

## **July 1991**

### **National Intelligence Estimate, NIE 5-91C, 'Prospects for Special Weapons Proliferation and Control'**

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#### **Summary:**

With the term "weapons of mass destruction" having not yet fully come into general usage, this NIE used the term "special weapons" to describe nuclear, biological, and chemical weapons (formerly the term "special weapons" was sometimes used to describe nuclear weapons only). With numerous excisions, including the names of some countries in the sections on "East Asia and the Pacific" and "Central America," this wide-ranging estimate provides broad-brushed, sometimes superficial, pictures of the situations in numerous countries along with coverage of international controls to halt sensitive technology exports to suspect countries.

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## Prospects for Special Weapons Proliferation and Control

National Intelligence Estimate

Volume II—Annexes

*This National Intelligence Estimate represents  
the views of the Director of Central Intelligence  
with the advice and assistance of the  
US Intelligence Community.*

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NIE 5-91C/II

## Prospects for Special Weapons Proliferation and Control

Volume II—Annexes

*Information available as of 31 May 1991 was used  
in the preparation of this National Intelligence Estimate.*

*The following intelligence organizations participated  
in the preparation of this Memorandum:*

The Central Intelligence Agency  
The Defense Intelligence Agency  
The National Security Agency  
The Bureau of Intelligence and Research,  
Department of State  
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*also participating:*

The Deputy Chief of Staff for Intelligence,  
Department of the Army  
The Director of Naval Intelligence,  
Department of the Navy  
The Assistant Chief of Staff, Intelligence,  
Department of the Air Force

*This Estimate was approved for publication by the  
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## Annex A

### Country Studies

#### Middle East and North Africa

##### Algeria

**Nuclear.** Algeria is building a nuclear reactor with Chinese assistance near 'Ain Oussera. The project was not publicly known until April 1991. Both the Algerian and the Chinese Governments indicate that the reactor will be a 15-megawatts (MW) research reactor using low-enriched uranium fuel and will be subject to International Atomic Energy Agency (IAEA) safeguards inspections. Some evidence, however, indicates that Algeria may intend to use the reactor for a weapons program.

We have no evidence that Algeria is acquiring or developing biological weapons or ballistic missiles, but Algeria reportedly has a small chemical weapons development program.

##### Egypt

**Nuclear.** Egypt has a nuclear research center but has no plans to develop nuclear weapons.

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[redacted]

**Ballistic Missiles.** Egypt will soon begin serial production of Scud B missiles with North Korean assistance and is retaining facilities for development (though development of the missile itself is suspended) of the 750- to 1,000-km range Condor II/Vector that initially was a joint SRBM program with Argentina and Iraq. Egypt will need to renovate portions of its Condor II production facility and acquire warhead and guidance technology before it can begin production of this missile. [redacted]

#### Iran

**Nuclear.** Iran has two overt nuclear R&D facilities, the Tehran Nuclear Research Center and the Esfahan Nuclear Technology Center. A secret facility that may be used for nuclear research may be under construction near Qazvin. Tehran has sought help from Argentina and China to develop its nuclear research facilities. The technologies sought may be used to lay the basis for developing weapons; however, we believe that the Iranians are still 10 years or more away from actually producing nuclear weapons. [redacted]

**Chemical.** Iran probably has been stockpiling mustard and blood agents and will continue to develop its capability to produce nerve agents such as sarin. Tehran has been purchasing precursor chemicals and production equipment needed for these agents. Iran has received foreign assistance [redacted] that have supplied precursors and equipment. [redacted]

**Biological.** Tehran has intensified its BW program since the end of the Iran-Iraq war and is in the late

stages of R&D of biological agents, taking full advantage of imported dual-use technology; some traditional infectious and toxin agents are likely to be produced during the next few years. [redacted]

**Ballistic Missiles.** Iran has obtained Scuds from North Korea and has concluded an agreement with North Korea for Scud C production technology. Tehran is also obtaining the B610 from China and is negotiating an agreement with China to purchase the M-9 SRBM. Although Iran publicly claims that it has begun to produce ballistic missiles, we anticipate that it will not be able to achieve significant series production until the mid-1990s or later. [redacted]

#### Iraq

Coalition air attacks damaged Iraq's nuclear, chemical, biological, and ballistic missile production facilities. Baghdad does, however, retain some special weapons capabilities. In one decade, Iraq was able to significantly develop many key elements of special weapons programs. Some of the capabilities described below have been substantially degraded and could not be resuscitated without massive infusions of capital and foreign technical expertise. [redacted]

**Nuclear.** Before the war, Iraq had the most advanced nuclear program among the Arab states. A variety of evidence, including Iraq's covert procurement of centrifuge enrichment technologies, indicates the emphasis given to its nuclear weapons program. Information available since the war [redacted] indicates that Iraq had made significant progress. Much of Iraq's enrichment capability escaped bomb damage and could be put back into operation. Baghdad probably also acquired the equipment and materials needed for small-scale reprocessing [redacted]

**Chemical.** Before 1991, Iraq had the largest CW program in the Third World. It was capable of producing 2,000 tons of blister and nerve agents annually and probably produced well over 10,000 tons since full-scale production began in 1983. Since the

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Figure 3

Iran and Iraq: Selected Special Weapons Facilities and SRBM Capabilities

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Iran-Iraq war, Iraq has been developing more advanced agents—particularly the nerve agent VX—and has been actively assembling an indigenous precursor production capability. Although known CW production facilities were heavily damaged by allied bombing, significant stocks of CW agents as well as production and filling capabilities most likely survived. [redacted]

**Biological.** We believe Iraq weaponized BW agents, including botulinum toxin and anthrax, and developed other biological agents. Iraq did not declare any of these BW capabilities to the United Nations after the war. Some production capability survived allied bombing. Furthermore, Iraq's existing dual-use facilities can be converted to BW-agent production [redacted]

**Ballistic Missiles.** Iraq has a large missile R&D and production infrastructure. It had achieved the capability to produce modified Scud-type ballistic missiles, warheads, and launch-support equipment. It probably could have soon produced solid-propellant rocket motors for its version of the Condor II, and the liquid-fuelled engines for a longer range ballistic missile or space launch vehicle. These production facilities were heavily damaged during the war and will require large and sustained investment to recover. Much of the remaining infrastructure, however, survived and, with some foreign assistance, can be used to reconstitute one or more of the ballistic missile programs. [redacted]

#### Israel

[redacted]

**Ballistic Missiles.** Israel has deployed over thirty 500-km-range [redacted] Ya-1 SRBMs (the Yavne-1, sometimes called Jericho), which can strike targets in Egypt, Syria, and Jordan. Israel has developed an MRBM (Ya-3 or Jericho II) and is now deploying it on a South African-developed transporter-erector-launcher. The Ya-3 is entering serial production, and the deployed force can be armed with a mix of [redacted] warheads. [redacted]

#### Jordan

Although it has no indigenous program [redacted]

[redacted] Front companies in Jordan may be used by other states seeking to acquire chemical agent precursors. [redacted]

#### Libya

**Nuclear.** Libya has tried to acquire nuclear weapons and technology, but Tripoli has been hampered by poor planning and lack of a technical infrastructure and, consequently, is unlikely to develop a weapon in this decade. [redacted]

**Chemical.** Libya continues to produce limited amounts of chemical agents at its Rabta facility and may be planning to build other facilities for production of CW precursor chemicals and agents. Libya is totally dependent on foreign suppliers and has developed a network of middleman operations in several countries [redacted]

[redacted] to facilitate procurement. Tripoli has imported chemical plant equipment and hundreds of tons of precursors by evading controls [redacted]

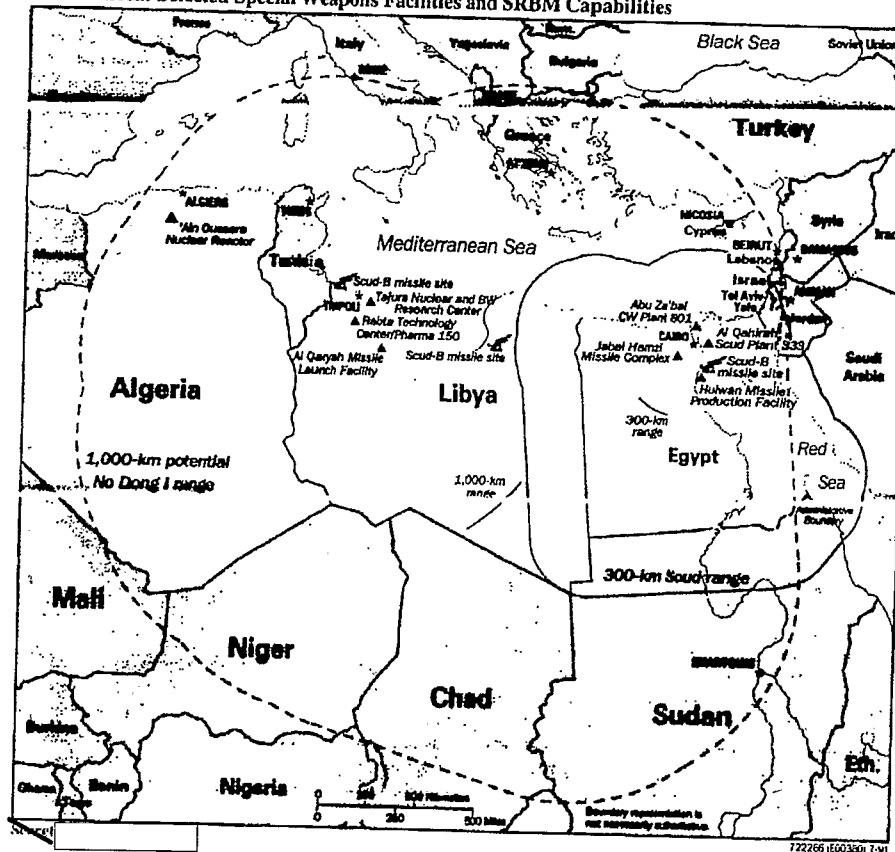
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Figure 4  
North Africa: Selected Special Weapons Facilities and SRBM Capabilities



**Biological.** Libya plans to develop biological agents and has entered the R&D phase. We anticipate Libya could have biological agents such as anthrax in three to five years, but development of an effective weapon will take longer.

**Ballistic Missiles.** Qadhafi has persistently sought to acquire ballistic missiles of longer range than his Soviet Scuds. So far, China has resisted selling longer range missiles or the production technology Libya wants, and Libya has been trying to develop its own. Depending on the extent of foreign assistance it can

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get, Libya may develop a missile that exceeds 500 km in range in three to five years and, perhaps, one with a 1,000-km range in 10 years. The Libyans are heavily dependent on foreign suppliers for almost every element of their ballistic missile program and are trying to evade the Missile Technology Control Regime (MTCR) controls through a sophisticated network of front companies and intermediaries. They are also increasingly pursuing missile-related cooperation with non-MTCR nations.

**Saudi Arabia**

**Nuclear.** Saudi Arabia is not likely to develop a nuclear weapons program during the next decade but

China probably left the door open to future negotiations on CSS-2 warhead upgrades.

**Ballistic Missiles.** Saudi Arabia bought about 40 CSS-2 missiles from China in 1987. This force is now operational. Though inaccurate, each missile can deliver an approximately 2,000-kg high-explosive warhead about 3,000 km.

Both Saudi Arabia and China deny that nuclear warheads were part of the original deal. The Saudis have conditional agreements to buy M-9 or M-11 SRBMs from China.

**Syria**

**Nuclear.** Syria has begun to show interest in acquiring some nuclear fuel cycle technology. However, because of long-term financial and technical constraints, Syria is unlikely to undertake a nuclear weapons program.

**Chemical.** Syria has an advanced CW program. The program has concentrated on developing sarin in two binary-type munitions: 500-kg aerial bombs and Scud B missile warheads. Syria has obtained equipment

from foreign countries, including three production lines for an essential component of binary sarin. The production lines have enabled Syria since 1984 to produce binary sarin at a rate sufficient to produce about 30 bombs and a few Scud B warheads per month. Syria appears to be actively developing a VX capability and has been seeking VX precursors since August 1990.

**Biological.** Syria has a mature offensive BW program, including the development of ricin toxin and possibly anthrax. The program has been limited because Syria is focusing its attention on CW. Some BW agents could be weaponized in the next three to five years.

**Ballistic Missiles.** Syria has about 300 Soviet-made Scuds with about a 300-km range and also has 70-km-range SS-21s purchased from the USSR. It is now importing 60 longer range North Korean Scud C missiles and plans to obtain the 600-km-range Chinese M-9 SRBM. Fearing heightened Western controls on technology transfer, Damascus has accelerated its missile development program over the past two or three years.

**Turkey**

Turkish military officials reportedly want an SRBM or ATBM capability. Some interest has been expressed in Pakistan's Hatf I SRBM. The government has provided its Tubitak Research and Development Institute \$5 million to begin an indigenous ballistic missile development program.

**United Arab Emirates and Gulf States**

**Ballistic Missiles.** Dubayy purchased 18 to 24 Scud missiles from North Korea in 1988, and Abu Dhabi may have made a deal with China for 80 M-11 SRBMs to be delivered within the next few years. Qatar was negotiating with Egypt to acquire Scuds in mid-1990, but, since the Gulf war, it has shifted to an effort to obtain Patriot missiles from the United States.

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Figure 5  
Arabian Peninsula: Selected Missile Facilities and SRBM Capabilities

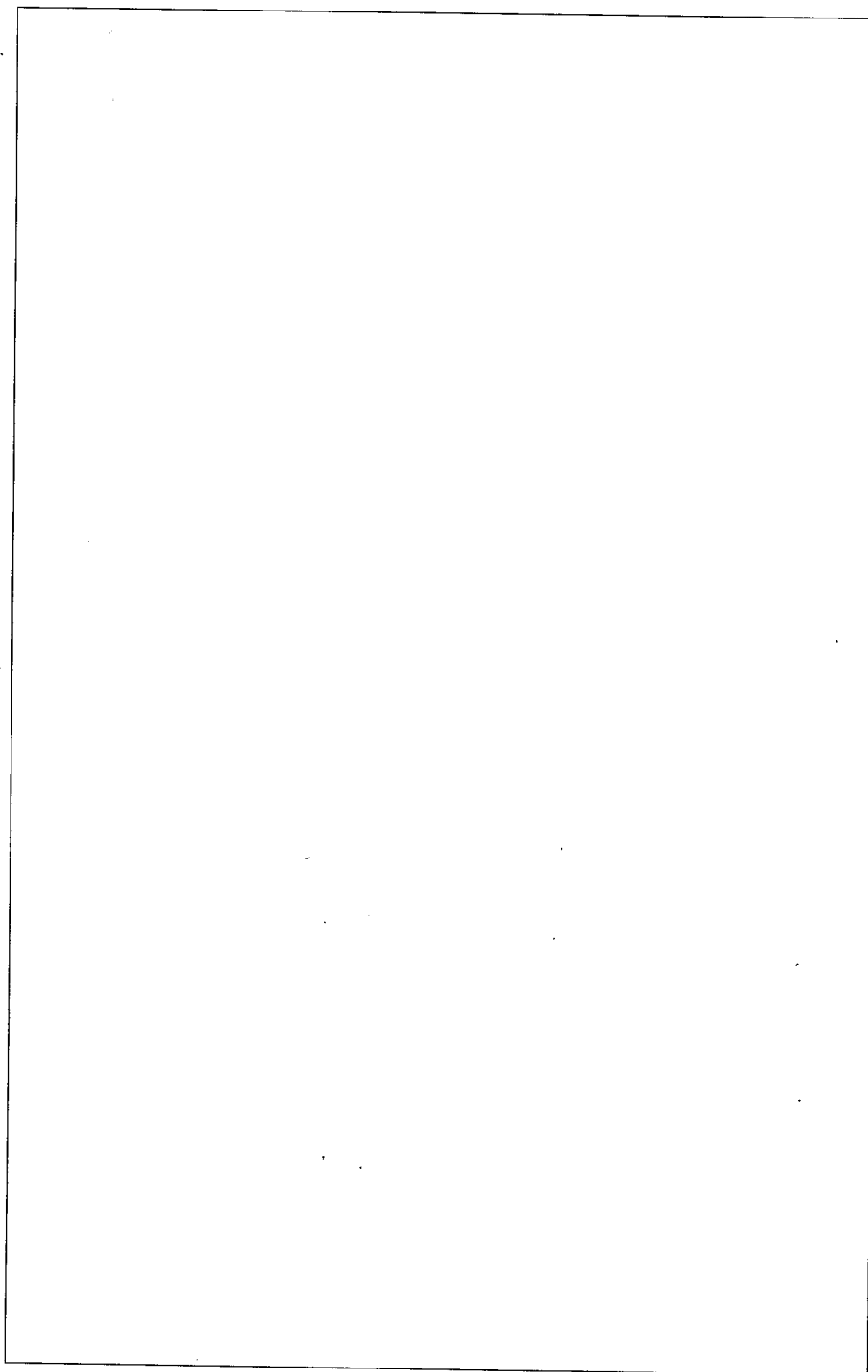


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~~Top Secret~~**Yemen**

North Yemen purchased SS-21 missiles from the Soviet Union, and South Yemen purchased Scuds. Both systems are operational with high-explosive warheads. We have no indication of further missile acquisitions or transfers. [ ]

**East Asia and Pacific****China**

China is a principal supplier of weapons and related technology and materials. China is a full-fledged member of the nuclear club, with a wide range of ballistic missiles<sup>1</sup> and a panoply of other special weapons. China sells to others to fund its own programs and to enhance its political influence worldwide. [ ]

**Nuclear.** China joined the IAEA in 1984 but is not a signatory of the nuclear Non-Proliferation Treaty (NPT). China has not agreed to adhere to voluntary international agreements on safeguarding exports of nuclear materials and technology, though, in response to criticism from the West, it has declared that it will not encourage nuclear proliferation. China's contribution to the nuclear programs of developing countries—especially Pakistan, Algeria, and Iran—is of concern [ ]

- China has provided Pakistan with enriched uranium, the design of a 10-kiloton (kt) nuclear device, and assistance developing the high-explosive components of a nuclear device. Beijing has since maintained high-level [ ] exchanges of nuclear scientists with Islamabad [ ]

- The Chinese are assisting in the construction of a nuclear reactor near 'Ain Oussera, Algeria. Some reporting indicates that the Algerians intend to use it in a nuclear weapons program.

<sup>1</sup> See NIE 13-8-90J, (Top Secret [ ] August 1990, *Chinese Capabilities for Nuclear Conflict*, [ ]

- China's nuclear cooperation with Iran is growing. Beijing is planning to supply Tehran with research reactors, a heavy-water reactor, and a number of pilot-scale nuclear fuel cycle facilities.
- Chinese nuclear cooperation with Brazil, Argentina, and Cuba has been growing over the past few years. Although there is no evidence of Chinese support to sensitive aspects of North Korea's program, some reports indicate that China has trained North Korean nuclear technicians. [ ]

**Chemical and Biological.** China has an offensive CW and BW capability. Chinese firms have become active or potential suppliers of CW precursors and production technologies to Pakistan, Libya, Iraq, and Iran, [ ] Pressure from the United States has prompted the Chinese to limit some sales, particularly to Iraq and Libya. We remain concerned, however, that Chinese enterprises will attempt to provide CW—and perhaps BW—materials and technology, primarily for financial reasons. [ ]

**Ballistic Missiles.** We estimate that Beijing plans to raise about \$250 million per year—25 percent of its R&D budget for strategic defense modernization—from arms sales abroad. A key component of these sales will be missiles and missile-production technology. Beijing has concluded conditional agreements to sell the 600-km-range M-9 SRBM to Syria and Saudi Arabia and is negotiating an M-9 sale to Iran; China has sold the 300-km-range M-11 SRBM to Pakistan. Although both systems have encountered delays, we anticipate the M-11 will be exported this year and the M-9 by 1992. China is also selling technological assistance to missile programs in Third World countries. For example, Chinese engineers have been assisting Pakistan in the testing and production of its Hatf I and Hatf II missiles, and Beijing has negotiated to provide Iran with production technology to indigenously produce rocket motors, nozzles, and propellants. [ ]

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~~Top Secret~~**Indonesia**

**Nuclear.** We have no evidence that Indonesia plans to develop nuclear weapons. [redacted]

[redacted] Indonesia, however, is developing a civilian nuclear program, including a research facility, which is probably operating and will be completed in the early 1990s. Indonesia could become a supplier of nuclear products and technology to other developing nations, but we have no evidence they intend to. [redacted]

**Ballistic Missiles.** Jakarta has an active sounding rocket development program and has announced plans to develop a space launch vehicle (SLV). If the government decides to go ahead and succeeds in acquiring SLV technology and foreign assistance, Indonesia could develop SRBMs by the end of the decade. However, we have no evidence that Indonesia plans to fund this program. [redacted]

**Japan**

Japan is a strong advocate of nonproliferation. Japan, nevertheless, has key technologies—including space launch, nuclear, chemical, and biological—that will tempt other nations. [redacted]

**North Korea**

**Nuclear.** North Korea's nuclear program is of grave concern to the United States, South Korea, and Japan. At its Yongbyon Nuclear Research Center, North Korea has been operating a small (10- to 30-MW) reactor since 1987 and constructing, since

the mid-1980s, a 50- to 200-MW reactor. It is also constructing facilities we suspect are for fuel fabrication and reprocessing. Upon completion, these facilities would enable the North Koreans to produce and separate weapons-grade plutonium. Depending on the difficulties encountered, P'yongyang could have a plutonium-based nuclear device in two to five years. Despite acceding to the NPT in 1985, P'yongyang has failed to conclude a safeguards agreement or to declare the facilities where we suspect a weapons program is being undertaken. North Korea has declared that it will not adhere to the provisions of the NPT until the United States removes its nuclear weapons from South Korea and guarantees North Korea's security. [redacted]

**Chemical.**<sup>1</sup> North Korea can produce nerve, blister, choking, vomiting, and blood agents. P'yongyang may possess the blood agent cyanogen chloride and the nerve agent VX. We judge that some of these agents have been weaponized. North Korea could easily adapt its indigenously produced Scud missiles for CW delivery. North Korea reportedly helped Iran obtain mustard agent and produce chemical mortar rounds in 1986 and provided CW-suitable artillery shells to Syria in 1989. [redacted]

**Biological.** North Korea can produce conventional infectious and toxin BW agents. It may hope to acquire more advanced biotechnology and equipment from China, the USSR, and Japan. [redacted]

**Ballistic Missiles.** The North Koreans are providing Scud production technology to Syria, Iran, and Egypt and [redacted] are planning to

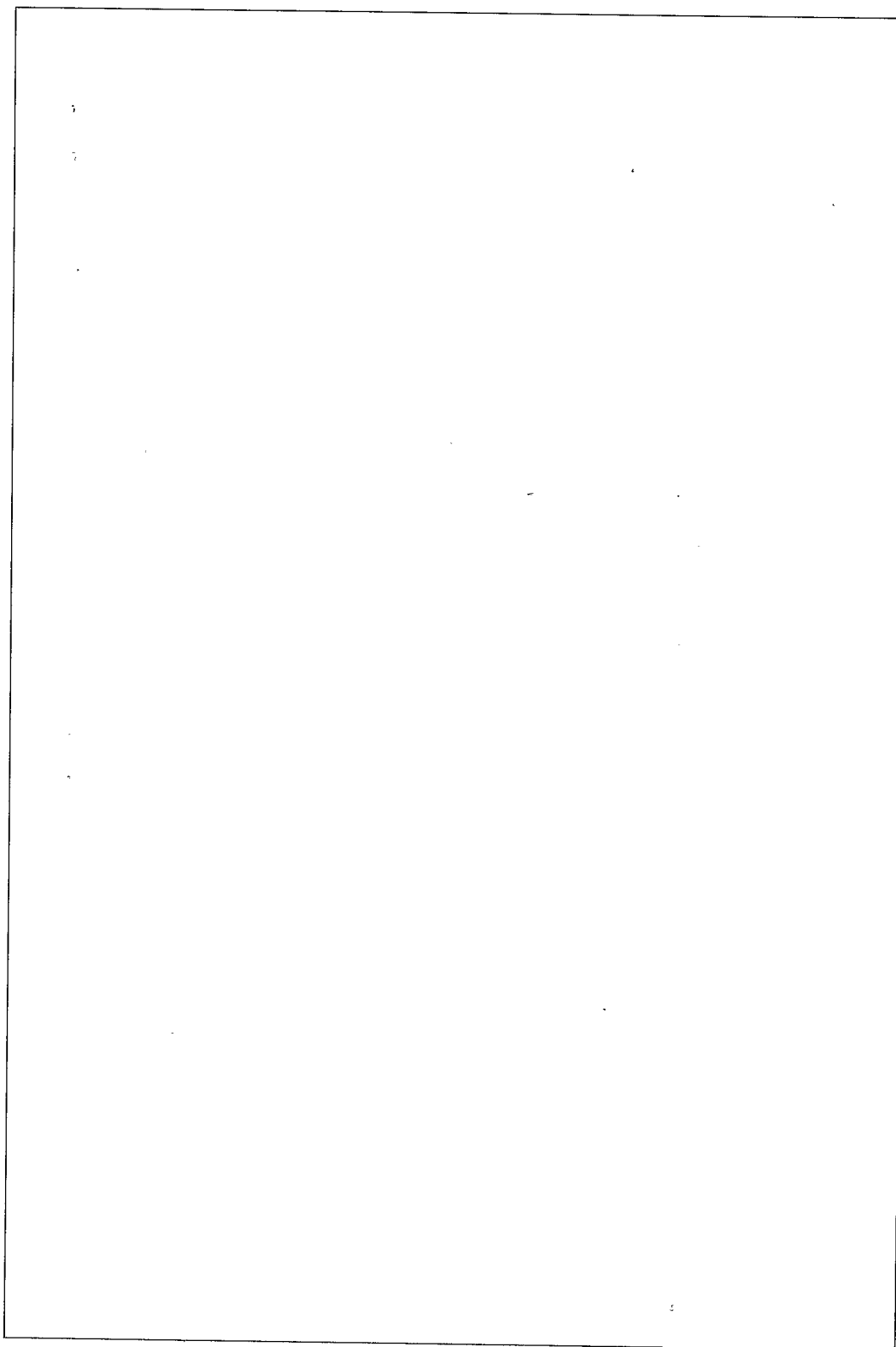
<sup>1</sup> See Volume 1, page 4, for a statement of alternative views. This judgment updates those made in NIE 42/14.2-1-90 (Secret), [redacted] The Military Balance in Korea, 1990-95, and NIE 42/14.2-2-90 (Secret). [redacted] Warning of War in Korea, both of April 1990. Those Estimates concluded that North Korea could develop a nuclear explosive device by the middle-to-late 1990s. [redacted]

<sup>2</sup> For a comparative assessment of North and South Korean capabilities, see CIA Intelligence Assessment SW91-10017CX, IA 91-10020CX (Top Secret) [redacted] March 1991, A Technical Overview of North and South Korean CW Capabilities. [redacted]

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sell SRBMs or components to Pakistan and Libya. P'yongyang shipped Scud C missiles to Syria in the spring of 1991. North Korea is developing a larger, longer range missile—the No Dong-1, advertised as 1,000 km in range—which we believe is intended primarily for export. This missile also could be used against allied facilities in Japan that would support South Korea if war on the peninsula again erupted. Engine testing for the new missile may be under way, and the production technology is being offered to Libya.

**Ballistic Missiles.** South Korea began deploying the 500-km-range Hyonmu SSM in late 1987. Seoul intends to produce 90 Hyonmus—a derivative of the US Nike Hercules SAM—over the next 15 years but, under US pressure, is redesigning the guidance system to reduce its range below the MTCR threshold. South Korea has announced plans to develop sounding rockets and SLVs. South Korea could combine this technology with Hyonmu technology to develop MRBMs by the end of the decade.

**Taiwan**

**Nuclear.** Taiwan has sufficient technical and industrial capacity to develop nuclear weapons.

We have no incontrovertible evidence that Taiwan has renewed its weapons program, but it could produce a weapon within 10 years should it decide to do so.

**South Korea**

**Nuclear.** South Korea halted its nuclear weapons program in 1976.

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also announced that it does not intend to pursue a SLV program, it is developing a wide range of tactical missiles and could readily turn that technology toward a ballistic missile effort. Taiwan, well aware of the ballistic missile threat it faces from China, may be considering converting one of its SAMs into an ATBM. Taiwan may also conduct research on ballistic missiles or space launch vehicles.

#### Vietnam

**Ballistic Missiles.** Vietnam has 18 Soviet Scud missiles. North Korea may have offered to provide additional missiles to Hanoi—possibly Scud Cs.

**Chemical and Biological.** We believe Vietnamese forces have tested and trained with various CW agents, but we lack information about stockpiles. Vietnam is reported to have received chemical and biological weapons and technology from the USSR and to have used chemical and biological weapons in Laos and Cambodia in the 1970s and early 1980s.

**Ballistic Missiles.** Taiwan has suspended work on two programs and does not have a ballistic missile currently under development. Although Taiwan has

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## South Asia

## Afghanistan

**Ballistic Missiles.** Afghanistan continues to receive Scud missiles from the Soviet Union and has fired over 1 900 against the resistance during the Afghan civil war. Some of these landed in Pakistan within 30 km of Islamabad. We anticipate that the use of Scuds will gradually subside as the Soviets cut back deliveries. [ ]

## Burma

**Chemicals.** Burma has a small chemical weapons production facility, built with West German assistance in the early 1980s. The facility originally produced laboratory amounts (about 500 liters) of mustard but now probably is not producing any. Some ethnic insurgents in Burma claim that the Burmese Army has imported chemical weapons from China to use in an offensive against them; these claims have not been verified. [ ]

## India

**Nuclear.** India conducts a wide range of unsafeguarded nuclear activities and probably could quickly produce as many as 20 devices. [ ]

[ ] India has continued nuclear weapons R&D and has accelerated these efforts in recent years. [ ]

**Biological.** We suspect that India may covertly develop an offensive BW program in response to Pakistan's program. India has a very large scientific and technical cadre and produces pharmaceuticals, vaccines, and antivenoms. This infrastructure could provide cover for both BW R&D and BW-agent production. [ ]

**Ballistic Missiles.** India will continue to develop ballistic missiles, primarily to deter China and Pakistan. India also will continue its ambitious SLV program that enables it to obtain dual-use technology. India is marginally self-sufficient in most aspects of missile production technology, but it requires foreign assistance to develop reliable guidance and control systems and to obtain high-quality materials. Within the next year or so, we anticipate India will deploy some Prithvi SRBMs. By the end of the decade, India could deploy the Agni MRBM, which most likely will have nuclear warheads. India wants to market some of its missiles and technology abroad, mainly for economic reasons. [ ]

## Pakistan

**Nuclear.** Pakistan has a viable nuclear weapons design and has components that it could assemble into nuclear devices on short notice. Neither Pakistan's extensive uranium enrichment plant nor its laboratory-scale plutonium reprocessing facility is under international safeguards. Pakistan is constructing a plutonium production reactor and is likely to expand its reprocessing efforts in order to produce plutonium and increase its nuclear weapons design options. [ ]

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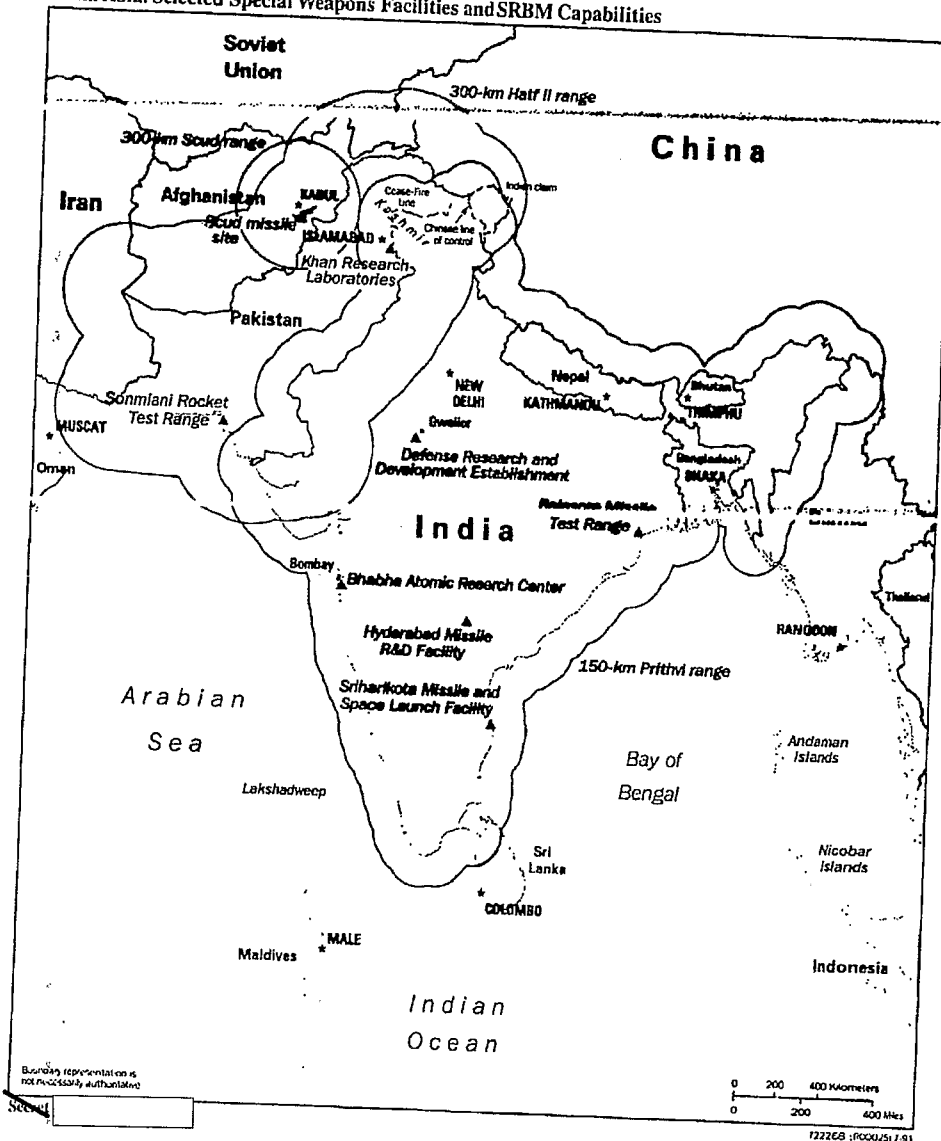
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Figure 9  
South Asia: Selected Special Weapons Facilities and SRBM Capabilities

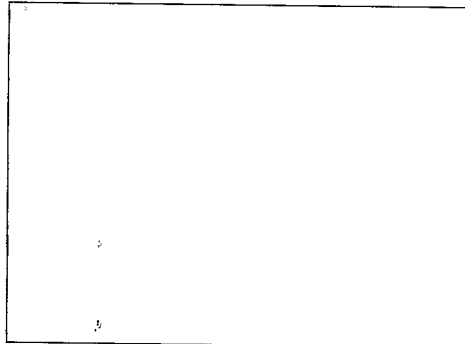


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**Ballistic Missiles.** Pakistan can make rocket motors and some unsophisticated components of ballistic missiles but will remain highly dependent on foreign suppliers for the next three to five years. Pakistan produces one SRBM, the 80-km-range Hatf I that may now be operational. By 1995, Islamabad could produce the 300-km-range Hatf II or the Chinese M-11 (Hatf III), but it will require continued Chinese assistance. The Hatf I and II are not accurate [redacted]

[redacted] Pakistan more likely will concentrate on developing the M-11 [redacted]

[redacted] China has already delivered a prototype and support equipment for the M-11 and is expected to deliver missiles and production technology beginning in late 1991. With continued Chinese assistance, Pakistan probably will be able to begin production of this missile in the late 1990s. [redacted]

#### Sub-Saharan Africa

##### South Africa

**Nuclear.** South Africa has produced [redacted] weapons-grade enriched uranium, has conducted extensive nuclear weapons R&D activities, and has the technical capability to assemble nuclear weapons on short notice. [redacted]

[redacted] The South Africans are developing centrifuge and laser isotope separation enrichment techniques that could enhance their ability to produce weapons-grade material. South Africa has acceded to the NPT and said it

will negotiate with the IAEA to extend international safeguards to its facility that produces low-enriched uranium. Signing the NPT would force South Africa to compile an inventory of enriched uranium and to decide how to dispose of the weapons and weapons-grade materials it has produced. [redacted]

**Chemical and Biological.** South Africa conducted research on nerve agents in the 1960s. It has substantial expertise and the requisite technical infrastructure to produce CW or BW agents, so further monitoring is warranted. [redacted]

**Ballistic Missiles.** South Africa will continue to cooperate with Israel in developing an MRBM or a space launch vehicle. Pretoria has twice tested missiles indistinguishable from the Ya-1 SRBM and is probably receiving technology to produce the Ya-3 MRBM. We estimate South Africa could produce a prototype nuclear-armed MRBM in the next three to five years should it continue this program, but Pretoria may limit itself to a cooperative space launch program with Israel. [redacted]

#### South America

##### Argentina

**Nuclear.** Although Argentina has fuel cycle facilities that are not safeguarded, we believe that the Menem administration will not attempt to develop nuclear weapons. Argentina is taking steps toward a bilateral nuclear safeguards regime with Brazil, as well as a joint Argentine-Brazilian full-scope safeguards agreement with the IAEA, and the government is committed to accede to some form of the Treaty of Tlatelolco. Also, the administration is reluctant to engage in sensitive nuclear exports that might harm relations with the United States. [redacted]

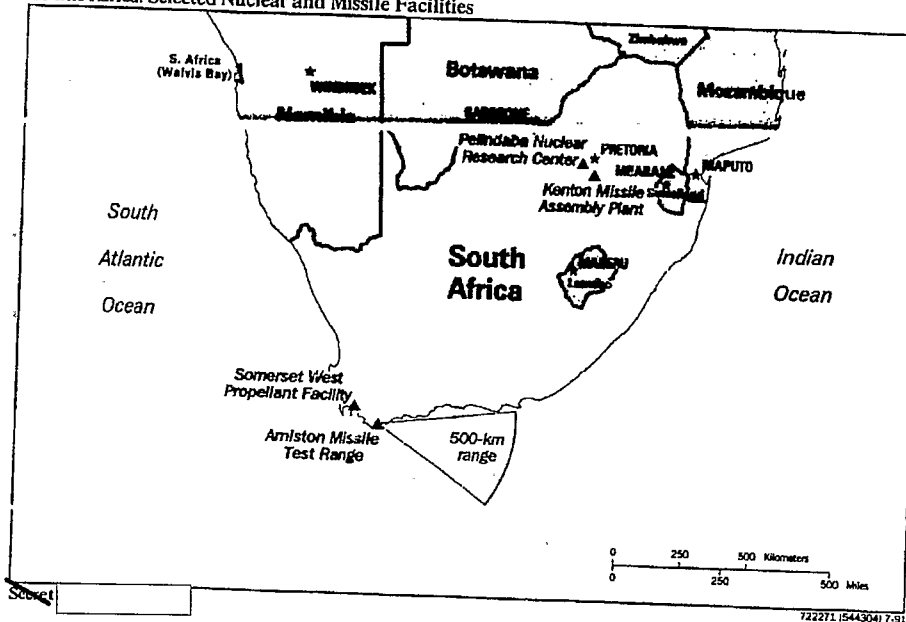
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Figure 10  
South Africa: Selected Nuclear and Missile Facilities



**Ballistic Missiles.** The Menem administration has frozen development of the Condor II ballistic missile and is attempting to dismantle the project. The Air Force may be willing to destroy its inventory and production facilities in exchange for US financial incentives. Nevertheless, some Argentines who have invested heavily in Condor—including military officers, defense officials, and contractors—certainly will try to preserve the option to resume the program. Even if a new government permits resumption of the program, Argentina would be unlikely to develop an operational missile by 1995.

#### Brazil

**Nuclear.** Brazil has been working with Argentina and the IAEA to negotiate regional and full-scope safeguards agreements and has pledged to bring the

Treaty of Tlatelolco into force. Brazil's nuclear program is particularly complex in that each of the military services has its own projects, which receive technical assistance from civilian institutes. Although the Collor government has acted to institute civilian oversight of the military's nuclear projects and halt the development of nuclear weapons, one or more of the military's projects probably will continue. We believe that Brazil will not develop a nuclear weapon during this decade, but the military's projects should be regularly monitored.

**Ballistic Missiles.** Brazil's Sonda IV program is designed to produce an SLV, and some Brazilian military and industrial leaders plan to use this program to develop a long-range ballistic missile. These

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Figure 11  
South America: Selected Special Weapons Facilities



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plans are not yet viable. Lack of funding, US diplomatic pressure, and MTCR controls have slowed progress. Brazil, however, hopes to maintain the program and is negotiating with the Soviet Union and France to provide use of the Alcantara launch facility in return for assistance and technology. [redacted]

[redacted] Some sources believe the Sonda IV—a powerful sounding rocket capable of carrying a 500-kg payload to an altitude of about 650 km—could be operational in the next three to five years. Others believe the SLV program is foundering. Its fate is likely to be determined by the amount of foreign assistance provided. [redacted]

[redacted] the Brazilian Government has submitted a draft law banning ex-government employees from contracting their expertise in technologically sensitive areas to foreign nations. Brazil also is considering adhering to MTCR guidelines. [redacted]

#### Chile

**Nuclear.** All of Chile's nuclear activities are safeguarded, and Chile apparently has no intention of developing nuclear weapons. Nevertheless, the military has control of Chile's research program, and some aspects of the nuclear fuel cycle that could have application to a weapons program have been under way on a laboratory scale. [redacted]

#### Central America

#### Cuba

**Chemical.** There is no evidence that Cuba possesses chemical weapons. Despite claims by Angolan insurgents that chemical weapons were used against them—possibly by Cuban forces—we have no reliable reporting to confirm such use. The Cuban military practices defenses against chemical warfare, but we have not observed the structural adjustments in the Cuban military that would normally be associated with an offensive CW program. [redacted]

**Biological.** We suspect that Cuba has an offensive biological warfare program that is presently in the research phase. Cuba recently opened a sophisticated biotechnology center with areas closed to foreign visitors. This center manufactures commercial products but also may secretly be working on the development of agents that could be directed against US agriculture. We have not observed in Cuba the type of military activity that normally would be associated with a battlefield BW program. [redacted]

#### Soviet Union and Eastern Europe

Political change in the Soviet Union and Eastern Europe has opened a new era in their respective approaches to special weapons. The USSR has the potential to become a major supplier of weapons of mass destruction, along with related material and equipment, but much depends on how its domestic economic and political situation unfolds. [redacted]

New governments in Eastern Europe, anxious to develop favorable political and economic ties to the West, are amenable to controls. Nevertheless, economic pressures are likely to weaken these governments' willingness to implement controls. Prague's recent decision to reverse its ban on arms exports is a case in point. As East European countries shift to market economies, and as they agree to disarmament

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measures that limit domestic demand for weapons, their industries will come under great pressure to export technology for hard currency. Moreover, East European nascent export control systems are not likely to be effective in preventing diversions through their territory. The weakness of central governments in countries like Yugoslavia and Bulgaria constrains their ability to halt transshipments. [ ]

#### USSR

Our chief concern is that the Soviet Union, constituent republics, or Soviet citizens could become suppliers of special weapons technology or expertise. This concern derives not from hard evidence about Soviet intentions but, rather, from the possible consequences of Soviet economic decline and political fragmentation:

- The Soviets might agree to supply systems, technology, and expertise in return for hard currency.
- We are concerned that the increasing breakdown of central control might enable some Soviet organizations [ ] or those of constituent republics, to surreptitiously engage in weapons or technology transfers.
- Unemployed specialists from the Soviet Union might seek employment with countries seeking to export or to acquire special weapons. [ ]

**Nuclear.** The Soviets have been strong supporters of IAEA safeguards, and all the pertinent facilities are covered by safeguards. Within IAEA obligations, Moscow has supplied nuclear research facilities to North Korea, Libya, Egypt, and Iraq and nuclear power reactors to Cuba (now under construction), North Korea (site preparation), and possibly India (discussions are now under way). We believe these facilities are not used in weapons programs. Nevertheless, these countries do acquire knowledge and experience through these facilities that can be applied to weapons programs. Should Soviet controls weaken, Soviet technology and expertise could become more readily available for these programs. [ ]

**Chemical and Biological.** The Soviet Union probably helped set up the Chinese CW program in the 1950s [ ]

[ ] The Soviet Union reportedly provided chemical and biological weapons to Vietnam, Afghanistan, and perhaps Ethiopia. The Soviets were involved in the establishment of Cuba's new genetic engineering facility that is suspected of conducting BW research. The extent of Soviet involvement in these programs is unknown. Nevertheless, as in other categories of special weapons, the Soviets have expertise and technology that increasingly might become available in the event of economic and political breakdown. [ ]

**Ballistic Missiles.** The USSR was the chief supplier of ballistic missiles to the Third World through the 1980s. It still supplies Scud missiles to Afghanistan. The Soviets have agreed to join the MTCR—they are not yet members because of disagreements over the conditions of their membership—and have exercised increasing discretion in transfers over the past few years. The Soviets, nevertheless, are involved in space launch-related activities that could contribute to proliferation. For example, Moscow has contracted to transfer cryogenic engines and production technology to India's space launch program, which could assist New Delhi's ballistic missile production efforts. The Soviets also have offered to assist the Brazilian SLV program. [ ]

#### Bulgaria

**Chemical.** We suspect Bulgaria maintains a supply of chemical weapons, and some research on CW may be conducted in Sofia. The Bulgarians reportedly are reluctant to give up these weapons but plan to sign the chemical weapons convention. If its policy changed, Bulgaria might be able to equip its SRBMs with chemical warheads. [ ]

**Biological.** Bulgaria has been involved in some phases of BW research but probably has not produced or stockpiled BW agents. [ ]

**Ballistic Missiles.** Bulgaria has SS-23 and Scud SRBMs supplied by the Soviet Union. We have no evidence that Bulgaria plans to improve its SRBM capabilities or to transfer weapons or technology to other countries. [ ]

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~~Top Secret~~**Czechoslovakia**

**Nuclear.** Skoda Works in Czechoslovakia has been producing nuclear reactors of Soviet design for several years. Most of these have gone to other East European countries. Skoda may market its capabilities more widely in the Third World and may offer a wider range of reactor types. [ ]

**Chemical.** Czechoslovakia has produced chemical agents and weapons. We do not know if the new government has maintained this capability. [ ]

**Biological.** Although several facilities in Czechoslovakia may have been involved in research with BW applications—including military tests of aerosols—there is no strong evidence that Czechoslovakia has an offensive BW effort. There is also no evidence that Czechoslovakia is supplying other nations. [ ]

**Ballistic Missiles.** Czechoslovakia received SS-23, SS-21, and Scud SRBMs from the Soviet Union. [ ]

**Hungary**

**Chemical.** Hungary produces a variety of chemicals and equipment suitable for use in CW-agent production. [ ] Hungary is not likely to become a chemical weapons state. [ ]

**Biological.** We have no evidence that Hungary is producing and stockpiling BW agents. However, Hungarian facilities reportedly have been involved in BW-related research. [ ]

[ ]

**Ballistic Missiles.** Hungary has one brigade of Soviet-supplied Scuds. It has high-quality guidance technology and basic propellant-production technology that might be marketed in less developed countries. [ ]

**Poland**

[ ]

**Ballistic Missiles.** Poland has Soviet-supplied Scud and SS-21 SRBMs. However, we see no evidence that Poland plans to further develop its missile force. Polish industry could provide dual-use equipment and services for Third World special weapons programs. [ ]

**Romania**

**Nuclear.** Romania is building one of the largest heavy-water production facilities in the world. It is developing more heavy-water capacity than it needs. [ ]

**Chemical.** Romania maintains plants for the production of CW agents. [ ] Bucharest has tightened export controls and has expressed interest in joining the Australia Group and the MTCR. [ ]

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[redacted]

[redacted]

**Ballistic Missiles.** Romania has Soviet-supplied Scuds. Before Ceausescu's ouster, the Romanians were reportedly involved in the Condor missile program. [redacted] Romanian industries may become a source of propellant technology for other Third World missile programs. [redacted]

#### **Yugoslavia**

Yugoslavia has industrial facilities that can produce CW-agent precursors. [redacted] Precursors have been sought from Yugoslavia, but we do not know if they have been supplied.

[redacted]

[redacted] As Yugoslavia collapses and republics become independent, controls over facilities could loosen. [redacted]

[redacted]

#### **Western Europe**

West European involvement in the transfer of special weapons materials and technology will most likely become more complicated as economic and political integration occurs. [redacted]

[redacted]

Although West European governments generally are beginning to show renewed interest in identifying arms trade offenders and strengthening export controls, coming to agreement may involve only [redacted]

[redacted] generalized set of rules for handling customs, licensing, and other export controls [redacted]

[redacted]

Besides the countries discussed below, several smaller European entities—Liechtenstein, Luxembourg, and other countries, principalities, and territories—also have companies with expertise and technology applicable to special weapons programs that will be targets of acquiring states. [redacted]

#### **Austria**

Austria has served as a key transit point for gray-market trade in special weapons materials and technology. [redacted]

[redacted]

[redacted] Austria has recently joined the MTCR and is adopting MTCR guidelines. This probably will result in some improvements to Austria's controls on those groups that attempt to use Austria for ballistic missile programs development. [redacted]

#### **Belgium**

Belgian firms have the expertise to provide special weapons materials and technical assistance. [redacted]

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[redacted]

material or equipment. Negotiations with Pakistan for the supply of a nuclear plant will be set back if the new approach is adopted. [redacted]

**Denmark**

Danish firms have technology and equipment sought by proliferating countries. [redacted]

We anticipate that the French aerospace industry—as it has with Brazil—will continue to press the government to approve major contracts with countries that have SLV development programs. French industry will claim that these programs can be monitored to ensure that the recipients do not divert technology into ballistic missile programs. [redacted]

**France**

French companies have been extensively involved in the transfer of materials and technology associated with special weapons development. [redacted]

[redacted]

The French Foreign and Defense Ministries are pushing for a reconsideration of longstanding French nuclear export policy. France now requires that only French-supplied material and equipment be safeguarded; the government is contemplating a requirement in which countries accept safeguards on all their nuclear activities before French firms can supply

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[REDACTED]

The former East German military had a very active CBW research program, and the East German Chemical Troops helped set up a defensive chemical warfare training area in Iraq. We are attempting to obtain information on the GDR's past program and possible involvement in proliferation [REDACTED]

[REDACTED]

We have no evidence that unified Germany is involved in an offensive BW program or supplies technology specifically intended for BW proliferation.

[REDACTED]

[REDACTED]

#### Italy

Like Germany, Italy is a favorite target of countries such as Iraq, Pakistan, and Libya that organize front companies and engage in other similar techniques to avoid export controls. The Italian Government has taken action to block some transfers but has not always been successful. [REDACTED]

[REDACTED]

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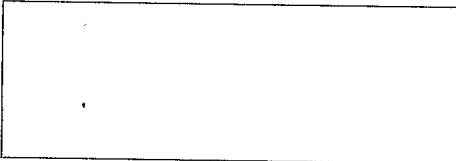
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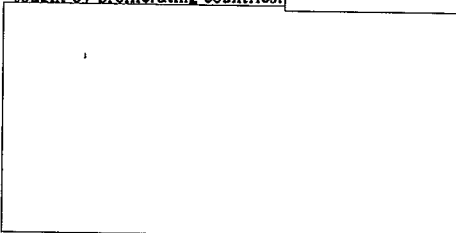
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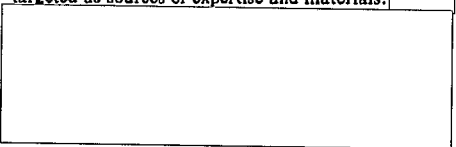
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~~Top Secret~~**Netherlands**

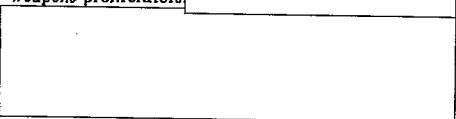
The Netherlands produces technology and materials sought by proliferating countries.

**Spain**

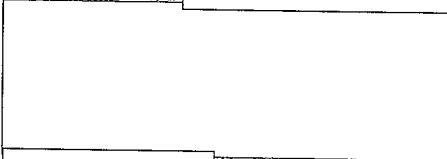
Spanish companies will most likely continue to be targeted as sources of expertise and materials.

**Sweden**

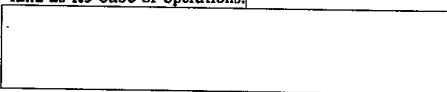
Like other West European states, Sweden has advanced technology that could be supplied to special weapons proliferators.

**Switzerland**

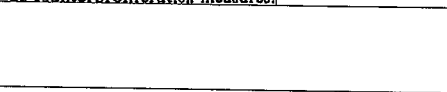
Swiss companies have material and technology sought by acquiring nations.



The Consen Group, the European consortium that has supervised the development of the Condor II in Argentina and has marketed its missile expertise around the world, uses Switzerland as its base of operations.

**United Kingdom**

Several countries that want special weapons have established front companies in the United Kingdom in order to obtain controlled materials and technology. In response, the United Kingdom has cooperated closely with the United States in trying to prevent transfers of materials and technology and is shoring up counterproliferation measures.

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## Annex B

### Weapons and Technologies

#### Nuclear Technologies

The production of nuclear weapons requires a variety of complex, advanced industrial technologies that are expensive and difficult for most Third World countries. The biggest hurdle for most countries is the production of special nuclear material that forms the core of the weapon. Highly enriched uranium (HEU) is obtained by separating uranium isotopes. Weapons-grade plutonium is produced by irradiating uranium in a reactor. Other technologies are needed to assemble a nuclear device and make the device into a deliverable weapon. [ ]

#### Uranium Enrichment

*Gaseous diffusion* has been used on a large scale to enrich uranium by the five declared nuclear weapons states—the United States, USSR, the United Kingdom, France, and China. Argentina has a gaseous diffusion plant, but the plant has serious technical problems, is currently not operating, and probably is incapable of producing HEU. [ ]

*Electromagnetic isotope separation (EMIS)* is an early but very costly method used to produce HEU; it is reliable, and the technology is publicly available. The United States used this method for the "Little Boy" bomb dropped on Hiroshima. The process requires expensive facilities, is labor intensive, and consumes large amounts of electrical power. Iraq had a large EMIS development effort under way before the war in the Gulf. [ ]

*The gas centrifuge process* has emerged as the technology of choice for many small-scale producers because it is less costly to operate and the technology is relatively easy to acquire. Commercial centrifuge plants are operated by the United States, the United Kingdom, Germany, Netherlands, Japan, and the USSR. China plans to use centrifuges to enrich uranium for power reactor fuel. Pakistan produces HEU in centrifuges; South Africa, India, Brazil [ ]

[ ] are developing the technology. Iraq had a centrifuge development effort before the Persian Gulf war. [ ]

*Aerodynamic separation* was used by South Africa to produce enough HEU for several weapons. Brazil constructed a small pilot plant [ ] Both are now abandoning this process because of its high power consumption and the difficulty in obtaining certain unique components. [ ]

*Chemical separation* processes have been developed by France and Japan. It was originally advertised as proliferation-proof because it supposedly could not be used to produce HEU. It has now become clear that these processes can be used to enrich uranium economically using mostly standard equipment and materials. [ ]

*Laser isotope separation (LIS)* is being developed as a low-cost commercial enrichment method by the United States, France, and the United Kingdom. All the equipment needed to conduct LIS research is commercially available, but enrichment plants require special high-power lasers and other technologically advanced equipment. [ ]

#### Plutonium Production

Plutonium is produced when natural or low-enriched uranium is inserted in an operating nuclear reactor, either as a fuel or as a target material. Many different types of reactors have been built, and the pace and suitability of plutonium produced for weapons vary with reactor type. [ ]

*Graphite reactors* were the first nuclear reactors built and are among the least technically demanding. The majority of US weapons-grade plutonium and virtually all weapons-grade plutonium in the USSR, the United Kingdom, France, and China have been produced in graphite reactors. North Korea has a small

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graphite reactor that began operation in 1987 and is building a much larger one. Pakistan is developing this type of reactor, and the Brazilian Army is planning to construct one. [ ]

Heavy water reactors have been used by Israel and India as a source of plutonium for weapons, and Pakistan is building one for this purpose. Algeria is believed to be building a heavy-water reactor for plutonium production. Taiwan had a heavy-water research reactor that was decommissioned in the late 1980s. [ ]

Heavy water is produced in Canada, the USSR, India, Romania, Norway, and China. [ ]

Light-water reactors are the most widely built type of power and research reactors. They do not produce plutonium as efficiently as either graphite or heavy-water reactors. Only the USSR has used this type of reactor to support a weapons program. Israeli suspicion that Iraq might have attempted to do so with the Osirak reactor led to Israel's 1981 bombing of that facility. [ ]

Fast-breeder reactors have been developed in the USSR, France, Japan, and India. Should this technology become commercially competitive in the future, large quantities of plutonium will be produced and move through international nuclear markets. [ ]

The second step in obtaining weapons-grade plutonium is its separation from other elements in the irradiated material through *fuel reprocessing*. Although the separation technology is not especially complex, the safety measures required to handle highly radioactive and toxic material demand carefully designed equipment and facilities. [ ]

#### Other Technologies

Nations intent on building an indigenous nuclear weapons capability face additional challenges in designing and manufacturing nuclear devices and making these into deliverable weapons:

- **Weapons design.** The two basic types of first-generation nuclear weapon designs are "gun assembled" and "implosion assembled" (referring to

the method by which a supercritical "assembly" of fissile material is created). While implosion-assembled devices are more efficient—in terms of yield per kilogram of fissile material—they are more complex designs, requiring good conventional explosives capability, extensive shock-wave physics expertise, high-speed diagnostics equipment, and hydrodynamic test facilities. The technical know-how required to build either type of weapon can be gleaned from open sources.

- **Manufacture.** Manufacturing a nuclear weapon requires the ability to machine toxic, radioactive, and explosive materials to relatively small tolerances. Nuclear weapons are manufactured using precision machining equipment in well-ventilated, glove-box-type facilities.
- **Testing.** Detonating nuclear devices in the atmosphere or underground requires a suitable location but presents little technological challenge. Third World countries may view tests as unnecessary and undesirable.
- **Weaponization.** Weaponizing a nuclear explosive device requires electrical engineering expertise and reliable electronic components, including power supplies, capacitors, detonators, and high-speed switches. [ ]

#### Chemical Weapons<sup>1</sup>

Chemical agents must be produced in ton quantities to be significant in a conflict. The most common agents—blood, blister, choking, and nerve agents—are the products of specific precursors. They sometimes can be identified when equipment and materials characteristic of their production are observed. [ ]

**Precursors** are the chemicals from which an agent is synthesized. Some precursors are rarely used outside CW-agent synthesis. Others, such as sodium fluoride,

<sup>1</sup> See Weapons and Space Systems Intelligence Committee (WSSIC), *The Chemical and Biological Warfare Threat: Collection Support Brief* (DCID, 10014-91), March 1991, for an authoritative categorization of countries with "confirmed" or "suspect" programs and detailed discussion of the nature of the threat. [ ]

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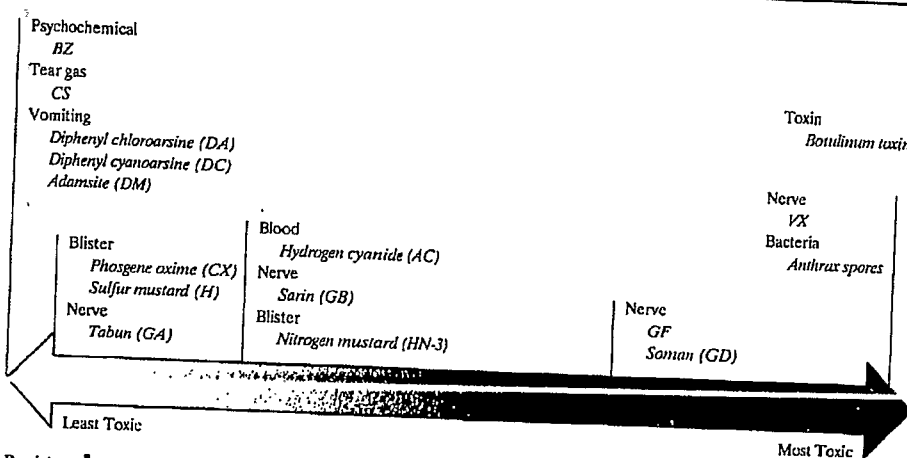
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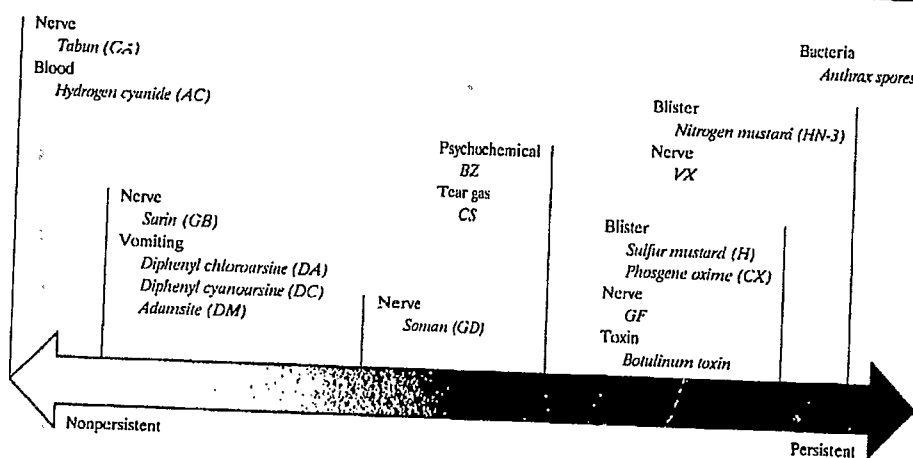
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**Figure 13<sup>a</sup>**  
**Chemical and Biological Warfare Agents**

Relative Toxicity



Persistence<sup>a</sup>



<sup>a</sup> Persistence reduced at higher temperatures

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however, are common and have a variety of commercial uses. A robust international trade in the latter makes the identification of illicit use difficult. Moreover, when some countries—such as the United States, Japan, and countries in Western Europe—try to control chemical agent proliferation by restricting shipments of precursors, countries such as Libya and Iraq find new suppliers. [ ]

New toxic chemicals are on the way. The chemical industry produces intermediate and waste products that have properties that make them attractive as chemical agents. Some of these byproducts of legitimate chemical manufacture can be easily hidden. Some can penetrate gas masks. [ ]

#### Biological Weapons

Although commonly grouped with chemical weapons, biological weapons are unique, comprised of living organisms and the products of living organisms. These include: human, plant, and animal pathogens such as viruses, bacteria, and rickettsia; toxins and venoms either whole or fragmented; and other biochemicals that can have a deleterious effect on humans, plants, or domestic animals. [ ]

Biological agents can be highly effective, even in small quantities or at very low concentrations. Significant quantities of these agents are, therefore, much harder to detect and easier to transport than chemical agents. Living agents often can be passed from one person to another, spreading the effect far beyond the area of original dissemination. Moreover, as modern warfare concentrates on the destruction and denial of supply and logistics, biological agents used behind the lines can be highly effective; they often can be surreptitiously disseminated with only a small risk of detection and retaliation. [ ]

In their simplest form, biological agents can be obtained from culture collections, hospitals, biomedical research laboratories, and even soil samples. Some sophisticated programs incorporate genetic engineering techniques that can make the agent difficult to detect and hard to protect against or, in some instances, make it nearly impossible to treat casualties. [ ]

The growth of pharmaceutical and agricultural biotechnology industries worldwide over the past decade has enabled developing countries to produce biological agents. These countries ordinarily establish an organization for research, development, testing, and production of agents that is separate from the mainstream of their legitimate biological endeavors. Sometimes this organization is part of the military or is subordinated to it. Countries are, however, increasingly aware that establishing a program in conjunction with the military is a tipoff, so they are beginning to hide their BW work behind legitimate activities. [ ]

#### Ballistic Missiles

##### Range and Payloads

Since Third World test programs are often cursory, most of the data on the ranges of missiles discussed in this Estimate are necessarily speculative.<sup>4</sup> Most Third World ballistic missiles are SRBMs (less than 1,000 km in range), but some countries are working on MRBMs (1,000 to 3,000 km). The CSS-2 is technically an IRBM (3,000 to 5,500 km); none are working on ICBMs (more than 5,500 km). [ ]

Both payload weight and flight profile affect missile range. Israel developed the Shavit SLV from its Ya-3 MRBM. If Israel, in turn, converts this SLV to a ballistic missile, the result would be an IRBM or ICBM, depending on the payload. Similarly, Indian, Brazilian, and other SLV programs could lead to the development of ballistic missiles with extended ranges. During the period of this Estimate, the Ya-3, the Agni, and perhaps the Nodong-1 missiles most likely will be able to deliver large payloads over 1,000 km. [ ]

The type of warhead is crucial to missile effectiveness. In the Third World, missiles generally have rudimentary guidance systems, so that even heavy conventional warheads are of marginal military value. The

<sup>4</sup> Authoritative analyses of these systems are included in DIA's *Proliferation of Missile Technology to the Third World* (VPT-1000S-177-91), March 1991, NPIC's *Third World Ballistic Missile Proliferation* [ ] 28341/90, July 1990, and WSSIC's *Missile Proliferation: Collection Support Brief* (DCIC 10031-90), June 1990). [ ]

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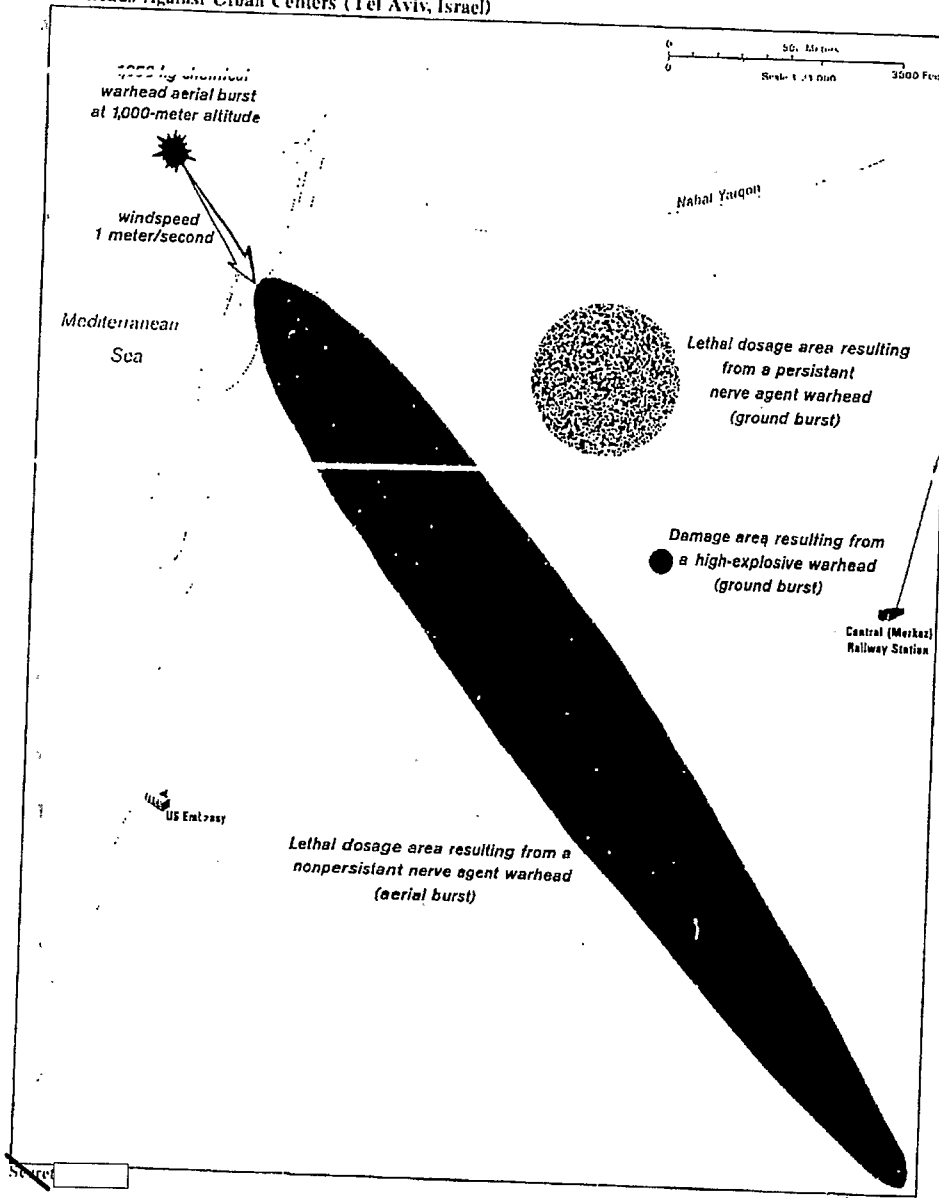
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Figure 14  
Comparative Effects of Air and Ground Burst  
Warheads Against Urban Centers (Tel Aviv, Israel)



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## Ballistic Missile Systems

	Range (kilometers)	Payload (kilograms) <sup>a</sup>	Comments
Agni	2,000	1,000	Flight-tested
B610	150	200	Exported; Aka CSS-8, 8610
Condor II	900	500	Prototype
CSS-2	3,000	2,000	Deployed
Haif I	80	450	Deployed
Haif II	300	450	Flight-tested
Hyonmu	500 <sup>b</sup>	500	Deployed; Aka NHK-2
Iraqi Scud	600	300	Used; Aka Al Husayn
Iraqi Scud	600	500	Used; Aka Al Abbas
M-9	600	500	Flight-tested; Aka CSS-X-6
M-11	300 <sup>c</sup>	800	Flight-tested; Aka CSS-X-7, Haif III
NHK-1	200	500	Deployed
No Dong-I	1,000	1,000	Prototype
Prihvi	150 <sup>d</sup>	1,000	Flight-tested
Scud B	500	1,000	Used
Scud C	500	750	Exported; Aka North Korean Scud
SS-21	70	500	Deployed; Aka Scarab
SS-23	400	700	Deployed; Aka Spider
Ya-1	500	1,000	Deployed; Aka Jericho I
Ya-2	1,500	1,800	Flight-tested; Aka Jericho II

## Notes:

<sup>a</sup> Nominal for the ranges specified; warheads normally weigh 200 kg less than payloads, which include reentry vehicle structure and fuzing mechanisms.

<sup>b</sup> Reportedly constrained to 250 km by its guidance system at this time (May 1991).

<sup>c</sup> May have a 400-km maximum range.

<sup>d</sup> May have a 250-km range with a 500-kg payload.

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MTCR payload threshold of 500 kg was chosen to severely constrain Third World nuclear delivery capabilities, since payloads with first-generation nuclear warheads are likely to exceed that weight.

The MTCR weight limit, however, is much less meaningful for chemical or biological warheads, which can be much lighter than nuclear warheads but still cause heavy casualties if detonated over targets or in salvos. For example, a few CW warheads or a

single BW warhead detonated over an urban area could inflict massive civilian casualties (see figure 14 for an example of the hypothetical lethality of a single accurately detonated 1,000-kg CW warhead). Several lighter CW warheads or a single BW warhead would be even more lethal. Consequently, some countries are now proposing that the MTCR payload threshold be lowered or eliminated.

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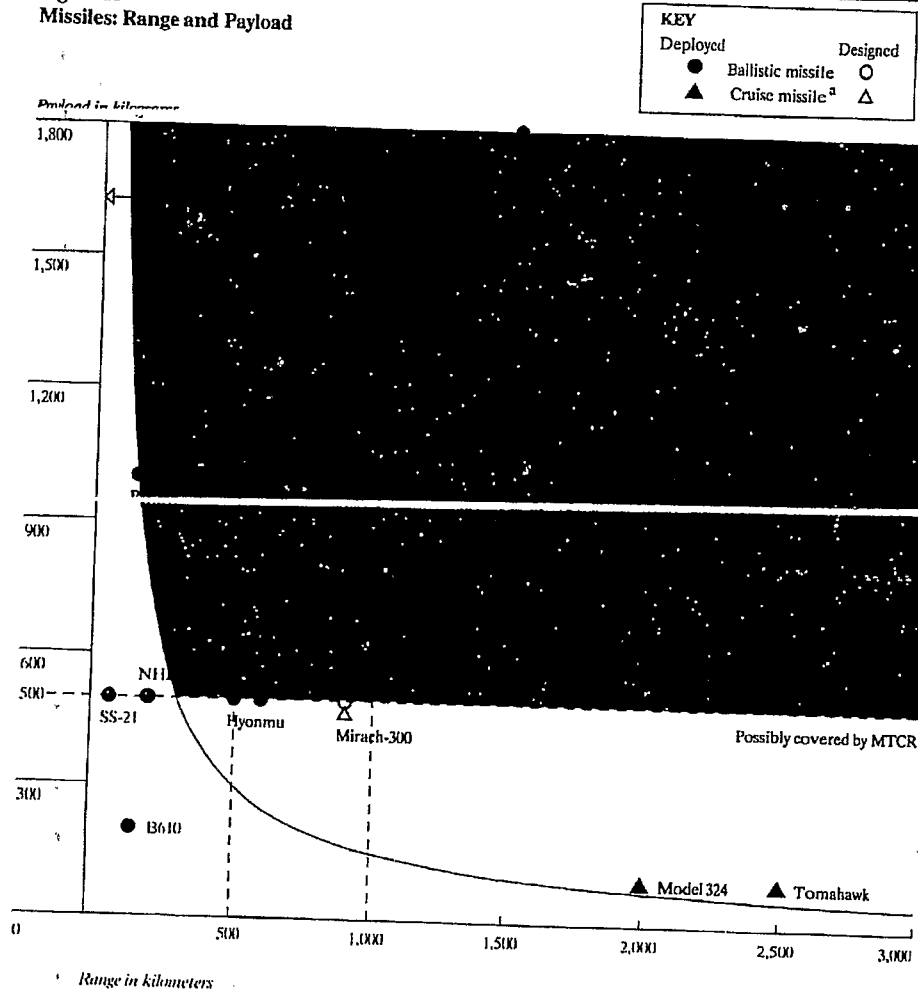
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**Figure 15**  
**Missiles: Range and Payload**



<sup>a</sup> For an excellent account of cruise missiles and their range-payload capabilities, see RTT 91-10017, January 1991: *The Worldwide Market for Unmanned Air Vehicles (UAV): New Customers and New Missions*.

The Mirach-300 is an Italian system suitable for reconnaissance or strike missions; Model 324 is an Egyptian UAV for reconnaissance, but the payload is about the same as the US Tomahawk missile.

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As the decade progresses, several Third World nations are likely to acquire cruise missiles. These will present particularly complicated challenges to MTCR thresholds, since they typically carry light payloads over very long distances. Moreover, advanced aerospace industries will market applicable propulsion and guidance technology in the Third World during this period. [ ]

#### Technologies Convertible to Ballistic Missile Programs

The propulsion subsystems for sounding rockets, SAMs, and SLVs are suitable for conversion to ballistic missile propulsion. When a country decides to build an SLV, it generally derives the initial version from a ballistic missile. As the SLV technology is developed, it may then be rapidly redirected toward the improvement of ballistic missiles. India, for example, is combining SLV and SAM technology in developing the Agni. Brazil hopes to convert its large Sonda-IV rocket to an SLV. Once the technology and materials needed for thrust control, staging, and the recovery of scientific payloads are acquired, they can be adapted fairly easily for use in ballistic missiles and can be transferred to other countries. [ ]

Reentry vehicle design, whatever the warhead (conventional, nuclear, chemical, or biological), requires a structure that will accommodate the size and shape of the payload, minimize weight, and survive reentry. SRBMs require relatively unsophisticated reentry vehicle technology, since they travel at lower, less stressful velocities. Aerodynamic modeling and precise guidance nevertheless remain crucial for the reliable performance of SRBMs against military targets. Reentry vehicles carried by MRBMs, IRBMs, and ICBMs experience high temperatures and dynamic stress during reentry. Maintaining accuracy during these reentries requires special materials, advanced fabrication technology, and sophisticated modeling to predict, for example, shape changes caused by heating during reentry. [ ]

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## Annex C

### Control Regimes

#### Nuclear

The nuclear Non-Proliferation Treaty (NPT)—signed by 140 nations—forbids nuclear weapon states from transferring nuclear explosives to any other state or assisting nonnuclear weapon states in manufacturing or otherwise acquiring nuclear weapon or explosive devices. It also forbids nonnuclear weapon states from receiving, manufacturing, or acquiring nuclear weapons or nuclear explosives and requires them to adopt full-scope safeguards applied by the International Atomic Energy Agency (IAEA). It also requires the application of IAEA safeguards to any nuclear material or facility that a party may provide to another nonnuclear weapons state. Several key countries have not signed the NPT: China, India, Pakistan, and Israel. The *Zangger Committee* develops a trigger list of items that NPT parties can export only under safeguards.

The IAEA develops and applies safeguards on declared facilities in NPT member countries. These safeguards are designed to detect and deter diversion of nuclear material to military purposes. Some nonsignatory states have accepted safeguards on imported facilities when it is required by the supplier. Historically, inspections of safeguarded facilities have been scheduled periodically rather than "on demand."

The Nuclear or "London" Suppliers Group consists of states that have made unilateral commitments to require safeguards as a condition before they will supply certain items specified on a list developed by the group. In addition, this group has formed a working group charged with developing new and detailed multilateral controls to be placed on nuclear-related dual-use items.

#### Chemical and Biological

The 1925 Geneva Protocol intends to prohibit the use of asphyxiating, poisonous, or other gases and bacteriological agents. It does not prohibit the manufacture, stockpiling, or even the sale or transfer of CW and BW agents. The protocol was signed with reservations by most parties, usually that the protocol ceased to be binding against an enemy that did not observe its provisions.

The Conference on Disarmament in Geneva is negotiating a comprehensive, global, and verifiable ban on all chemical weapons. In 1989, 149 nations issued the Paris Declaration calling for a ban on CW. However, negotiations have not successfully concluded a treaty.

The *Australia Group* is an informal group of 20 countries whose representatives meet twice a year to review chemical and biological weapons proliferation. It encourages members to harmonize and impose national export controls on precursor chemicals and to control chemical- and biological-agent production technology and equipment.

The Biological and Toxin Weapons Convention (BWC) was negotiated in 1972 and entered into force in 1975. Thus far, 111 countries are signatories including the United States, the United Kingdom, and the USSR, the depositories for the Convention. Officially entitled the "Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and

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**GRAPHIC MATERIAL**  
MAY NOT REPRODUCE CLEARLY

**Figure 16**  
**Control Regime Membership**  
**April 1991**

	Missile <sup>a</sup>	Chemical and Biological Warfare <sup>b</sup>	Nuclear <sup>c</sup>
Australia	•	•	•
Austria	•	•	•
Belgium	•	•	•
Bulgaria			•
Canada	•	•	•
Czechoslovakia			•
Denmark	•	•	•
Finland	•		•
France	•	•	•
Germany	•	•	•
Greece	•	•	•
Hungary			•
Ireland		•	•
Italy	•	•	•
Japan	•	•	•
Luxembourg	•	•	•
Netherlands	•	•	•
New Zealand	•	•	
Norway	•	•	•
Poland			•
Portugal	•	•	•
Spain	•	•	
Sweden	•		•
Switzerland	•	•	•
United Kingdom	•	•	•
United States	•	•	•
USSR			•

<sup>a</sup> Missile Technology Control Regime.<sup>b</sup> Australia Group.<sup>c</sup> London Suppliers Group or Zangger Committee.

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on Their Destruction," its first three Articles contain these key provisions:

- Article I forbids any country to develop, produce, stockpile or otherwise acquire or retain any biological agents or toxins, except for peaceful purposes, or to develop weapons to deliver such agents.
- Article II requires signatories to destroy or to divert to peaceful purposes any agents, toxins, weapons, equipment, or means of delivery they possess within nine months.
- Article III requires that none of the agents, toxins, weapons, equipment, or means of delivery possessed by a country be transferred to any recipient whatsoever.

#### Ballistic Missiles

The *Missile Technology Control Regime* (MTCR) is the international mechanism for controlling ballistic missile technology. It was announced in April 1987 by the United States and its six economic summit partners—the United Kingdom, Japan, France, Germany, Italy, and Canada. The MTCR essentially is a non-binding agreement to restrict the transfer of missile systems and production technology to nonmembers. Members agree to regulate the export of key technologies to control the development of ballistic missiles, SLVs, sounding rockets, cruise missiles, and other systems capable of delivering a 500-kg payload to a distance of 300 km.

Two categories of equipment and technology are controlled:

- Category I comprises complete systems and subsystems, complete missile stages, thrust vector controls and guidance mechanisms, and facilities to produce these items. There is a presumption of denial for all category I exports.

- Category II comprises less sensitive and dual-use equipment and technology needed to manufacture or support the manufacture of category I items. This includes certain computers, propellants, special materials, and guidance components. End-user assurances are to be obtained prior to export.

During the first two years of its existence, the MTCR's most notable success was in helping mobilize international opinion against the Condor II program in Argentina, Egypt, and Iraq. Nevertheless, different interpretations—especially on SLV and dual-use technology—among the members hampered the MTCR's effectiveness. Sensitive exports were diverted through nonmember countries. Furthermore, nonmembers such as China and North Korea aggressively marketed missile technology, and the Soviet Union continued shipping hundreds of Scuds to Afghanistan.

Prospects for MTCR effectiveness have improved somewhat. Membership has increased to 16, and the Soviet Union has agreed to join if invited. The French are acting as a clearing-house for information exchange, and new member states have been helpful in specifying the types of dual-use technology that are subject to licensing. Some member countries are amending their export laws to cover items that were decontrolled by COCOM. Control of commercially lucrative SLV technology, however, will continue to be a very difficult issue.

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