the NPT and agreeing to international inspections is not assurance that the country is not seeking the nuclear bomb.

c. Iraq's Delivery Systems. During the 1980s when Iraq was at war with Iran, French aircraft were sold to Baghdad. In February 1981 the first four of 60 Mirage fighter-bombers were delivered. In June 1983, France agreed to sell Super Entendard jet bombers to Iraq. Five Super Entendards arrived the following October. These aircraft could deliver nuclear bombs. But missiles are also in the works.

Scud missiles, with a range of 160 nautical miles, were supplied by Moscow. These could likewise be mounted on trucks. In mid-August 1989 an explosion leveled a secret Iraqi military plant at Hilla, about 60 miles south of Baghdad. The British *Independent* reported that the plant was engaged in research to extend the range of Iraq's missiles. Iraq was receiving sensitive missile technology information from West Germany, France and Italy through a sly network of European front companies. With this help, Iraq increased the Scud missile's range to 270 nautical miles, enough to reach any capital city in the Mid-East.

A US House of Representatives panel was told during September 1989 that Egypt had ended participation with Iraq and Argentina in the effort to build a medium-range missile based on Argentina's Condor-2, and that Iraq had intentions of fitting it with nuclear or chemical warheads. Although it would have a range of 750 miles, accuracy is only claimed at 250 miles or less. Two American rocket scientists were sentenced to prison on 5 December 1989 for conspiring to smuggle sensitive information to Egypt which would help the Condor-2 missile program with Iraq.

Technology and Development Group (TDG) near London, an Iraqi front company, through its subsidiary, Matrix Churchill in Coventry north of London, received a $16 million loan commitment from BNL to supply precision lathes and other equipment to support Iraq's Condor-2 missile program. Due to US bureaucratic bungling the letters of credit were not stopped.

On 7 December 1989, Iraq announced that two days earlier it had launched a three-stage, 48-ton rocket which could put a satellite into orbit, making it the first Arab country capable of such a feat. This missile, named *Tammuz*, was launched from a space research center in Anbar province, west of Baghdad, and could also be used as a long-range ballistic missile. Iraq claimed it had developed two new surface-to-surface missiles with a range of 1,240 miles.

In April 1990, Saddam threatened to wipe out half of Israel with chemical weapons if it tried another attack on Iraqi facilities. According to the *New York Times* on 29 March 1990, Iraq had for the first time built fixed launchers for its missiles within ranges of the capitals of Israel (Tel Aviv) and Syria (Damascus).

In mid-1990 there was a request to ship a US supercomputer to a Brazilian team helping Iraq with its ballistic-missile program, and which could also be used in Iraq's nuclear program.

Lindberg Heat Treating Company of Chicago in September 1990 had Commerce Department approval to ship seven rocket motor case sections to Brazil, although Brazil was still helping on Iraq's missile program.

Contributing to the accuracy of Iraq's missiles, including the extended-range versions of the Soviet-supplied Scud missiles, were imaging enhancement systems to

analyze satellite photos and determine targets, obtained from International Imaging Systems of Milpitas, California. The company admits furnishing such systems, purportedly for civilian use, in 1981 and 1987.

d. Iraq Today. Since the 1991 Persian Gulf war, Saddam Hussein has played a cat and mouse game with IAEA inspectors attempting to make certain that Iraq is not pursuing a nuclear capability. But in 1993 his attitude seemed to change as the embargo against Iraqi oil, started to take its toll. In April of that year Saddam agreed that the last of its weapons-grade uranium could be removed by the United Nations. In November Iraq agreed to allow UN monitoring of its industries on a long-term basis to assure it isn't developing weapons of mass destruction. Immediately after that agreement, Saddam called for a lifting of the oil embargo. Perhaps the UN Security Council will do that if a third of the revenues earned go toward paying Iraq's war debts and the other two-thirds is used for humanitarian purposes. But Saddam will first have to demonstrate his sincerity, and that may take time.

3. Iran.

Iran is a Persian nation with a fundamentalist (Shiite) Muslim government. It has tried to spread its fundamentalist politics, especially in Iraq. Iran and Iraq have for decades battled over their border region and access to the Persian Gulf. Since the Iranian revolution Iraq, with a secular government of hegemonistic ambitions, has been resisting the spread of Muslim fundamentalism. The two nations fought a long war during the 1980s, primarily over that issue. Becoming a nuclear state will greatly aggravate relations with Iraq. And more, it will irritate Pakistan to the east which is believed to already possess nuclear bombs.

a. Iran's Nuclear Quest. Iran has been working through a huge network of foreign suppliers in its nuclear program. In early 1992 the US was able to block Iran's purchase of a large research reactor from China and a nuclear fuel reprocessing plant from Argentina -- a suspicious combination. But in 1993 Russia and China agreed to supply Iran with two nuclear reactors each. In late 1993 Iran was negotiating with the Czech Republic regarding nuclear technology, ostensibly for peaceful purposes. Iran has pledged to submit to international safeguards, but since IAEA inspections are scheduled in advance evidence of bomb making could be transferred to a reprocessing plant prior to the visit.

In March 1992, when former Soviet battlefield nuclear weapons were being transferred to Russia, there were unconfirmed media reports that two or three tactical weapons may be missing in Kazakhstan. During the following October, an Associated Press dispatch said that Iran had finalized a deal with Kazakhstan in July to buy four nuclear warheads. Of course the parties concerned denied the allegations, but the source had provided accurate information in the past.

Nevertheless, it is feared that Iran will produce a nuclear bomb by the end of the 1990s. Iran ratified the NPT in 1970, one year after Iraq, but could easily withdraw on short notice. As Iraq and North Korea have demonstrated, being a signatory to the NPT

legitimizes and even facilitates the production of nuclear weapons material. Iran already has a stockpile of chemical weapons.

b. Acquiring the Delivery System. For delivery vehicles Iran has received modern Backfire bombers from Russia, with a combat radius of over 2,000 nautical miles, as well as some 20 Su-24 Fencer deep strike aircraft. In March 1994 Iran was negotiating with China to buy Jian Hong-7 fighter bombers. These aircraft can fly long-range precision attack day or night in all weather.

In 1991 North Korea sold several dozen 300-mile-range Scud-B missiles to Iran, and another shipment destined for Syria may have been diverted to Iran. Iran also wants to buy North Korea's longer-range Rodong-1 missiles which could reach Israel. So far North Korea has resisted that sale, but may be holding out for trade in oil.

Iran has also fielded cruise missiles accurate enough to threaten US naval forces. Russia and Ukraine are becoming more willing to sell missile technology prohibited by the Missile Technology Control Regime which bans the sale of missiles with greater than 190 miles range. [*AW&ST*, 1 March 1993, p. 25]

Iran's missile technology has been slowed recently because it lacks skilled workers, science-intensive technology, scarce materials, and sufficient funding. In mid-1993 the US asked the European Union (formerly European Community) to curtail trade with Iran to prevent the sale of weapons. Belgium, Luxembourg, Britain, France, Germany, Greece, Netherlands, Spain, and Italy had all done significant business with Iran. Denmark, Ireland and Portugal had done so on a smaller scale. Nevertheless, there is no sign that Iran is being prevented from pursuing a buildup of both conventional armaments and weapons of mass destruction.

4. Nuclear Delivery Capability.

Several Mid-East countries have recently obtained ballistic missiles and aircraft which could be used to deliver nuclear, chemical or biological warheads. These countries may not be actively pursuing the nuclear bomb but if Iraq or Iran obtain nuclear weapons the picture could change.

a. Saudi Arabia. It became known in March 1988 that Saudi Arabia had obtained from China the CSS-2 IRBMs (also known as the DF-3) which have an inertial guidance system and a range of 1,550 nautical miles. These are now the longest-range ballistic missiles in the Mid-East. Saudi Arabia has also assembled a large inventory of F-15 fighter aircraft from the US, which can deliver weapons of mass destruction. Another $9-billion deal is pending for an additional 72 F-15 fighters. Saudi Arabia is not a party to the NPT.

b. Syria. Syria is also acquiring ballistic missiles which could deliver weapons of mass destruction -- nuclear, chemical or biological. It has purchased Scud missiles from North Korea and has tested one. Syria ratified the NPT in 1969. Syria is

one of 26 nations on the list of countries involved in international drug trade, and cannot receive US aid or US support for World Bank loans.

B. INDIA AND PAKISTAN

India and Pakistan have had strained relations since the 1948 partitioning of India, when Pakistan was established. Disputes have had ethnic-religious overtones but the bottom line is borders and territory -- especially in the Kashmir region. Enmity was heightened in 1971 when India stepped in with military force to help the liberation of Bangladesh (formerly East Pakistan).

Now the competition has turned to a nuclear standoff. In May of 1990 India and Pakistan faced off on the verge of a nuclear exchange. The crisis was defused by the Bush administration but kept from Congress and the American public because of high-tech sales to Pakistan. [See Hersh, "On The Nuclear Edge."] The next time they go to war over the Kashmir, it might very well be nuclear.

1. India.

During border clashes with China in 1962, India fared poorly. When China conducted its first nuclear test in 1994, the balance of military force shifted unmistakenly in China's favor. India decided that an accelerated nuclear program was justified. Although Pakistan was a hostile threat at that time, it was China that first motivated India's nuclear program.

a. India's Bomb Program. India purchased a nuclear reactor from Canada, and thus provided a case example of how a civilian nuclear power program can divert spent reactor fuel to a chemical reprocessing plant to make a nuclear weapon. The first Indian nuclear test was ordered in 1973, and that country exploded a 12-kiloton atom bomb underground at Pokaran in the Rajasthan Desert on 18 May 1974. It was advertised as a peaceful use for nuclear explosives -- a futile attempt to stimulate water resources -- but it served notice to both China and Pakistan that India had the bomb. India than ostensibly abandoned its nuclear weapons program but threatened to restart it if Pakistan appears near to developing such weapons.

Nevertheless, India's nuclear technology reached the point in 1985 where it could produce plutonium at domestic sites free from outside inspection. By 1985 it had tons of plutonium stored without IAEA safeguards. India has not signed the NPT because it exempts from controls those countries already possessing the bomb. This plutonium storage caused international concern regarding illicit sales or acquisition by terrorists.

Pressure continued to mount in parliament for India to resume its nuclear bomb program. Then in 1985 the New Delhi government announced that its new reactor near Bombay could produce weapons-grade plutonium -- possibly enough for ten bombs. "This is a landmark in the country's atomic energy program," said then Chairman Raja Ramanna of India's Atomic Energy Commission. [*SJMN*, 9 August 1992, p. 18A]

India's current nuclear capability is as follows:

-- The Cirus and Dhruva reactors can theoretically produce more than 30 kilograms of weapons-grade plutonium per year; enough for four fission bombs. Other civilian reactors also produce plutonium.

-- It was estimated in mid-1992 that India's stockpile of weapons-grade plutonium exceeded 300 kilograms; enough for forty or fifty atom bombs.

-- Uranium enrichment has also begun at two gas centrifuge plants but the capacity is still very low.

-- Research work at Bhabha Atomic Research Centre appears to be addressing fission for thermonuclear (hydrogen) bombs.

b. India's Delivery Systems. To compliment its nuclear program, India has also amassed the means of delivering weapons of mass destruction. It has tested the Agni intermediate-range ballistic missile (IRBM) that will carry a one-ton warhead 2,500 kilometers (1,350 nautical miles). The Agni can reach targets in China, Saudi Arabia, and Iran, as well as Pakistan. On 23 May 1989 the two-stage Agni missile was launched from the new Balasore Test Center in eastern India. It was apparently a failure. A second test was conducted three years later, on 29 May 1992. The third (second successful) test was conducted against a sea-based target in the Bay of Bengal on 19 February 1994. West German cooperation in India's space program is suspected to have helped develop this missile. The launches are interpreted as a sign that India intends to assert its military dominance in the region.

India also has a tactical short-range ballistic missile (SRBM) called Prithvi which is nuclear-capable and can reach out for 250 kilometers (135 nautical miles) with a one-ton payload. It a highly-mobile, single-stage weapon with an accuracy of 250 meters (820 feet). The tenth test of Prithvi took place on 7 February 1993.

Besides missiles, the Indian Air Force also has both Soviet- and French-made aircraft capable of delivering nuclear bombs. They include Jaguar-IS strike aircraft along with Mirage-2000 and MiG-29 fighters.

Other events are causing concern for India. China is embarked on an ambitious military modernization program, including the purchase of modern fighter planes from Russia. Military cooperation between Pakistan and China was signaled when China allegedly sold Pakistan road-mobile M-11 missiles capable of carrying a nuclear warhead for 185 miles. And a 23 March 1994 report from India's defense ministry called for a complete reassessment of the regional threat because the quantity and sophistication of arms being acquired by Pakistan are beyond legitimate defense needs. The report also warned against the sale of F-16 fighter planes to Pakistan by the US.

2. Pakistan.

Pakistan is another country with civilian nuclear reactors and a bomb program. Zulfikar Ali Bhutto launched Pakistan's nuclear weapons program in 1972, thereby creating another action-reaction cycle with India. After India exploded its bomb in 1974,

the Pakistani leader said his people would eat grass before they let the Indians get ahead. Pakistan is not a signatory to the NPT.

a. Pakistan's Bomb Program. The 1973 oil "crisis" sparked a flow in cash in the Mid-East and countries such as Libya were willing to finance Pakistan's endeavor. Rising oil prices also created a boom in nuclear power stations, and enterprising countries started a uranium shortage scare to promote plutonium reprocessing plants. The extracted plutonium could be used for power plant fuel or for bombs. Pakistan ordered such a plant from France in 1975. In 1977 the US confronted France with evidence of Pakistan's intent and the sale was quietly cancelled.

Meanwhile, Pakistani scientists working at the Netherlands' Urenco plant -- a British-Dutch-German consortium -- stole plans for the gas-centrifuge enrichment of uranium. Pakistan then built a similar facility at Kahuta, about 12 miles southeast of Islamabad. Pakistan then engaged in a clandestine program of obtaining critical equipment from abroad. When it became evident that Pakistan was producing weapons-grade uranium, the US Carter administration cut off aid in 1979, but the levels of aid were too small to have much effect. When the US needed Pakistani help in getting weapons and supplies to Soviet-occupied Afghanistan, Congress in 1981 passed a $3.2 billion economic and military assistance package for Pakistan. The rules were changed that aid would be cancelled if Pakistan developed a nuclear bomb. In effect, the US had turned its back on developing such weapons. By 1984 the Kahuta plant was operating.

In late 1986, US President Ronald Reagan certified to Congress that Pakistan did not have nuclear weapons. There is evidence, however that Pakistan was well along the way toward achieving that goal. A leaked Defense Intelligence Agency report that same year said Pakistan detonated its second high-explosive test during September 1986 as part of its continuing effort to develop an implosion trigger for a fission bomb. Intelligence reports also showed that Pakistan had enriched plutonium above the 90 percent needed for a bomb.

Although Pakistan's main effort so far appears to be on the simpler uranium bombs, it apparently has not given up on graduating to the higher technology of plutonium devices. On 31 December 1991, China announced that it was selling Pakistan a 300-megawatt nuclear reactor but that it would be subject to safeguards and inspection by the IAEA. But Pakistani Foreign Secretary Shahryar Khan said on 6 February 1992 that his country has the components and expertise to assemble a nuclear bomb -- the first time an official had publicly revealed the status of Pakistan's nuclear program.

Retired Pakistani Army Chief of Staff Mirza Aslam Beg revealed in July 1993 that his country's first successful nuclear test was conducted in 1987. Pakistan's industrial enriching plant now has the capacity to produce enough highly-enriched uranium to make 12 nuclear bombs a year. With the Iranian threat from the west as well as friction with India over the Kashmir to the east, there is no motivation for Pakistan's to slow its bomb-making effort.

b. Pakistan's Delivery Systems. Pakistan tested a ballistic missile on 25 April 1988 in its southern Thar Desert. The missile had the range to reach Bombay or New Delhi in India. It was designed by Pakistan but with help from the Chinese. Pakistan tested two more short-range missiles in January 1989.

In early May 1993, US officials alluded to reports and other indications that China might be shipping road-mobile M-11 SRBMs with spare parts to Pakistan. China rebutted that it was not violating its promise to stop selling delivery systems for mass destruction.

In October 1990, US President Bush could not certify that Pakistan does not have an atomic bomb. Some $564 million in new military and economic aid was cancelled along with $2.7 billion in previously-authorized military aid and sales, including 71 F-16 fighter jets. But that cancellation did not occur before the US provided its staunch ally during the Afghanistan war with $4 billion in aid, including delivery of 40 F-16 fighters which make excellent nuclear delivery vehicles. Pakistan also has French-supplied Mirage aircraft.

3. The Indian-Pakistani Standoff Today.

On New Year's Day 1992, India and Pakistan exchanged lists of nuclear facilities under a mutual agreement not to strike each other's installations. In January 1994, talks between India and Pakistan regarding the Kashmir collapsed. India then submitted proposals to keep the peace -- including maintaining tranquility along the line of control dividing Kashmir where troops clashed in October 1993, disengagement of troops from the disputed Siachen glacier, and a pact of "no first use" of nuclear weapons. To punctuate its proposal, India in February tested its Agni IRBM.

The US government is now seeking a waiver from Congress in order to sell 38 aircraft to Pakistan for $700-million. In return the Pakistani's are asked to promise not to make any more fissionable material. This is part of a larger effort by the Clinton administration to ease the crisis over the Kashmir. It does not appear that Pakistan is too willing to make such a pledge.

On 7 April 1994, Deputy Secretary of State Strobe Talbott opened talks in New Delhi. His attempt to defuse tensions met a cool response. Pakistani Prime Minister Benazir Bhutto said she would never curtail her country's peaceful nuclear program if India were not made to do the same. India's foreign and finance ministers all but ruled out a two-nation agreement with Pakistan to verifiably end fissionable material production. They said a broader-based accord is needed.

The unsuccessful talks broke off on 8 April 1994. The situation is still critical. The nuclear threat prevails.

C. EAST ASIA

East Asia is also an area of nuclear competition with several facets. North Korea is still at odds with South Korea and its alliance with the US and Japan. Japan fears the North Korean nuclear potential and South Korea fears that potential from both North Korea

and Japan. Many in Japan also want the nuclear capability because of world status and to help become a permanent member of the United Nations Security Council. Meanwhile Taiwan still bitterly contends for recognition as the legitimate Chinese government.

1. Japan.

On 4 January 1993 the Japanese freighter *Akatsuki Maru* completed its 2-month voyage carrying 3,300 pounds of plutonium oxide from France to Japan -- the first of a total 50 metric tons to be transported to Japan as fuel for its experimental breeder reactor. This plutonium was originally furnished to Japan by a 1988 Implementing Agreement approving its use and shipment for 30 years. Because it has already given 30 years of prior approval, Congress cannot modify or disapprove shipments on a case-by-case basis -- its oversight powers are diminished. Under Annex 5 of that agreement, the US administration approved the shipment in September 1992. The 15,000-mile voyage commenced on 16 November 1992. Opponents to the shipment cited hijacking by terrorist groups as one of the dangers. Besides being fuel for Japan's planned series of breeder reactors, this reprocessed fuel is a first step toward weapons-grade material. The US halted its breeder reactor program in the 1970s, largely to stop the spread of weapons-grade plutonium. France has also given up on breeder reactors.

a. Japan's Nuclear Materials Programs. Because Japan does not presently have reprocessing facilities of its own, with US approval it entered into agreement with Cogema (a French government-company located at La Hague, France) and British Nuclear Fuels Limited (a government-owned company located at Sellafield, England) to reprocess Japan's spent reactor fuel. Eventually Japan expects to meet its own reprocessing needs at its Tokai and Rokkasho reprocessing facilities, plus a new plant to be built. By 2010 Japans supply of plutonium -- recovered both at home and abroad -- will be 85 metric tons. Shortly after the turn of the century Rokkasho alone will recover 4.5 to 5 metric tons of plutonium a year. [GAO/RCED-93-154, p. 3] Rokkasho also enriches uranium. [Tsuchida, p. 7]

Dr. Atsushi Tsuchida, a Japanese physicist living in Tokyo who specializes in the physics of energy resources and the environment, has written an enlightening paper unmasking the intrigue of Japan's nuclear program. [See Tsuchida, "The Nuclear Arming of Japan" in bibliography] Much of the discourse in this section on Japan will be taken from his paper.

Threat of the Akatsuki Maru being hijacked was overblown because the low-purity plutonium created by normal reactors is not suitable for building bombs. Tsuchida feels the furor was orchestrated by nuclear-weapons proponents in both Japan and the US who would benefit. As stated by the US General Accounting Office, the shipment "raised or revived broader concerns about the growth of plutonium stocks around the world and the increasing risk of nuclear proliferation. [GAO/RCED-93-154, p. 13] With more potential "enemies" it is easier to justify more nuclear weapons.

Tsuchida points out that "even as the world waxed hysterical over the plutonium shipment, the Japanese government was quietly hatching a more ominous scheme: the

reprocessing of spent fuel from its own fast breeder reactors to produce 98% pure Pu-239. [This] cannot be justified as a response to the country's chronic energy shortage. Rather, it is a clear step toward the production of tactical nuclear weapons." [Tsuchida, p. 1]. Highly-pure Pu-239 is essential to building nuclear weapons light enough to be delivered.

Japan is building a Recycling Equipment Test Facility at its Tokai nuclear complex which will process the spent blankets from Japan's Jyoyo fast breeder reactor. The Jyoyo reactor was taken out of private utility company hands in late 1992 and also made a government project. The reprocessed plutonium from ordinary reactors is used in the core of a breeder reactor. Around that is a blanket of depleted uranium (U-238). When the core is irradiated, the composition of the blanket becomes 98% weapons grade Pu-239 with only 2% Pu-240 and trace amounts of other contaminants. This process takes about two years. Only the 40 kilogram blanket is to be "recycled" at Tokai, which will produce enough plutonium for 20 tactical nuclear weapons. Soon the new Monju fast breeder reactor will go on line and Japan will be able to produce enough Pu-239 for 20 tactical nuclear weapons a year.

The cycle will then be to reprocess the spent fuel from normal nuclear reactors which will then be used as the core of breeder reactors. Then the blanket from breeder reactors will be processed to make bomb-grade material.

The uranium enrichment facility at Rokkasho has also been stepped up. Besides enriched uranium, another product is the depleted uranium used for the breeder reactor blankets. Activities at Rokkasho are indispensable to Japan's bomb-making ambitions. Rokkasho will also give Japan the option of a plutonium bomb or the simpler uranium bomb which needs no testing.

Japan is also experimenting with two new types of reactor for producing bomb-grade plutonium. One is an advanced pressurized water reactor which is midway between a conventional light water reactor and a breeder reactor. The other is a special light water reactor which uses the depleted uranium blanket.

b. Nuclear Carrier Vehicles in Japan. Japan is well along on missile technology. It has space-launch vehicles which could be converted to weapons carriers. Japan has a good handle on missile technology.

Japan also has aircraft which could deliver tactical nuclear bombs. In its air force are some 72 F-4 and 158 F-15 fighter jets.

c. Japan's Constitution Permits Nuclear Weapons. Misunderstandings about Japan having a non-nuclear constitution should also be clarified. The constitution does not specifically prohibit nuclear weapons. It bans war-making capabilities in excess of what is needed for national defense. In that light, strategic nuclear weapons would be outlawed but tactical nukes are acceptable. It is true that Japan's Atomic Energy Act allows only peaceful use of nuclear power. But it is a general law with no punitive provisions, so it lacks the teeth to prevent the Japanese military from building tactical

nuclear weapons. Then there are the much heralded Three Non-Nuclear Principles which are nothing more than a proclamation and can be changed as circumstances dictate. In summary, there is no legal provision to stop Japan from being a nuclear power. Japan is a party to the NPT, but that can be abrogated on short notice. In addition, the NPT is fast losing its credibility as an instrument to prevent proliferation of nuclear weapons.

On the other hand, there are events that encourage Japan to join the nuclear club. The US has proposed that United Nations Security Council membership be upped from 15 to 20, and that Japan and Germany become permanent members. Although not by written decree, the current five permanent members are the five proclaimed nuclear powers. Membership in that council might give Japan implied authority to become a nuclear weapons state.

Mr. Pluto is a round-faced, rosy-cheeked, animated character created by Japan's nuclear-power industry to defuse public concern over the dangers of plutonium. Featured in a promotional videotape entitled *The Story of Plutonium: That Dependable Fellow, Mr. Pluto,* he promises, "Hey everybody, I'm not a ghost! If everyone treats me with a peaceful and warm heart, I'll never be scary or dangerous." Sporting red boots and a green helmet with the chemical symbol for plutonium on it, the perky and pint-sized Mr. Pluto congratulates a boy for drinking a plutonium-laced soda pop. The narration misleads people by saying that if plutonium were swallowed, most of it would pass through the body. But even the smallest residue of the silvery-gray radioactive material is poisonous to humans.

2. North Korea.

Only an armistice resulted from the Korean war. No peace treaty has ever been signed. Hostilities still exist and it is difficult to sort out truth from propaganda. This section will attempt to meld together the differing views to provide some substance for judgment.

a. Some Historical Background. The Korean war was a major war. There were more bombs dropped there than all the conventional bombs dropped on Japan during World War II. Three to six civilians died for every combatant that was killed. Figures from the South Korean Red Cross show almost a quarter million dead and a similar number wounded, with 303,213 missing. Technically the war still rages while north and south are still divided by a so-called de-militarized zone on the 38th parallel. Vietnam and Germany are now reunited but there are still two Koreas.

Each year the US military carries out joint exercises with South Korean forces in the largest military maneuvers worldwide. Called "Team Spirit," this simulated battle with North Korea practices everything from beachhead landings to nuclear strikes. US nuclear weapons are stationed in South Korea.

North Korea responds by deploying strong invasion forces along the de-militarized zone. This is then used by US and South Korean officials to justify continued maneuvers -- and so the spiral goes.

During the 1980s there had been no indication that North Korea intended to invade the South. On 13 December 1991 the two Koreas signed a non-aggression and reconciliation agreement. They each agreed to "not interfere in the internal affairs of the other" and "refrain from all acts aimed at destroying and overthrowing the other side." Both agreed to "discontinue confrontation and competition" and to cooperate in "joint development of resources," permit "free travel and contacts between citizens" and to "connect several railways and roads." [Cited in Swomley, p. 24] The pact called for de-nuclearization of the Korean Peninsula but the details have yet to be negotiated.

The US removed its nuclear weapons from South Korea in late 1991 and suspended the 1992 "Team Spirit" exercise. North Korea already a party to the NPT, signed the nuclear safeguard accords which permit IAEA inspections of nuclear facilities. In the eight months between 11 May 1992 and 26 January 1993 the IAEA made six inspection team visits to North Korea. That was the situation at the beginning of 1993.

b. North Korea's Nuclear Program. North Korea has been pursuing a nuclear program since the 1950s, possibly with China's and the Soviet Union's help. It has been operating a Soviet-supplied research reactor since 1968. The transition to a military program probably took place in the late 1970s.

Since 1980 US spy planes have been monitoring the construction of an unusually large reactor near Yongbyon, about 60 miles north of Pyongyang, which was completed in 1987. The complex now comprises about 100 buildings contains two reactors and a fuel reprocessing plant. The largest reactor was expected to begin operation in late 1992 and produce enough plutonium to construct seven bombs a year. The reprocessing plant would be in operation shortly thereafter. It was expected that North Korea could have its first nuclear bomb in 1994.

North Korea became party to the NPT in 1985, possibly to make it easier to obtain nuclear materials and technology. But it did not fulfill its obligation to sign a safeguards agreement with the IAEA within 18 months, possibly to hide construction of its Yongbyon complex.

After signing the 13 December 1991 non-aggression agreement North Korea still did not allow IAEA inspections immediately. In January 1992 North Korea cited Japan's plutonium program as reason for holding off. In April 1992 the story came out that North Korea was producing weapons-grade plutonium, but the purity of such reprocessed plutonium would make a bomb too heavy for North Korean aircraft, and they had not yet developed a missile. North Korea then signed the nuclear safeguard agreement and inspections began in May.

In early 1993 reports inspired by newly-appointed CIA director R. James Woolsey entered the media that North Korea was secretly developing nuclear weapons. Apparently there were some inconsistencies in the quantity and quality of nuclear material between what North Korea declared and IAEA findings. During its 25 February 1993 meeting the IAEA board, hoping to resolve the inconsistencies, passed a US-sponsored resolution calling for inspection of two nuclear waste sites which had not been declared. North Korea claimed these were secret military facilities with no connection to its nuclear

program. "Team Spirit 1993" took place in March, using an extra 19,000 US troops and the aircraft carrier *Independence*.

On 8 March 1993 North Korea reacted by putting all its armed forces on war alert, and on March 12th gave the required three-months notice that it would withdraw from the NPT. The North Korean statement said: "Some officials of the IAEA secretariat insist stubbornly on the 'inspection' of our military bases as dictated by the United States, while ignoring our demand for inspection of the nuclear weapons and nuclear bases of the United States in South Korea." [Cited in Swomley, p. 25] The IAEA Board of Governors reported North Korea's non-compliance to the UN Security Council. On 11 May 1993 the Security Council passed a resolution, with China and Pakistan abstaining, calling upon North Korea to comply with IAEA safeguard agreements.

After successfully testing its Rodong-1 IRBM, North Korea announced on 11 June 1993 that it would stay on as a party to the NPT, at least for now. The remainder of 1993 saw a heated exchange of rhetoric and diplomatic bluffs over North Korea's stance on inspections. There was much talk of sanctions, military exercises, positioning Patriot anti-ballistic missiles in South Korea and Japan, ad infinitum. A December 1993 *Los Angeles Times* poll indicated that 51 percent of Americans favored "using American military force to eliminate ... suspected North Korean nuclear weapons installations" if negotiations to allow inspections fails. [*SJMN*, 10 December 1993, p. 17A] Punctuating this media hey-day were CIA exhortations that North Korea already has one or two nuclear weapons.

When pressure was getting heavy on North Korea during mid-February 1994, it agreed to resume IAEA inspections at the seven declared sites. But it still would not allow inspection of the two disputed waste dumps. When IAEA inspectors wanted to take a closer look at a plutonium-processing area during mid-March, inspections were again called off. That was followed by another threat to pull out of the NPT.

Again a heated diplomatic exchange commenced. Various agencies and groups released reports giving their estimation of North Korean capabilities and intentions. "Team Spirit" exercises, which had been suspended, are being re-evaluated. That is the situation at the time of this writing.

c. North Korea's Delivery Systems. North Korea on 29 May 1993 successfully fired an improved Scud missile, dubbed Rodong-1, with a range of 1,000-1,300 kilometers (540-700 nautical miles or 620-808 miles). Fired into the Sea of Japan, the missile only went half its alleged range. Although this event was used to bolster military spending by the US and some of its allies, other military leaders doubt that North Korea has the technical and industrial capability to develop and produce such an IRBM.

North Korea does have Scud-B SRBMs with a range of about 300 miles, and could probably produce 100 of these annually.

d. What Next? Since the end of the cold war, and the shift in US policy to emphasize regional wars rather than global, Korea has always been mentioned as a potential future US battleground. We must diligently search out the truth rather than

relying on a controlled media if we want to avoid another "enemy" image that merely serves the goals of nuclear and military proponents.

We have heard much in the media about North Korea's nuclear ambitions, and most of it may be true. But that does not mean we should rule out a peaceful solution. Former Commander-in-Chief of US Pacific Forces, retired Admiral Ronald J. Hays, warned that threats, trade sanctions and isolation are not the answer. He said, "This view underestimates the toughness and determination of the Korean people when faced with adversity." He said the best approach "is the opposite of isolation. Offer instead increased contacts, expanded dialogue; reduce the embargo; support the North's objective of establishing free economic and trade zones; and grant diplomatic recognition.... Why not, therefore, fight without weapons a delaying action on nuclear weapons development and strive for an accelerated transition to a friendlier regime with Pyongyang?" The admiral suggested that an approach "coordinated with South Korea, Japan, China and Russia can work, but only with patience, negotiating skills and perseverance." The only alternative, warned the admiral, is "a military ultimatum ... but only if we are prepared for a second war on the Korean Peninsula." [*Honolulu Star Bulletin*; cited in Swomley, p. 25]

3. South Korea.

South Korea should be considered because it not only worries about a North Korean bomb and the Rodong-1 missile, it also worries about Japan. The Korean people have not forgotten Japan's brutal 36-year rule of their country prior to World War II. South Korea is a party to the NPT.

A 21 July 1992 editorial in the *Korean Daily* argued that Japan's plan for a breeder-reactor blanket processing facility, coupled with Japan's shipment of reprocessed plutonium from France, indicated more than just a program for energy resources. Recalling that Japan now participates in UN peacekeeping forces and has requested a permanent seat on the UN Security Council, the editorial continued, "If Japan next acquires the capacity to build nuclear weapons any time it wants, its transition to a political and military superpower will be complete. If this happens, we shudder at the implications for Northeast Asia." [Cited in Tsuchida, p. 5]

South Korea in September 1992 announced it is buying two Canadian CANDU reactors which are capable of producing weapons-grade plutonium. Concern over Japan's plutonium program has now caused the South Korean government to announce in June 1993 that it would counter with its own fast breeder reactor program.

South Korea currently has aircraft that could deliver a nuclear bomb. Its air force operates at least 48 F-16 fighters (with plans for 120) and 96 F-4 fighters. Another 36 F-4s are in storage. The air force also has 142 F-5 fighters with another 16 in storage.

The US stopped South Korea's nuclear weapons program in the late 1970s. But South Korean lawmaker, Rep. Suh Su Jong, chief policy analyst for the ruling Democratic Liberal Party, said South Korea was still working on plans to develop nuclear weapons as late as 1991. The importation of Canadian CANDU reactors shows that the US no longer has the muscle to restrain South Korea's ambitions, if it ever had. For whatever reasons, the US has not blocked the import of the Canadian CANDU reactors as it once did when those same reactors were previously considered.

4. Taiwan.

Since 1969, with the delivery of a large research reactor from Canada, the US has wondered about Taiwan's nuclear intentions. Then in January 1988 Colonel Chang Hsien-yi, one of Taiwan's top nuclear scientists and deputy director of the military's nuclear energy research center at Chungshan Institute of Science and Technology, defected to the US with blueprints revealing Taiwan's nuclear weapons plans. In late March of that same year, the US pressured Taiwan to stop work on a secret plutonium reprocessing plant and to shut down its Canadian-supplied reactor. Taiwan has signed and ratified the NPT (but is not a member of the UN or IAEA) and has protested that its nuclear programs were strictly for civilian use.

In early 1993 the military-controlled Chung Shan Science Institute submitted a proposal to the government for a nuclear reactor. Some scholars believe the military has an interest in the project.

Taiwan also has plans for a fourth nuclear site which was originally to have two 1,000-megawatt reactors. In early 1994, after construction was approved in the face of much opposition, the specifications were revised upward to 1,300 megawatts. This again has touched off much citizen and political opposition. Reason for the increase was to take advantage of the so-called "advanced" pressurized water reactor designs in that megawatt range. It is this type of reactor -- halfway between a conventional reactor and a fast breeder reactor -- that Japan is experimenting with to produce bomb-grade plutonium.

Taiwan currently has F-5 and F-104 fighters. The French Air Force has been training Taiwanese pilots to fly the Mirage-2000 airplane. Taiwan is purchasing 60 Mirage fighter-bombers from France, with delivery in 1995. It is also apparently negotiating with the US to buy 150 F-16 fighters.

The good news is that anti-nuclear consciousness seems to be growing and entering the political arena across party lines. Although the growth is most noticeable around the four nuclear plant sites, there is confidence that it will spread across the nation.

D. AFRICA

Evidence abounds of suspicious activities to become nuclear powers, or possessors of other weapons of mass destruction. There are innumerable reports of unauthorized shipments to these countries that were foiled. One must conclude from the number of unsuccessful attempts that there have been many that were successful. Africa has not been immune from this activity.

1. Algeria.

Algeria is a country experiencing a fundamentalist Muslim upheaval in a campaign of terror aimed at gaining control of government. The Islamic Salvation Front is the main fundamentalist movement. In mid-April 1994, hard-line Prime Minister Redha Malek resigned, not unexpectedly. Malek had been cracking down on radical gunmen. President

Liamine Zeroual favors a dual-track approach of cracking down on terrorist but also trying to negotiate with jailed leaders. Zeroual appointed a 54-year-old technocrat, Mokdad Sifi, as the new prime minister. Sifi had previously been minister of equipment.

China has given extensive help to Algeria in constructing a nuclear reactor in a remote site south of Algiers. Western observers fear this heavily-guarded complex is for producing plutonium for a fission bomb. Algeria is not a party to the NPT.

Algeria has many combat aircraft which could be modified to deliver nuclear weapons. Already configured for ground attack are 30 MiG-17, 17 MiG-23, and 10 Su-24 fighter aircraft. It also has an additional 149 MiG-21/-23/-25 fighters which could be converted to deliver nuclear weapons.

2. Libya.

Libya has taken an aggressive interest in nuclear weapons. It would like to buy a weapon or hire some former Soviet weapons scientists. US officials claim that Libyan leader Moammar Gadhaffi has offered Pakistan billions of dollars for nuclear technology. Libya ratified the NPT in 1975.

Regarding delivery vehicles, Libya is well endowed. It has 40 Soviet-built Frog-7 SRBMs with a range of 40 nautical miles (74 kilometers). Their accuracy is about one-quarter nautical mile (463 meters). Libya also has 80 Scud-B SRBMs with an accuracy of half a nautical mile (925 meters) over a range of 160 nautical miles (296 kilometers).

In the way of aircraft, Libya has 5 Tu-22 "Blinder" bombers. These were once used as a strategic medium bomber for the Soviet union. Libya also has 28 MiG-23, 40 Mirage, and 55 Su-20/-22/-24 fighters configured for attacking ground targets. In addition the Libyan Air Force has 238 other fighters -- 162 MiG-23s, 58 MiG-25s, and 18 Mirage.

3. South Africa.

South Africa has a large supply of natural uranium. It is widely believed that this country has developed centrifuge technology, and possibly even laser technology, to concentrate weapons-grade Uranium-235. Soviet *Cosmos* satellites in mid-1977 detected preparations for an underground nuclear test in South Africa's Kalihari desert. Soviet and US pressure dissuaded the South African government from proceeding with that test.

On 22 September 1979 a US *Vela* satellite (67,000 miles above the earth with nuclear-detection sensors aboard) spotted what looked like a nuclear explosion in the ocean south of Africa. New Zealand's Institute of Nuclear Science later reported a slight increase in radioactive fallout. Although vigorously denied, South Africa was accused of setting off a small nuclear blast. Israel was also suspected of being involved.

The United Nations in 1985 accused the US and other western nations of allowing South Africa to obtain equipment needed to develop nuclear weapons. There have also been allegations that Israel shared nuclear technology with South Africa in exchange for

uranium. Israeli cooperation dates back to the 1970s. Of course this covert partnership is hotly denied.

In March 1993 South African President F.W. deKlerk revealed that between the late 1970s and when he became president in 1989, six nuclear bombs had been built. He said those bombs were destroyed in early 1990, the uranium-enrichment plant was decommissioned, and uranium fuel was diluted to below weapons-grade. South Africa signed the NPT in July 1991 and is now adhering completely to treaty requirements.

Later, in mid-1993, South Africa cancelled its RSA-4 space launch vehicle which would provided a ballistic missile capability. That now enables the country to abide by the terms of the Missile Technology Control Regime.

E. SOUTH AMERICA

In South America the fear of a nuclear standoff centers on Brazil and Argentina. Although neither country is party to the NPT, both countries signed Treaty for the Prohibition of Nuclear Weapons in Latin America (also called the Treaty of Tlatelolco) in 1967. But according to Article 13, to become a party to the treaty each country must make arrangements with the IAEA for the application of safeguards. It was not until 13 December 1991 that Argentina and Brazil signed such agreements with the IAEA. Also in 1991 these two countries, along with Cuba, signed a declaration prohibiting the production and use of chemical or biological weapons.

Brazil did have a bomb program. Six months after Fernando Collor de Mello took office as president in March 1990, he learned of a secret atom bomb program that had been going on since 1975. He dismantled the project and had filled with concrete a 1,050-foot-deep hole drilled to test a bomb in the Cachimbo mountain range of the remote central Amazon.

Collor was the first popularly-elected president since the 1964 military coup, but he was suspended from office on 2 October 1992, and subsequently ousted, for alleged corruption. His successor's nuclear policy is not yet known.

F. CONCERNS ABOUT NUCLEAR MATERIALS AND TECHNOLOGY

Worries have been mounting for decades, and were raised to new heights by the breakup of the USSR, about international safeguards over nuclear materials and technology. There appears to be an international black market for these commodities. Following are a few instances that came to public attention.

1. Sweden.

Sweden says it halted its nuclear program in 1957, but its nuclear scientists continued to develop defenses against a nuclear attack. This activity was used to justify the 1985 acknowledgement by Swedish research specialists that an underground plutonium bomb was detonated in 1972. The Swedish embassy in Washington confirmed the nuclear test but Sweden's defense ministry claimed the tests were conventional. Sweden ratified the NPT in 1970.

2. Norwegian Heavy Water.

Norway's Foreign Ministry confirmed in May 1988 that 15 tons of Norwegian heavy water (deuterium oxide) was missing. It was in December 1983 diverted to unknown locations from its intended destination in West Germany. Some speculate that the destination was India. Heavy water is tightly controlled because it simplifies the making of a nuclear bomb. Heavy-water reactors can run on the easily-obtained natural uranium, rather than scarce and tightly-controlled enriched uranium. The plutonium byproduct can then be reprocessed for bomb use. It takes about 20 tons of heavy water to produce enough plutonium for one bomb.

Later in May 1988, Norway was investigating whether another shipment of heavy water destined for Romania may have been diverted to an unknown destination.

3. Former Soviet Nuclear Weapons.

Since the breakup of the Soviet Union, the former USSR's strategic nuclear weapons are distributed among four republics. Some of them are now experiencing ethnic strife, and the control of nuclear weapons in those volatile locations is in doubt.

In addition, with the apparently well-organized and well-financed nuclear black market, there is a global fear that some weapons may fall into the wrong hands. Two former Soviet residents were arrested by German authorities in March 1992 with 2.6 pounds of uranium in their car. They were apprehended after trying to sell the radioactive material for $1.1 million. Bavarian police suspect these two were merely couriers in a larger smuggling ring.

During the following October, a Bavarian customs official said Munich police had arrested seven black-marketeers for smuggling 4.85 pounds of weapons-grade uranium from the CIS. Two days before that, Frankfurt police arrested three people who tried to sell a police informant some radioactive material and a Soviet warhead. During 1992, German police have investigated over 100 cases involving smuggling of nuclear materials -- in 1991 there were 29 cases investigated. Government authorities in Belarus told visiting US senators in November 1991 that on numerous occasions smugglers had been caught trying to take enriched uranium into Poland. They fear other shipments may have gotten through because the border is not secure.

Russia is selling missile guidance technology, rocket engines, and other advanced weapons systems technology to the Peoples Republic of China. At first these sales seemed to be individual systems such as SU-27 fighter jets and missile guidance systems. Now there is concern about a broad spectrum of technology which will give China a leading edge in modern weaponry. The real concern arises if China passes this technology on to aspiring nuclear powers.

In early 1993 the CIA said there were no confirmed cases of nuclear weapons being offered on the black market but there have clearly been attempts to smuggle nuclear materials. Plutonium and uranium give off alpha radiation which can be shielded with aluminum foil. It would be impossible to detect a shipment so packaged with a Geiger counter. So far the smuggling attempts have been of low-grade materials. But as disassembly of weapons proceeds, weapons-grade materials will become more abundant.

The dismantling of former Soviet weapons under the START and INF treaties will generate about 500 tons of highly-enriched uranium and 96 tons of weapons-grade plutonium. To date the most difficult part of making a nuclear bomb has been the enrichment of fissionable materials. As this stockpile becomes abundant the smuggling danger will be magnified -- where will the fissionable material be safely stored and how will it be safeguarded.

The US has pledged to buy the 500 tons of highly-enriched uranium from Russia to prevent its sale to other countries. It will ostensibly be diluted to use as reactor fuel. But bringing it to the US is not necessarily making it safer. Between January 1989 and September 1990, routine DOE security inspections identified more than 2,100 security deficiencies at 39 of its contractor-operated weapons-related facilities. These are only the ones "found" during "routine" inspections.

4. Former Soviet Nuclear Scientists.

There are some 10,000 scientists, engineers and chemists who had been working on Soviet nuclear weapons. They have a wealth of knowledge and experience which is sought in other countries. On 8 December 1992 Russian authorities arrested 36 nuclear experts just as their aircraft was ready to take off for North Korea, where the experts had been hired. The concern is that these experts, and others, may become mercenaries for aspiring nuclear powers in the same manner that German scientists worked for the US and USSR after World War II. Ex-Soviet scientists could fuel another nuclear arms race in some sector of the world, just as their German counterparts did about a half-century ago.

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