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The nuclear weapons programs of Israel and Pakistan : similarities of obsession

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Similarities of obsession**

Mosher, Timothy Craig, M.A.

San Jose State University, 1991

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**THE NUCLEAR WEAPONS PROGRAMS OF ISRAEL AND PAKISTAN:
SIMILARITIES OF OBSESSION**

**A Thesis
Presented to
The Faculty of the Department of Political Science
San Jose State University**

**In Partial Fulfillment
of the Requirements for the Degree
Master of Arts**

**by
Timothy Craig Mosher
December, 1991**

APPROVED FOR THE DEPARTMENT OF POLITICAL SCIENCE

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ABSTRACT

THE NUCLEAR WEAPONS PROGRAMS OF ISRAEL AND PAKISTAN: SIMILARITIES OF OBSESSION

by Timothy Craig Mosher

This thesis shows the high degree of similarity between the nuclear weapon programs of Israel and Pakistan, nations with largely dissimilar resources and geopolitical situations. An extensive comparison of program histories, and especially of nuclear acquisition methods, resulted in several conclusions. The two programs share highly comparable motivations, means, and (given the different ages of the bomb programs) results. Though differences in the programs exist, most are superficial and do not significantly alter program drives and goals. Importantly, the two nations relied heavily on the same acquisition technique, covert purchases of nuclear-related materials and systematic evasions of the nuclear control regime (headed by the United States). The thesis concludes with implications for potential nuclear proliferators and for the control regime.

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LIST OF ABBREVIATIONS AND ACRONYMS

ATBM	anti-tactical ballistic missile
C3	command, control, and communications
EEC	European Economic Community
EURATOM	European Atomic Energy Commission
FDO	Fysisch Dynamisch Onderzoekslaboratorium (Physical Dynamics Research Laboratory)
HWR	heavy water reactor
IAEA	International Atomic Energy Agency
IRBM	intermediate-range ballistic missile
KANUPP	Karachi Nuclear Power Plant
kt	kiloton
LWR	light water reactor
mt	megaton
MTCR	Missile Technology Control Regime
NNPA	Nuclear Non-Proliferation Act
NPT	Nuclear Non-Proliferation Treaty
NNWS	non-nuclear-weapon state(s)
NSG	Nuclear Suppliers Group
NWS	nuclear-weapon state(s)
PAEC	Pakistan Atomic Energy Commission
PINSTECH	Pakistan Institute of Nuclear Science and Technology
PLO	Palestinian Liberation Organization
Pu	plutonium
SDI	Strategic Defense Initiative

SNF	small nuclear force
SRBM	short-range ballistic missile
U	uranium
UK	United Kingdom of Great Britain and Northern Ireland
UN	United Nations
USA	United States of America
USSR	Union of Soviet Socialist Republics

CHAPTER 1

INTRODUCTION

It has always been our intention to develop a nuclear potential.
We now have that potential.

Ephraim Katzir, President of Israel

If India builds the bomb, we will eat grass and leaves, even go
hungry. But we will get one of our own. We have no alternative.

Zulfikar Ali Bhutto, President of Pakistan¹

The nuclear era is as filled with political longings and desires as any preceding era. Nations facing particularly disadvantageous external circumstances may find their hopes fleeting, their goals fatally dependent on increasingly awesome machineries of war. In several cases, vulnerable nations have selected a nuclear weapons option, bargaining that the nuclear genie might make surrounding armies turn away and murderous threats vanish.

The Middle Eastern states of Israel and Pakistan are two such nations. Both have pursued a nuclear option single-mindedly despite considerable obstacles, and in opposition to major external threats. Both believe a nuclear option is crucial for national survival. And neither nation has let any barrier stand in the way. Despite dissimilar resources, industrial development, and geopolitical situations, similar driving motivations and mindsets power the nuclear weapons programs of Israel and Pakistan—with parallel results.

¹Quoted in Steve Weissman and Herbert Krosney, The Islamic Bomb: The Nuclear Threat to Israel and the Middle East (New York: Times Books, 1981): 105 and 161 respectively.

This thesis will demonstrate the predominant similarity of the two nuclear weapons programs in conduct, methods, and outcome.

This thesis will especially test the hypothesis that the two nations used similar means to bypass the international control regime (which intends to prevent the horizontal proliferation of nuclear arms) in many aspects of weapons acquisition.

This study will be largely non-quantitative. It will rely on the running record (the enduring written record over an extensive period of time), including published governmental policies and laws, treaties and international organization documents, speeches and statements by principal figures, journalistic reports (especially from premier newspapers), and the wealth of journalistic and scholarly material on military technology and strategy. Descriptions of the nuclear arsenals of Israel and Pakistan are not officially available; of necessity, this paper will rely on estimates by leading proliferation experts, unofficial program participant accounts, and official pronouncements by interested governments.

One basic assumption for this thesis is that non-proliferation is a worthwhile arms control objective. Though political scientists are not unanimous in this normative belief, the great majority in the West hold it firmly. Many international systems analysts, for example, believe that proliferation diminishes international stability and leads to particular regional dangers (to cite a few: Morton Kaplan, Karl Deutsch, J. David Singer, and Richard Rosecrance).² The heightened risks of nuclear use in a

²See Morton A. Kaplan, "Variants on Six Models of the International System," in International Politics and Foreign Policy, ed. James N. Rosenau (New York: The Free Press, 1969): 303 on incomplete nuclear diffusion; Karl

local conflict, use by accident, or use by subnational groups, make proliferation an especially ominous aspect of the nuclear weapons problem. Thus, successful nonproliferation efforts reduce several risks, many hold. This study is based on that belief.

This thesis will discuss the motivations and mindsets of Israel and Pakistan in the context of their weapon acquisition and current forces and capabilities. An analysis featuring comparison and contrast will then evaluate the two programs, and the paper will conclude with a brief commentary on ramifications for proliferation prevention. Appendices (including a glossary), tables, and maps supplement the text.

Descriptions of Israeli and Pakistani programs will be preceded by an introduction to the nuclear fuel cycle, which creates the uranium and plutonium necessary for nuclear explosives, and to the international control regime, which attempts to prevent the spread of nuclear weapons.

W. Deutsch and J. David Singer, "Multipolar Power Systems and International Stability," World Politics Vol. 16 (1964): 390-406; and Richard N. Rosecrance, "Bipolarity, Multipolarity, and the Future," Journal of Conflict Resolution Vol. 10 (1966): 314-327.

CHAPTER 2

THE TECHNOLOGY AND POLITICS OF PROLIFERATION

Nuclear weapons proliferation is possible largely because nuclear power programs around the globe make fissile materials (uranium-235 and plutonium-239) or the technology for their production available. (Fissile materials readily split, or fission, at an atomic level when struck by a slow neutron, releasing more neutrons and causing a chain reaction.) The nuclear weapons/nuclear power connection, and the political regime intended to stop or slow the misuse of that connection, are described generally below to provide a setting for the specific courses chosen by Israel and Pakistan.

The Nuclear Fuel Cycle

Controlled chain reactions of fissile material can produce heat for power generation or neutrons for research. Extremely rapid and uncontrolled chain reactions result in nuclear explosions. Since the processes for the production of useful fissile materials are the same regardless of application, nuclear power or research capabilities inevitably are accompanied by nuclear weapons potential.

Two types of nuclear fuel can be used in atomic weapons, uranium-235 and plutonium-239, both derived ultimately from uranium ore. These fissile materials are processed in a typical light-water reactor (LWR) fuel track in six steps (see also Figure 2-1 and Appendix 1: Glossary).

Step one—mining and milling. Uranium ore is mined and milled (often on site) to form yellowcake, an eighty percent uranium oxide (U₃O₈) concentrate.

Step two—conversion. The yellowcake is converted into uranium hexafluoride, often in gaseous form, in preparation for enrichment.

Step three—enrichment. The concentration of the fissile isotope U-235 is increased through one of four complex procedures: the gaseous diffusion, gas centrifuge, jet-nozzle, and laser techniques. The desirable isotope is present in natural uranium at 0.7 percent; LWRs require lightly-enriched uranium (about three percent U-235) to sustain a power-producing chain reaction. Uranium can be enriched much further, however; when it is enriched to ninety percent U-235, it is regarded as weapon-grade and can be used to construct nuclear explosives.¹

Step four—fuel fabrication. The lightly-enriched uranium is fabricated into fuel rods of uranium oxide (UO₂).

Step five—reactor use. The fuel rods are used, or “burned” in a reactor core moderated and cooled by ordinary, or “light” water. (A moderator is a material that slows neutrons and thus enables a sustained nuclear chain reaction). The diversion of fuel rods during loading or unloading could make fissile material available during this stage.

Step six—fuel rod disposition. In a once-through fuel track, “spent” or “burned” fuel rods are stored for cooling and later disposed of as high-level radioactive waste. However, fissile materials can be withdrawn from the rods and recycled instead (see Figure 2-2). The fuel rods are reprocessed, a chemical technique by which “unburned” U-235, Pu-239 (created by the irradiation of fuel rods in the reactor core), and waste products are separated.

¹More cumbersome nuclear explosives can be made with any highly-enriched uranium (over twenty percent U-235).

The fissile materials can be used again in the fuel cycle. Recovered U-235 can be mixed with unenriched uranium to produce mixed-oxide fuel rods in an additional step. The reprocessed materials can also be diverted for bomb production.

An alternate fuel cycle, based on heavy water reactors (HWRs), differs in that unenriched uranium is used to fabricate fuel rods, and heavy water ($^2\text{H}_2\text{O}$, which contains deuterium, a heavy isotope of hydrogen) is used as moderator. This reactor type is important because a few fuel rods can be removed from an HWR while the reactor continues to operate (unlike a LWR), creating another point at which diversion is possible. Additionally, such a diversion could be masked by the constant refueling characteristic of HWRs (and not of LWRs). Also, HWRs are more frequently used for secondary irradiation in which fertile materials (such as U-238 and thorium-232) are blanketed around the reactor to absorb neutrons and produce fissile U-235 and Pu-239 (this operation remaining entirely outside the operating system of the core). Thus, most experts consider HWRs more proliferation-prone than LWRs.²

In sum, diversion of fissile materials is possible at several points in the nuclear fuel cycle, most importantly during enrichment, reactor use (especially in HWRs), and reprocessing.

²David Fischer and Paul Szasz, Safeguarding the Atom: A critical Appraisal, ed. Jozef Goldblat (London and Philadelphia: Taylor and Francis, 1985): 47-50.

Just fifteen kilograms of highly-enriched uranium can produce a nuclear explosion. Only about five kilograms of plutonium-239 are needed.³ Fissile materials and the processing which produce them comprise the crucial elements of nuclear weapons acquisition. Weapon design and delivery pose lesser challenges; mastery of the fuel cycle remains the most difficult problem for those pursuing the bomb.⁴

The Nuclear Control Regime

International efforts to prevent or manage proliferation date back to the beginning of the atomic era.⁵ During the 1960s and 1970s, a control regime consisting of nuclear weapon states (NWS) and other major suppliers of nuclear technology emerged. The regime has attempted to limit the production of weapons-destined fissile materials through international agencies, diplomacy, political incentives, and restrictive export policies. Currently the control regime is manifested in five primary components.

³Mitchell Reiss, Without the Bomb: The Politics of Nuclear Nonproliferation (New York: Columbia University Press, 1988): 273-275.

⁴General sources for this section on the technology of proliferation are: Thomas B. Cochran, William A. Arkin, and Robert S. Norris, "U.S. Nuclear Weapons Production: An Overview," Bulletin of the Atomic Scientists Vol. 44 No.1 (Jan/Feb. 1988): 12-16; Paul Leventhal, "The Nuclear Power and Nuclear Weapons Connection," Social Education Vol. 54 No. 3 (March 1990): 146-50; David J. Rose and Richard K. Lester, "Nuclear Power, Nuclear Weapons, and International Stability," Scientific American Vol. 238 No. 4 (April 1978): 45-57.

⁵Examples include the United Nations Atomic Energy Agency (established in 1946), the precursor to the IAEA: the Baruch Plan, a USA proposal for an international omnibus atomic agency; and the UN Committee on Disarmament and its predecessor, the Eighteen-Nation Disarmament Committee (established in 1961).

First, the spread of nuclear weapons is addressed diplomatically by the Nuclear Non-Proliferation Treaty (NPT), signed originally on 1 July 1968. Over 130 non-nuclear weapon states (NNWS) have ratified the treaty in addition to the NWS sponsors, the USA, UK, and USSR. Under the treaty, NNWS agree not to manufacture or receive nuclear explosives, or to export nuclear technology without careful controls. They also agree to accept safeguards on their nuclear facilities including inspections and audits of nuclear materials, and to help disseminate information on peaceful uses of nuclear technology. In turn, the NWS signatories pledge not to help other nations build the bomb, but also agree to share “peaceful” nuclear technology with developing countries. All parties (though NWS are particularly obligated) pledge to pursue the cessation of the nuclear arms race, nuclear disarmament, and a treaty on general and complete disarmament. Finally, the treaty includes provisions for amending the NPT and for periodic review conferences. The NPT will expire unless extended in 1995.⁶

While the NPT can be regarded as an effective part of the control regime, several key states (including NWS France and China, plus undeclared nuclear powers Israel, South Africa, India, and Pakistan) are not parties. Moreover, tensions resulting from the built-in discrimination between nuclear “haves” and “have-nots” threaten the treaty’s extension. Review conferences in 1985 and 1990 were filled with bitter recriminations as NNWS charged the NWS sponsors with meager efforts in arms control

⁶U.S. Arms Control and Disarmament Agency, Arms Control and Disarmament Agreements, Text and Histories of Negotiations (Washington, D.C: Government Printing Office, 1982): 82-95.

(singling out the lack of negotiations for a comprehensive nuclear test ban, long regarded as an important goal by many NNWS). Critics of the NPT also point out that any signatory can legally withdraw from it with just three months notice, a tactic which might be exploited by a nation pursuing a nuclear weapon program while using the NPT to reassure its neighbors. And, many experts wonder if it is possible to simultaneously advance "peaceful" nuclear energy programs and suppress bombs built with the same technology. Still, most observers believe that the international consensus against proliferation embodied by the NPT has probably prevented the development of the bomb by a number of states. Most hope that the NPT is extended, perhaps in altered form, in 1995. The recent announcement by France that it will sign the NPT is widely viewed as a boost for extension proponents.⁷

Second, the International Atomic Energy Agency (IAEA) has been given the tremendous responsibility of monitoring nuclear programs. The UN-affiliated body conducts nuclear plant design reviews (for both the new and old facilities), audits the amounts of nuclear materials received and used, and analyzes reports from nuclear facilities and national atomic energy agencies, conducts inspections, and monitors sensitive facilities by tamper-proof sensors (activities collectively known as "safeguards"). The IAEA has over 110 member countries and oversees more than seven hundred

⁷For more detailed discussions of the NPT and its deficiencies, see Fischer and Szasz, 17-18 and 80-82; Warren H. Donnelly, "Managing Proliferation in the 1990s, 'Something Borrowed, Something New...'" Social Education Vol. 54 No. 3 (March 1990): 156-158; and Ben Sanders, "Non-Proliferation Treaty: A Broken Record," Bulletin of the Atomic Scientists Vol. 46 No. 6 (July/Aug. 1990): 15-18.

installations (including nuclear conversion, enrichment, reactor, and reprocessing facilities) in over fifty nations. NPT signatories are required to negotiate safeguards agreements with the IAEA, and individual transfers of nuclear materials between states are also often safeguarded through the agency. Non-NPT states with some safeguarded facilities also negotiate agreements with the IAEA when alterations or additions to their materials are contemplated.⁸

Weaknesses of the IAEA include many shared by international organizations in general: lack of enforcement power, understaffing, inadequate budgets, and ambiguity in agency statutes resulting from quarreling members. These factors have lead the agency to conclude in a 1988 report that the diversion of a bomb's worth of fissile material has a significant chance of going unnoticed even if IAEA inspection goals are met.⁹ Also, though about ninety percent of nuclear plants outside of the NWS are safeguarded, key facilities in several nations are not. And ominously, "IAEA safeguards do not and cannot exclude the possible existence of a secret plant."¹⁰ The agency is not set up to detect an independent, undeclared fuel cycle, and in fact must rely on the accuracy of the initial report of each

⁸An example is the IAEA agreement with non-NPT Pakistan over additional fuel rods for the safeguarded KANUPP reactor in 1968.

⁹Richard Bolt, "Plutonium For All: Leaks in Global Safeguards," Bulletin of the Atomic Scientists Vol. 44 No. 10 (Dec. 1988): 14.

¹⁰Fischer and Szasz, 36. A former IAEA inspector, Robert Richter, has noted that "You have no authority to look for undeclared nuclear materials. Your job is to verify that the declared material accountancy balance is correct." Quoted in Weissman and Krosney, 22.

country which signs an agreement with it. Despite misgivings, virtually all concerned analysts view the IAEA as a crucial regime component, and many provisions for its improvement have been suggested.¹¹

Third, the Nuclear Suppliers Group (NSG) coordinates efforts by most exporters of nuclear-related technology and equipment to guard against misapplication in importing nations.¹² Guidelines restricting sales of sensitive hardware and information complement IAEA safeguards on nuclear materials, so much so that the agency has circulated the ever-updated Trigger List (so called because the sale of items on the list trigger special safeguards agreements as a requirement of sale) as IAEA document INFCIRC/209 to all members. NSG guidelines also require NNWS recipients of nuclear technology to refrain from the manufacture of nuclear explosives, accept IAEA safeguards on the transaction, assure physical security to prevent theft or sabotage, agree not to retransfer materials without the consent of the original seller, and use “restraint” in exports of sensitive items.¹³ The groups arose in 1974 as an extension of earlier cooperation

¹¹For a detailed description of the IAEA, see Fischer and Szasz in entirety. See also Jon Jennekens, “The IAEA, International Safeguards and the Future of the NPT,” in Nuclear Non-Proliferation and Global Security, ed. David B. Dewitt (New York: St. Martin’s Press, 1987): 73-84.

¹²Currently, NSG membership consists of Australia, Belgium, Canada, Finland, France, Germany, Italy, Japan, the Netherlands, Poland, Sweden, Switzerland, the UK, the USA, and the USSR.

¹³For a more detailed overview, see Leonard S. Spector with Jacqueline R. Smith, Nuclear Ambitions: The Spread of Nuclear Weapons 1989-1990 (Boulder, CO: Westview Press, 1990), Appendix F: “Nuclear Suppliers Organizations,” 433-436. See also Fischer and Szasz, Ch. 13: “Trigger Lists, the London Club and INFCE,” 101-108.

among suppliers and also as a response to continuing proliferation (most notably evidenced by India's nuclear test that year). Its program has tightened access to bomb-related items and information considerably.

But despite the web of NSG constraints, several nations have broken through to attain nuclear weapons in the past decade. Of these, Pakistan has found ingenious ways around NSG guidelines (following the earlier example of Israel, which thwarted the nascent control regime). All of the proliferators have taken advantage of NSG "loopholes" and carelessness.¹⁴

Also, the NSG does not include a number of emergent or "second-tier" suppliers, nations which could soon become substantial exporters of sensitive technology (for example Argentina, Brazil, China, and India). Sales outside of NSG (and IAEA) auspices might someday provide states such as Libya or Syria with nuclear weapon capability. Thus, incorporating emergent suppliers into the control regime will be a major challenge in this decade.¹⁵

Fourth, seven nations announced a missile technology control regime (MTCR) in April, 1987. These countries pledged to limit exports or gifts of equipment and technology that might provide a significant assist in the development of unmanned delivery systems for nuclear warheads.¹⁶ Clearly,

¹⁴For an early account of NSG laxness, see Albert Wohlstetter, "Spreading the Bomb Without Quite Breaking the Rules," Foreign Policy, No. 25 (Winter 1976-77): 88-96, 145-179.

¹⁵See Stanley Ing, "Emergent Suppliers, the Non-Proliferation Regime and International Security," in Nuclear Non-Proliferation and Global Security, ed. David B. Dewitt (New York: St. Martin's Press, 1987): 73-84.

¹⁶David M. North, "Seven Nations Curb Nuclear Weapon Launch System Exports," Aviation Week and Space Technology Vol. 126 No. 16 (20 April 1987): 28-29.

this effort is little and late. The regime's current membership (original members Canada, France, [West] Germany, Italy, Japan, the UK, and the USA, plus recent additions the USSR and several more Western states) does not include several important exporters of missiles and related expertise (most importantly China). Additionally, a number of potential and actual proliferators have significant ballistic missile programs of their own. For instance, Israel and India are already advanced enough to test satellite-launch vehicles (which could be adapted for use as intercontinental-range missiles). While the MTCR might slow the spread of missile technology to some nations, many others can soon take advantage of a second tier of rocket suppliers. The only hope for the MTCR is to involve more nations, especially emergent suppliers.¹⁷

How important would an effective MTCR be? Improving Third World air defenses have made penetration with even the best fighter and bomber aircraft far less certain than was true some years ago. Therefore, guided rockets are increasingly viewed as the best means of hitting a target (as purchasing patterns demonstrate). Missiles with nuclear warheads must be regarded as likely in several regions within a decade—reportedly, Israel has

¹⁷See Spector and Smith, 19-28, for an overview. See also Janne E. Nolan and Albert D. Wheelon, "Third World Ballistic Missiles," Scientific American Vol. 263 No. 2 (Aug. 1990): 34-40. Another article of interest is Aaron Karp, "The Frantic Third World Quest for Ballistic Missiles," Bulletin of the Atomic Scientists Vol. 44 No. 5 (June 1988): 14-20.

them now.¹⁸ The strategic implications are enormous. An effective MTCR, should it be possible, could at least limit the threat of a regional nuclear missile war, and perhaps prevent such a conflict entirely in some areas. Still, this aspect of the control regime may have arisen many years too late.

Fifth, the regime also consists of a variety of national and regional arrangements which work in concert with other regime components. An example of the former includes the tough export policies of several NSG members (Australia, Canada, Sweden, and the USA require full-scope safeguards as a condition of supply to NNWS, a higher standard than that held generally in the NSG). Enabling national legislation, such as the USA's 1978 Nuclear Non-Proliferation Act (NNPA) and updating amendments, pose long term obstacles for potential proliferators. However, Congress has waived some provisions of this legislation due to other strategic considerations, most notably in the case of Pakistan.¹⁹

Examples of regional cooperation which mesh with other efforts include the Treaty of Tlatelolco (which establishes a nuclear-weapon-free zone in Latin America with IAEA full-scope safeguards; it is in effect in all but Argentina, Brazil, Chile, and Cuba); the European Atomic Energy

¹⁸"Capabilities of Israeli Missiles Cited," Washington Post 15 Nov. 1989, A14; this article cites Defense Intelligence Agency documents released under the Freedom of Information Act to the Natural Resources Defense Council.

¹⁹An American aid cut-off, forced in 1979 by revelations that Pakistan had an active nuclear weapon program, was revoked after Iran's change of government and Afghanistan's occupation by the Soviets. In 1981, Congress granted Pakistan a six year waiver of the Symington Amendment, which prohibits USA aid to nations with unsafeguarded reprocessing plants. This will be explored in greater detail subsequently.

Commission (EURATOM, the nuclear branch of the EEC which has a special working relationship with the IAEA); and informal agreements between nations with advancing nuclear programs. Of the latter, one is especially relevant here. A December 1985 meeting between Indian Prime Minister Rajiv Gandhi and Pakistani President Zia ul-Haq resulted in an oral agreement that the two nations would not attack each other's nuclear facilities, a minor but stabilizing move on the tense subcontinent. Bilateral arrangements elsewhere have been even more useful (an Argentine-Brazilian accord particularly).²⁰

To summarize, the technological challenges of the nuclear fuel cycle plus political barriers raised by the international control regime create a daunting obstacle course for states desiring the bomb. In many respects, the regime has been successful. During the 1960s many experts predicted a world of thirty to forty NWS by the 1990s, but as of 1991, just nine exist.²¹ As nuclear energy expert Herbert Kouts has said, "I am convinced that without the treaty [NPT] and the agency [IAEA], a multitude of nations would

²⁰Fischer and Szasz, 103-104 and 122 on the NNPA: ACDA, 59-81 on the Treaty of Tlatelolco; and Spector with Smith, 96 on the Indo-Pak oral agreement, and 222 on the Argentine-Brazilian cooperation.

²¹The five declared NWS (the USA, USSR, Britain, France, and China) have been joined by Israel, India, South Africa, and Pakistan. Documentation for the Israeli and Pakistani cases will appear in later chapters; evidence is readily available in declassified literature for India and South Africa also.

have gone nuclear by now. The nonproliferation safeguards have been as effective as we hoped they would be.”²²

But Israel and Pakistan, despite dissimilar circumstances, have run the obstacle course successfully. The next chapter will detail Israel’s pursuit of the bomb.

²²Quoted in George Russell, “Who Has the Bomb,” Time 3 June 1985, 50.

Fig. 2-1. Light Water Reactor Fuel Track

Sources: Harold A. Feiveson, Frank von Hippel, and David Albright, "Breaking the Fuel/Weapons Connection," Bulletin of the Atomic Scientists Vol. 42 No. 3 (March 1986): 27; and Paul Leventhal, "The Nuclear Power/Nuclear Weapons Connection," Social Education Vol. 54 No. 3 (March 1990): 146.

Fig. 2-2. Light-Water Reactor Fuel Cycle with Fissile Materials Recovery

Sources: Harold A. Feiveson, Frank von Hippel, and David Albright, "Breaking the Fuel Weapons Connection," Bulletin of the Atomic Scientists Vol. 42 No. 3 (March 1986): 27; Paul Leventhal, "The Nuclear Power/Nuclear Weapons Connection," Social Education Vol. 54 No. 3 (March 1990): 146; David J. Rose and Richard K. Lester, "Nuclear Power, Nuclear Weapons and International Stability," Scientific American, vol. 238 No. 4 (April 1978): 52-55.

CHAPTER 3

ISRAEL'S ACQUISITION OF NUCLEAR ARMS

Israel acquired nuclear weapons primarily through the reprocessing of plutonium. It capitalized on the willingness of a major control regime nonparticipant to collaborate on nuclear and missile technology, stole other materials, illegally imported still more, and evaded the enforcement of agreements it had signed both with nations and with international agencies. Israel stopped at nothing. What motivated Israel to embark on the difficult and costly drive for nuclear weapons?

Motivations

Israel's motivations can be addressed from both external and internal perspectives. Neither presents a complete picture; together, these perspectives paint a portrait of a desperately insecure nation. The external strategic environment and a complementary internal mindset account in large part for Israel's bomb.

Strategic Environment

Surrounded by adversaries, Israel has always made military security its highest priority. The Arab states of the region represent an implacably hostile force with substantial numerical advantages in personnel and conventional weaponry. Several major wars (in 1948, 1956, 1967, 1969-70, 1973, and 1982) and dozens of smaller skirmishes have taught Israel that military preparedness is its alternative to national annihilation. The increasing technological sophistication of the Arab armed forces has steadily eroded the Israeli lead in that area during the past decade. Now more than

ever, nuclear weapons appeal to Israel as a way “to compensate for the great disparity between Arab and Israeli strength, to deter Arab aggression, and to guarantee its own survival.”¹ Jerusalem hopes to ensure the survival of the Jewish state by using or threatening to use nuclear weapons in several plausible ways.

First, the bomb is a weapon of last resort, a nation saving threat (probably against Arab cities) in the face of defeat in war, or to deter a second holocaust. Reportedly, Golda Meir readied nuclear warheads on missiles for that purpose early in the 1973 war.²

Second, nuclear weapons help deter massive Arab attacks on Israeli cities, or attacks featuring chemical or biological weapons. Some Israelis will regard this implicit threat as the key reason that Iraqi Scuds landing on Israel in 1991 did not contain chemical warheads (although technical constraints may have been a factor).

Third, the pressures of warfare could result in tactical use against Arab military targets on the battlefield. Though this is unlikely both because of international responses and the dangers of radioactive fallout on Israel, it must be noted that crises can produce extraordinary decisions. Doubtless Israeli military planners have considered this scenario.

¹Peter Pry, Israel's Nuclear Arsenal (Boulder CO: Westview Press, 1984): 5.

²“How Israel Got the Bomb,” Time 12 April 1976, 39. See also Shlomo Aronson, “The Nuclear Dimension of the Arab Israeli Conflict: The Case of the Yom Kippur War,” Jerusalem Journal of International Relations Vol. 7 Nos. 1-2 (1984): 107-142.

Fourth, Israeli nuclear arms deter a future first strike by an Islamic bomb, especially to the extent that some Israeli nuclear weapons are highly survivable (as bunkered Jericho missiles are).

Fifth, the arsenal is a psychological weapon against hostile neighbors. Jerusalem hopes to discourage them from military action and perhaps to prod them to compromise at the bargaining table someday (a regional nuclear-weapon free zone and withdrawal from the West Bank in exchange for guarantees of Israel's existence, in some scenarios).

Other, more remote possibilities include deterrence of nuclear terrorism, and perhaps even blackmail against the USA to ensure its continued diplomatic and military support (threatening use of the bomb in the region in time of crisis and thus playing on American anxieties about a catalytic nuclear war involving the superpowers).³

Israel's perceptions of its strategic environment and its ideas of nuclear strategy both result from and feed a particular mindset.

Mindset of a Garrison State

Israel is a "garrison state," a term indicating a relatively small nation outnumbered by surrounding adversaries and vulnerable to international isolation because of limited size and resources. A global scope of isolation and reliance on only one or two outside sources of support culminates in a siege mentality in which perceived security threats remain at a constant crisis

³Robert Harkavy, Spectre of a Middle Eastern Holocaust: The Strategic and Diplomatic Implications of the Israeli Nuclear Weapons Program, Monograph Series in World Affairs (Denver: University of Denver, 1977), 57-59.

level. (For comparison, Pakistan, Taiwan, South Korea, and South Africa may also be regarded as garrison states to varying extents.)⁴

Israel fits the category well. It is surrounded by hostile states; is one of the smallest states in the region; has very limited physical resources; is diplomatically isolated on a global scale; and has relied on France and (since about 1960) the USA as outside security guarantors. An obsessive siege mentality results from the perception that the state is an outpost or garrison, not unlike the military forts isolated from civilization and certainty that characterized the American West of the 1860s and 1870s. In such an outpost, supply is unsure, constant vigilance is required, and any available means is used for survival. As Israel demonstrates by example, garrison states are likely to pursue a nuclear "equalizer." Indeed, the short list of garrison states contains most of the significant nuclear proliferation threats in the world today.

⁴Pierre Lellouche, "The Garrison States," in Nuclear Proliferation in the 1980s, ed. William H. Kincade and Christoph Bertram (New York: St. Martin's Press, 1982), 63-111. Lellouche builds on earlier conceptual work by Yehezkel Dror, who coined the term "crazy state" to describe nations somewhat like Lellouche's garrison states—Crazy States (Lexington, MA: DC Heath-Lexington Books, 1971); by Robert Harkavy, whose categorization focused on the outcaste status of Israel and others—"The Pariah State Syndrome," Orbis Vol. 21 No. 3 (Fall 1977): 623-649; by Richard K. Betts, who discussed several overlapping categories of potential proliferators—"Paranoids, Pygmies, Pariahs, and Non-Proliferation," Foreign Policy No. 26 (Spring 1977): 157-183; and other work by proliferation specialists George H. Quester, Stanley Hoffman, and Richard Falk. For early thoughts along this line, see David Vital, The Inequality of States: A Study of the Small Power in International Relations (Oxford: Clarendon Press, 1967), Ch. 9: "The Nuclear Weapons Factor."

The reasons for Israel's diplomatic isolation, as for the other garrison states, relates to the legitimacy of the state itself. The ethnic structure of the State of Israel, its tumultuous origins in the predominantly Arab region, frequent violations of international behavioral norms (such as occupying foreign territory), and moral considerations (regarding treatment of the Palestinians) have contributed to its isolation. A few Western states, and particularly the United States, have retained close ties, though Jerusalem's desperation has compelled it to alienate allies in its quest for the bomb.⁵ To Israel, the threat of total isolation must seem entirely possible (as even America calls for a Palestinian settlement).

The garrison mindset feeds on particular fears and derives from a particular history. In Israel's case the fears arise from an imbalance of forces and from a history of armed clashes with several cooperating Arab opponents. Though Israel holds a qualitative edge in weaponry, it is badly outmanned, and faces the growing menace of high technology acquisitions. Soviet-supplied missiles in Syria and Iraq, Chinese-supplied missiles in Saudi Arabia, chemical and biological warheads in several nations, nuclear aspirations in Libya and Iraq, and advanced fighter and bomber aircraft pose a direct challenge to the Israeli technological advantage.⁶

Though fear is the primary motivator, it may not be the only one. Political incentives for a nuclear program include greater international

⁵Lellouche, 65.

⁶On the particularity of fears, see Robert A. Strong, "The Nuclear Weapon States: Why They Went Nuclear," in Nuclear Proliferation in the 1980s, ed. William H. Kincade and Christoph Bertram (New York: St. Martin's Press, 1982), 7.

leverage, a desire for respect, and some reintegration into the world community. Certainly Israel's military might commands respect. Still, politics also involves risk; Israel is vulnerable to the loss of American arms transfers and money, and chances provoking the neighbors it hopes to deter.⁷

Garrison states find nuclear weapons so desirable because those weapons are perceived to offer certainty—to ensure survival, or victory, or freedom of action where assurance is otherwise nonexistent. Israel's strategic environment and garrison mindset have resulted in a nuclear weapon program in which the end justified an array of means, most of them outside the boundaries of international law.

Thwarting the Nascent Control Regime

Israel decided to pursue atomic weapons in the earliest days of its existence. Methods of acquisition are detailed below (for a chronological outline, see Appendix 2).

Indigenous technology and materials. Under David Ben-Gurion, Israel began building its nuclear infrastructure shortly after independence. Clearly, the nation benefited greatly from highly-qualified immigrant European scientists from the start of its program. In the early 1950s, students were sent abroad to specialize in nuclear technology, a technical center opened at Rehovot (near Tel Aviv), and geologists discovered uranium in phosphate deposits in the Negev (see Figure 3-1 following the chapter). During this period the Rehovot scientists invented an extraction process which made the phosphate source usable. Other early technical

⁷Lellouche, 81-85.

developments included the invention of a new method for producing heavy water, the moderator in natural-uranium reactors.⁸ Later, in the 1970s, Israeli scientists perfected an experimental process to enrich uranium using lasers, starting production of enriched uranium in 1981.⁹

Open acquisition of technology and materials. In 1955, the USA began training Israeli scientists as part of the “Atoms for Peace” program, and agreed to construct a small, five-megawatt research reactor at Nahal Soreq (on the coast south of Tel Aviv). Activated in June 1960, the reactor was constrained by USA (and later IAEA) safeguards, and provided Israel with expertise in using nuclear materials and equipment, but probably no fissile material.¹⁰

Starting in the late 1950s, Israel purchased uranium (to add to its own modest production) openly on the world market from several sources, including French-controlled mines in what was then French West Africa, and from South Africa and Argentina.¹¹ In 1959, Israel purchased 22 tons of heavy water, again to supplement its own limited production, from Norway under careful safeguards. Norway was quite lax, however, in implementing

⁸Pry, 5-7

⁹Frank Barnaby, The Invisible Bomb (London: I.B. Tauris, 1989), 25. Barnaby’s information came directly from Israeli nuclear technician Mordechai Vanunu (more in Chapter 4).

¹⁰Pry, 8-9.

¹¹Leonard Spector with Jacqueline Smith, Nuclear Ambitions: The Spread of Nuclear Weapons 1989-1990 (Boulder, CO: Westview Press, 1990), 153. See also “CBS Evening News with Walter Cronkite,” CBS Television Network, 21 Feb. 1980, on South Africa.

those controls (more below).¹² The USA also supplied several tons of heavy water under safeguards, though again the implementation of the agreement has been questioned.¹³

Additionally, Israel has routinely received weapon-related information as a part of scientific visits by Israelis to USA nuclear weapons laboratories such as Lawrence Livermore and Los Alamos. Several press reports also suggest that specific warhead design assistance was also provided by former USA scientists who emigrated to Israel.¹⁴

Recent USA-Israeli cooperation on the Arrow anti-tactical ballistic missile (ATBM) system, despite program difficulties and delays, likely has provided some missile guidance data and expertise (as did Lance short-range missiles sold by America in the 1970s). This program violates the spirit and also possibly the letter of the MTCR, and has drawn increasing criticism from control regime members who worry that improved versions of Israeli missiles will feature systems derived from Arrow even if the ATBM is never produced.¹⁵

¹²Gary Milhollin, "Heavy Water Cheaters," Foreign Policy No. 69 (Winter 87-88): 100; and Charles R. Babcock "Norway Eyes Israel's Use of Nuclear Ingredient," Washington Post 10 Nov. 1986, A26.

¹³John H. Cushman, Jr., "U.S. Sent Liquid to Israel for Reactor," New York Times 10 Nov. 1986, A10.

¹⁴On the former, see U.S. General Accounting Office, Nuclear Proliferation: Major Weaknesses in Foreign Visitor Controls at Weapons Laboratories (Oct. 1988): 25-26, GAO/RCED 89-31. On the latter, see Spector with Smith, 157, for a summary.

¹⁵Spector with Smith, 364 (note 103); Gerard C. Smith and Helena Cobban, "A Blind Eye to Nuclear Proliferation," Foreign Affairs Vol. 68

Covert acquisitions. France, an early dissenter from the (then informal) control regime, provided the Israeli program with a big boost in the late 1950s. France wanted a regional ally (especially in the wake of the Suez crisis), coveted Israel's heavy water production technique for its own nuclear program, and benefited (as did Israel) from joint efforts to produce not only nuclear warheads but also short-range nuclear-capable missiles. The relationship was never a subject for public discussion in either of these democracies.

The biggest contribution by Paris was the large, secret nuclear reactor at Dimona in the Negev, which the French company St. Gobain Techniques Nouvelles began constructing in 1958. Also, the French started building a secret plutonium reprocessing plant at the same site. The sole purpose of the Dimona facility was to be the production of fissile materials for the weapons program.

Though the USA discovered the reactor via U-2 reconnaissance in late 1960, it did not uncover the reprocessing plant (which was built largely below ground level). That plant's existence was suspected but not confirmed until the 1986 revelations of a technician who worked there, Mordechai Vanunu (more in Chapter 4). The French withdrew from the Dimona project under USA pressure in 1960, but Israel had acquired the reprocessing plant plans and continued construction with French subcontractors.

The reactor began operating at full capacity in about 1962; the reprocessing plant was in production by 1966. The facilities were expanded

(Summer 1989): 64; and "Arrows and Spears," Arms Control Today Vol. 20 No. 7 (Sept. 1990): 21.

to include uranium enrichment in the late 1970s, though how Israel acquired or developed this technology is not known.¹⁶

Also in the late 1950s, France and Israel secretly collaborated on the design of short-range missiles; the Israeli result was the Jericho, with a 250-mile range (more in Chapter 4). The French also provided warhead design and manufacturing information. And, Israel may have obtained data from the first French nuclear test in February 1960.¹⁷

Finally, according to French sources, France quietly supplied several tons of heavy water to Israel in 1960, almost certainly for the Dimona HWR. Some of this shipment may have been an illegal re-export of heavy water sold to France by the USA and Norway.¹⁸

Clandestine acquisitions. (These are distinguished from covert acquisitions by the lack of willingness on the part of the supplier.) According to a former CIA official, Israel stole about 220 pounds of highly-enriched uranium from a fabrication plant in Pennsylvania in the mid-1960s. The agency believes that the material was used to build nuclear warheads (from four to six, depending on the skill of the fabricator). Though conclusive

¹⁶For detailed descriptions of Dimona's construction, see Pierre Pean, Les deux bombes (Paris: Fayard, 1981). Other sources suggest that the reactor may not have been in full operation until 1963, and that full scale plutonium reprocessing did not begin until after a shake-down period (as late as 1968 or 1969); see "How Israel Got the Bomb." Pean's account meshes well with Vanunu's revelations, however, and is more convincing.

¹⁷Pean, Chapter VII; and Steve Weissman and Herbert Krosney, The Islamic Bomb (New York: Times Books, 1981), 114.

¹⁸Pean, Ch. VI. See also Milhollin, 106-107.

evidence has never surfaced, strong circumstantial evidence supports the CIA opinion.¹⁹

In November 1968, Israeli agents using intermediaries shipped two hundred tons of yellowcake from Antwerp to Genoa. The yellowcake "disappeared" in route in the Mediterranean from a vessel secretly owned by an Israeli front company. This much yellowcake can provide fuel for a reactor the size of Dimona for several years (and, indirectly, a number of nuclear warheads).²⁰

Other clandestine operations are more recent. In May 1985, American citizen Richard K. Smyth was indicted in Los Angeles for illegally exporting over eight hundred krytrons (high-speed electronic switches used as nuclear warhead triggers) to Israel earlier in the decade. Israeli officials later admitted that they had the krytrons, and returned several hundred unused ones. Smyth also reportedly smuggled several key components for use in Israel's Jericho II nuclear-capable missile. He disappeared before his trial, and is believed to be in Israel; the USA has not attempted extradition.²¹

¹⁹"C.I.A. Concluded, Ex-Aide Says, That Israel Made Nuclear Arms," New York Times 2 May 1981, 2; see also John J. Failka, "The American Connection: How Israel Got the Bomb," The Washington Monthly Vol. 10 No. 10 (Jan. 1979), 50-58.

²⁰For a detailed account of this odd theft, see Elaine Davenport, Paul Eddy, and Peter Gillman, The Plumbat Affair (Philadelphia and New York: J.B. Lippincott Company, 1978).

²¹"Californian Indicted in Export of Triggers to Israel," New York Times 17 May 1985, A8; "U.S. Worried That Israel Has Illegal A-Bomb Devices," San Francisco Chronicle 15 May 1984, 11; and Spector with Smith, 156.

Evasion of international controls. Israel openly disdains the international control regime by avoiding falling under safeguards, by evading the safeguards it does come under, and by assisting other undeclared nuclear powers and threshold states.

Israel is not a party to the NPT, and does not accept IAEA safeguards on most of its nuclear infrastructure, including the entire Dimona complex. (The USA-supplied research reactor at Nahal Soreq is safeguarded through an agreement between the two states and the IAEA). Jerusalem regards the NPT as discriminatory and, in any case, not helpful in its strategic context. Though Israel is an IAEA member, many of its actions have undermined the agency's effectiveness (more below).²²

Even when safeguards arrangements are made, Israel sometimes hides its activities. After the United States discovered the Dimona reactor in 1960 (previously referred to as a textile factory by Ben-Gurion), the USA demanded inspection rights. The inspections were so infrequent and inadequate, however, that the USA never discovered the reprocessing plant at the same site. Apparently, inspectors were also shown a fake reactor control room, designed to disguise the true size of the reactor. Inspections were quietly dropped amidst growing American suspicions in 1969.²³

Along this line, Israel also benefited from Norwegian laxness after purchasing safeguarded heavy water from Oslo in 1959 (see above). Norway

²²For a thorough exposition of the Israeli position, see S. Freier, "The NPT and the Middle East," in Nuclear Non-Proliferation and Global Security, ed. David B. Dewitt (New York: St. Martin's Press, 1987), 189-200.

²³Pean, Ch. VI; "Revealed: The Secrets of Israel's Nuclear Arsenal," Sunday Times (London) 5 Oct. 1986, 1.

exercised its right to inspect the material only once, in 1961. Revelations of this history in 1986 led Norway to ask Israel to submit the heavy water to IAEA inspection, a request Jerusalem soon rejected. After a year of squabbling, the two governments announced (in June 1988) that Israel would allow the IAEA to inspect the remaining Norwegian heavy water, claimed to be just nine tons, away from the Dimona site. The Norwegian parliament rejected this plan because it did not account for the use of the material since 1961 (and also since far more of the original twenty-two tons was thought to exist than the Israelis admitted). In 1990, the two nations agreed that Norway would buy the nine tons Israel said remained—its use for nearly three decades completely undocumented despite a safeguards agreement.²⁴

Israel has also disregarded the international nonproliferation regime by assisting and collaborating with potential proliferators and another undeclared power. That power, South Africa, has conducted joint missile tests with Israel; circumstantial evidence suggests that a full-fledged nuclear relationship (possibly involving the exchange of South African uranium for Israeli technology) may well exist, though details are not available (more below).²⁵ Jerusalem is also reported to have aided Taiwan by exporting missile technology based on American-supplied Lance nuclear-capable

²⁴Milhollin; Spector with Smith, 153, 165-66.

²⁵On joint missile testing, see "NBC Nightly News," National Broadcasting Company, 25 Oct. 1989; see also Russell Watson with John Barry, "Israel's Deal with the Devil?", Newsweek 6 Nov. 1989, 52. For a synopsis of the suspected Israeli-South African relationship, see David Albright and Tom Zamora, "South Africa Flirts With the NPT," Bulletin of the Atomic Scientists Vol. 47 No. 1 (Jan-Feb. 1991): 29-30.

missiles.²⁶ Until the USA pressured Taiwan to shut down bomb-related projects in the late 1980s, that nation was clearly trying to “go nuclear.” Other collaborations between Israel and nations with nuclear ambitions have been suggested but not documented conclusively.²⁷

Policy supporting acquisition—nuclear ambiguity. What has made the realization of nuclear power status possible, in large part, is Israel’s careful policy of nuclear ambiguity. Even the most emphatic statements by Jerusalem’s spokesmen indicate only nuclear capability; officials never admit to possession of the bomb itself, much less to a deliverable arsenal.²⁸ At the same time, the same group of officials announces nuclear superiority through lightly-veiled threats against Arab neighbors. For example, former Israeli UN Ambassador Gideon Raphael has alluded to his nation’s arsenal (“radiation weapons”) openly.²⁹ And Defense Minister Yitzhak Rabin has

²⁶Michael Brzoska and Thomas Ohlson, ed., Arms Production in the Third World (London and Philadelphia: Taylor and Francis, 1986), 223.

²⁷For example, Israel reportedly approached India about a joint attack on Pakistan’s Kahuta enrichment plant; see Leonard Spector, The Undeclared Bomb: The Spread of Nuclear Weapons 1987-1988 (Cambridge, MA: Ballinger, 1988), 15.

²⁸The usual formula, used in countless statements by many speakers, is that “Israel will not be the first country to introduce nuclear weapons into the Middle East.” This bland reassurance means almost nothing. One Israeli official added to the formula—“And we won’t be the last.”

²⁹Gideon Raphael, “Syria and Israel: Too Near the Brink,” Washington Post 11 Jan. 1987, C7.

warned that if Israel is attacked with chemical weapons, "The response will be one hundred times stronger."³⁰

This two-faced ambiguity holds several advantages for the Israeli nuclear weapons program. First, Israeli denials of a nuclear arsenal keep American aid flowing. Washington wants to believe, or appear to believe, in a pre-nuclear Israel, and its ally's disclaimers enhance this official position. Second, Israeli denials assuage other Western states in the same way, which helps Jerusalem maintain its tenuous participation in international trade and relations. Third, denial prevents the Arab states from using the open existence of an Israeli arsenal for political capital internationally (and as a direct justification for their own nuclear ambitions).³¹

On the other hand, doubt must be balanced by suspicion. Implication may deter the Arabs from massive conventional attacks, chemical or biological weapons use, and even perhaps from full-scale political maneuvering. It also wrests large amounts of economic and military aid from an acquiescent Washington. This intent has been stated quite baldly on several occasions, once by Amos Rubin, an adviser to Yitzhak Shamir: "To enable Israel to abstain from dependence on nuclear arms calls for \$2 to \$3 billion in US aid."³²

³⁰Quoted in Joel Brinkley, "Israel Fears That Peace In the Persian Gulf Will Unleash a Bitter Foe," New York Times 24 July 1988, E2.

³¹For elaboration, see Norman Moss, "Vanunu, Israel's Bombs, and U.S. Aid," Bulletin of the Atomic Scientists Vol. 44 No. 4 (May 1988): 7.

³²Quoted in Mary Curtius, "Israel Needs More US Aid to Spur Economy and Immigration, Economist Says," Christian Science Monitor 20 Jan. 1987, 9, 14.

The costs of ambiguity, however, are increasing. American acceptance of Israel's denial is viewed as hypocritical, and may have helped push aside anti-proliferation arguments in South Asia. Ambiguity also may undermine military deterrence, because deterrence rests largely on stated consequences for opponent military actions.³³ A few Israeli analysts now advocate an overt, open deterrence policy based on a declared arsenal.³⁴

Whatever the desires of Jerusalem, ambiguity after the 1986 Vanunu revelations is fading fast. Assertions that Vanunu was convicted for breaking security oaths and not for actual revelations contradict a prosecution statement that the nuclear technician "caused serious damage to the security of the state."³⁵ In fact, no real doubt exists in any capital that Israel has a nuclear arsenal. Ambiguity as an official policy served the purpose of masking nuclear efforts for many years, but the policy is now essentially dead. For the time being, Israel has chosen to continue a public display of the corpse.³⁶

³³For a discussion of this in light of the recent Iraq-Coalition war, see Yossi Melman, "Why Israel May Show Its Nuclear Hand," New York Times 6 Aug. 1990, A13.

³⁴See, for a prominent example, Shai Feldman, Israeli Nuclear Deterrence: A Strategy for the 1980s (New York: Columbia University Press, 1982).

³⁵Quoted in Moss, 7.

³⁶For a good, brief discussion of post-Vanunu ambiguity, see Louis Rene Beres, "Israel's Tough Nuclear Choice: Ambiguity Vs. Disclosure," Christian Science Monitor 3 Feb. 1988, 11. See also Avner Cohen and Benjamin Frankel, "Israel's Nuclear Ambiguity," Bulletin of the Atomic Scientists Vol. 43 No. 2 (March 1987): 15-29.

Policy supporting acquisition—military and intelligence support. Several activities not directly related to the nuclear weapons program have nonetheless strengthened Israel's nuclear posture by disrupting the nuclear program of a key Arab antagonist. This is an important facet of Israel's determination to be the uncontested nuclear power in the region.

Iraq's nuclear ambitions rose in the 1970s under Saddam Hussein, who wanted to enhance his status among Arab leaders and to counter Israel's undeclared arsenal. His purchase of the large Osiraq research reactor from France in 1976 aroused Israeli anxieties considerably. During construction of the reactor in 1979, the original reactor core structure was destroyed at a warehouse in France in an unexplained explosion. Also, in 1980, an Egyptian nuclear scientist working for the Iraqi Atomic Energy Commission was murdered in Paris (the mysterious case has not been solved). And, several bombings and bomb threats plagued French and Italian subcontractors for Osiraq during this period. Many observers believe Israel to be behind these acts, though direct evidence has not been uncovered.³⁷

There is no doubt, however, about what happened next. On 7 June 1981, Israeli F-16s bombed and destroyed the Osiraq reactor, within a month or two of its scheduled start-up. The Iraqis were unable to respond militarily, in part because of their war with Iran, but they did respond diplomatically via the UN and IAEA. As an NPT member, Iraq claimed that comprehensive

³⁷Weissman and Krosney, 227-233 on the reactor's destruction; 239-243 on the Egyptian scientist; and 243-248 on the terror campaign against the subcontractors.

safeguards were in place at Osiraq, and that France had secured rigorous inspection rights. Subsequently Israel was suspended from IAEA membership in 1982, and only a threatened withdrawal by the USA from the agency (and an Israeli statement that it would not attack safeguarded facilities again) made way for continued Israeli participation in 1985. Still, the IAEA's reputation and credibility were strained by this incident.³⁸

One other military operation, if it in fact occurred, provided very direct support for Israel's nuclear program. On 22 September 1979 an American Vela satellite (designed to detect nuclear explosions on the earth's surface) observed a flash in the ocean near South Africa. Data analysis from Vela and other information sources led an ad hoc White House panel to conclude that the event was "probably" not a nuclear detonation. The Naval Research Laboratory and the Defense Intelligence Agency both concluded that the flash was a nuclear explosion of very low yield, however. Many analysts believe that this event was a joint Israeli-South African nuclear test; the consensus is that the White House panel was on a political leash, and that the evidence was not as ambiguous as they had stated. This much-studied event may never be fully understood unless new evidence surfaces or the responsible power takes credit for the probable nuclear test.³⁹

³⁸Leonard Spector, The New Nuclear Nations: The Spread of Nuclear Weapons 1985 (New York: Vintage Books, 1985), 145-46. For details on the Osiraq bombing, including information on how the USA aided the operation, see Shlomo Nakdimon, First Strike (New York: Summit Books, 1987).

³⁹United Nations Centre for Disarmament, South Africa's Plan and Capability in the Nuclear Field (New York: UN, 1981), 31-33, AN/35/402; Michelle Flournoy and Kurt M. Campbell, "South Africa's Bomb: A Military Option?" Orbis Vol. 32 No. 3 (Summer 1988): 386-387; Eliot Marshall, "Navy Lab Concludes the Vela Saw a Bomb," Science Vol. 209 (29 Aug. 1980): 996-

Purchases of delivery systems. In addition to Israel's indigenous missile production, Jerusalem has enhanced delivery options for its nuclear arsenal by buying a large number of dual-capable (able to function in both nuclear and conventional roles) aircraft quite openly. All of these fighter-bombers have been supplied by the USA (F-4E, F-15, and F-16 aircraft) or depend on American components (Israel's own Kfir, which uses an engine built by General Electric).⁴⁰ For more on the nuclear delivery capabilities of these aircraft, see Chapter 4.

Conclusion

To summarize, a garrison state mindset has lead Israel to the acquisition of nuclear weapons. Its program developed with the open and covert cooperation of two nuclear powers, clandestine acquisition, evasion of international control regime measures, support from its foreign policy establishment, and assistance from the military and (probably) intelligence services. Israel did not balk at any means which it judged would serve its nuclear security goal. The nuclear forces and capabilities Israel's program produced will be summarized in the next chapter.

997; Colin Norman, "Dispute Reopened on Mysterious 1979 Flash," Science Vol.228 (7 June 1985): 1180; and Barnaby, 14-21.

⁴⁰Spector, The Undeclared Bomb, 48.

Fig. 3-1. Israel's Nuclear Sites. Map by Victor L. Kundargi

CHAPTER 4

ISRAEL'S NUCLEAR FORCES AND CAPABILITIES

Estimates of the current size of Israel's nuclear arsenal vary. Much of the uncertainty stems from doubts about the exact size and output of the Dimona reactor.

Arsenal size. Before Mordechai Vanunu's 1986 revelations about operations at Dimona, most analysts believed that Israel possessed an arsenal of twenty to twenty-five nuclear warheads, though a minority suggested a higher figure. The London Sunday Times projected, in its report based on Vanunu's information, that Israel could have up to two hundred warheads (a figure extrapolated from the scale of the hitherto secret reprocessing operation).¹ This view is shared by Frank Barnaby, a British nuclear scientist who personally questioned Vanunu and calculated that, based on the rate at which the reprocessing plant functioned while Vanunu worked there, over 180 warheads would have been produced from start-up (stated to be in 1966) to 1989.² Both Barnaby and the Sunday Times investigative team hypothesized that the Dimona reactor must have been enlarged to produce the amount of plutonium Vanunu helped extract.

¹"Revealed: the Secret of Israel's Nuclear Arsenal," Sunday Times (London), 5 Oct. 1986, 1. See also accompanying articles, 4-5. It should be noted that the consensus of expert opinion is that Vanunu's information is generally accurate and reliable. His revelations confirm earlier reports based on French sources knowledgeable about the construction of Dimona, especially concerning the reactor. Also, a former Mossad agent has called his description and interpretation "accurate"; see Victor Ostrovsky and Clair Hoy, By Way of Deception (New York: St. Martin's Press, 1990), 150-151.

²Frank Barnaby, The Invisible Bomb (London: I.B. Tauris, 1989), 31.

Vanunu explained that the reactor (originally twenty four megawatts) was expanded twice, first to seventy megawatts and then to an unspecified higher capacity, perhaps as high as 150 megawatts. These increases occurred before his employment at Dimona, and were accompanied by corresponding expansions of the reactor's cooling equipment.³

American nuclear specialists, however, suggest an alternate possibility. They posit that the reactor was forty megawatts at the outset (as French journalist Pierre Pean also argues); that it may have been expanded once, to seventy megawatts, before Vanunu was hired in 1977; and that the high level of plutonium extraction during Vanunu's tenure resulted from a backlog created by early operating problems at the reprocessing facility. With the possible expansion, plutonium sufficient for ninety warheads would have been produced by 1989. Without it, enough for fifty to sixty warheads would have existed by that year.⁴

These figures (whether nearer two hundred or fifty warheads) do not include warheads made from high-enriched uranium. Israel's theft of about 220 pounds of that fissile material in 1968 (see Chapter 3) could produce from four to six additional bombs. Also, according to Vanunu, Israel began enriching uranium with gas centrifuges in 1979 and with lasers in 1981. He did not reveal the size of this operation or indicate the level of enrichment attained (uranium which is enriched to over ninety percent U-235 is

³Barnaby, 28.

⁴Leonard Spector with Jacqueline Smith, Nuclear Ambitions: The Spread of Nuclear Weapons 1989-1990 (Boulder, CO: Westview Press, 1990), 160. For a French source on Dimona's original size (forty megawatts), see Pierre Pean, Les deux bombes (Paris: Fayard, 1983), Ch. VI.

considered weapons-grade). Israel may have added to its arsenal by the enrichment processes, but no further details are known.⁵

In sum, Israel may have from fifty to two hundred nuclear weapons, certainly more than pre-Vanunu estimates. More precise figures must await confirmation or further details from an informed source. In any case, the existence of a minimum of fifty nuclear weapons in the arsenal implies that Israel has placed greater reliance on nuclear weapons strategically than was previously thought. The substantial arsenal also assures that a portion of it would survive any Arab first-strike with conventional-warhead missiles on airbases and other suspected nuclear deployment areas. Israel owns a reliable second-strike capability, and will likely retain it well into the future.

Types of nuclear warheads. Another revelation by Vanunu, supported by several of his photographs, is that Israel has developed advanced nuclear warheads.

Israel was known before 1986 to have produced first generation bombs similar in effect to those dropped on Hiroshima and Nagasaki. These fission warheads were constructed with both plutonium and highly-enriched uranium cores, and probably took the form of gravity bombs in most cases.⁶

Vanunu revealed that Israel also has developed "boosted" fission weapons, in which a fission reaction is enhanced by the presence of tritium (a radioactive isotope of hydrogen). Such boosted warheads use no more fissile material than ordinary fission bombs, but yield explosions several times

⁵Barnaby, 25.

⁶Peter Pry, Israel's Nuclear Arsenal (Boulder, CO: Westview Press, 1984), 29.

greater.⁷ For this reason, Israel could construct nuclear warheads with less fissile material and boost them to desired yield levels, thus building more nuclear explosives with available stockpiles of plutonium and highly-enriched uranium. Additionally, according to American nuclear weapon designer Theodore Taylor, Israel is also constructing “super-boosted” warheads (enhanced with lithium deuteride, a compound which undergoes fusion when exposed to a fission explosion, releasing enormous energy).

These warheads could result in an explosion of about one hundred kilotons, comparable to some of the warheads on American and Soviet ICBMs.⁸ Barnaby estimates that perhaps thirty-five of Israel’s nuclear warheads are boosted or super-boosted (based on Dimona’s production of tritium, lithium deuteride, and their chemical antecedent, lithium-6).⁹

Because many boosted warheads would actually be smaller than simple fission warheads, applications could include missile warheads and possibly other delivery modes which depend on miniaturization.

Israel is unlikely to have produced “staged” thermonuclear warheads (so-called hydrogen bombs), in which a fission explosion triggers the fusion of a surrounding blanket of material (often lithium deuteride). Warheads of this type present extremely complex engineering difficulties, and presumably

⁷For example, the yield of a standard fission bomb, such as those dropped on Japan, is about twenty kt. A boosted warhead using the same amount of fissile material could produce a yield of about fifty kt.

⁸Taylor’s assertion was based on his examination of Vanunu’s photographs; see Spector with Smith, 161. For details of Israel’s tritium production at Dimona, see Barnaby, 38-40.

⁹Barnaby, 25.

Israel would require a nuclear testing program to produce reliable staged weapons. Israel is definitely interested in designing this type of weapon, however, as is shown by its attempts to purchase super computers from the USA to aid in necessary calculations.¹⁰

Delivery systems. (See also Table 4-1.) Israel owns several kinds of aircraft capable of delivering half ton gravity bombs. Nuclear-capable fighter/bombers include USA-supplied A-4 Skyhawks, F-4E Phantoms, F-15 Eagles, and F-16 Fighting Falcons, plus Israeli Kfirs (similar to the French Mirage V). The F-15 has range, payload, and avionics advantages that make it one of the most feared air weapons in the region. Flexibility and the option of recall may make it the delivery system of choice for many Israeli warheads.¹¹ Additionally, more F-16s are on order from the USA following the Iraq-Kuwait War.

Israel's missile options are expanding rapidly. A dozen USA-supplied Lance missiles, some now likely with nuclear warheads, remain from a 1970s purchase. This mobile, relatively accurate short-range ballistic missile (SRBM) is being largely supplanted by Israel's own missile production. Its limited range (variously reported as between forty-five and eighty miles)

¹⁰Gary Milhollin, "Why Are We Helping the Third World Go Nuclear?" Washington Post 1 April 1990, C1, 4. Staged thermonuclear warheads are capable of monstrous yields, often measured in megatons.

¹¹Leonard Spector, The Undeclared Bomb: The Spread of Nuclear Weapons 1987-1988 (Cambridge, MA: Ballinger Publishing Co., 1988), 48. See also Pry, 99-107. The range of the F-15 encompasses by far most of the Middle East.

makes its use as a nuclear delivery system problematic save in unlikely tactical (battlefield) roles, for instance against enemy troop concentrations.¹²

The Jericho missile (this name is a Western designation), first developed with France in the 1960s, has undergone several improvements in the past decade. Most versions of Jericho, like Lance, are carried on a mobile launcher, though some may be deployed in silos, bunkers, or caves. The original version of this missile has a range of 250 to three hundred miles, and consists of two solid fuel stages. Some first-generation Jerichos are probably still in service.¹³

In the early 1980s, Israel tested and deployed an improved version, dubbed Jericho II. With a 400-mile range and reported improvements in accuracy, the Jericho II presents an ominous threat to fairly precise targets throughout Egypt, Syria, Jordan, and portions of Iraq and Saudi Arabia. It is also Israel's first fully-indigenous nuclear delivery system.¹⁴

Further improvements in Jericho have been made in recent years. Tests of the Jericho IIB were conducted in the late 1980s, demonstrating an extended range of nine hundred miles and putting the southern USSR in range (as well as Baghdad). Though designated IIB, more than one improved

¹²Pry, 94; on numbers of Lance owned by Israel, see the International Institute for Strategic Studies (IISS), The Military Balance 1990-1991 (London: Brassey's for the IISS, 1990), 107.

¹³Paul Rogers, Guide to Nuclear Weapons, Bradford Peace Papers: New Series No. 2 (New York: St Martin's Press for Berg, 1988), 90. On bunkering, see Spector, 188.

¹⁴Spector, 31-32.

version may be in development. A total of about a hundred Jerichos are believed deployed, some probably not with nuclear warheads.¹⁵

Additionally, the launches of satellites by Israel in 1988 and 1990 signals the possible development of an ICBM. The three-stage launcher, designated Shavit (Comet) II by the Israelis, may be an offshoot of the Jericho program and indicates the potential for long-range surface-to-surface warhead delivery. Targets could include the entire Middle East, Pakistan, Europe, and much of the USSR.¹⁶ Whether an ICBM will have a greater deterrent than antagonistic effect on the Soviets remains to be seen.

At minimum, Lance and Jericho missiles are insurance against preemptive attack on Israeli nuclear-capable aircraft (for example, by Syrian missiles supplied by the USSR). This has become more credible as the Israelis have deployed more missiles in hardened bunkers or silos. Also, Jericho and Lance are virtually guaranteed to penetrate enemy air defenses, though even the best aircraft might not.

Other delivery systems are considered possible but are unconfirmed. These include nuclear warheads for Israel's Gabriel short-range ship-to-ship

¹⁵"Unfriendly Skies," Bulletin of the Atomic Scientists Vol. 45 No. 9 (Nov. 1989): 52; "What is Known About Israeli Missiles," Bulletin of the Atomic Scientists Vol. 46 No. 1 (Jan./Feb. 1990): 48; and Spector with Smith, 162-63.

¹⁶"Israeli Satellite Launch Sparks Concerns About Middle East Missile Buildup," Aviation Week and Space Technology 26 Sept. 1988: 21; and Spector with Smith, 163-164.

missile, nuclear artillery shells, and nuclear mines. These may not be current options because of daunting complexities of miniaturization.¹⁷

Deployment. Some Jericho and Lance missiles are deployed at sites in the Negev. Others, on mobile launchers, may be headquartered at Dimona or the nearby airbase at Hatzerim, and would be dispersed in time of crisis. Nuclear gravity bombs may also be stored at Dimona or Hatzerim. It is unknown if bombs are dispersed to other bases; for security reasons this seems unlikely.¹⁸

Superstructure. The Israeli Atomic Energy Commission oversees all aspects of the nation's nuclear program. Originally in the Defense Ministry, it was expanded and moved to the prime minister's office in 1966 (at about the time the first warheads were produced). Nuclear weapons policy is therefore directed from the highest levels of government.¹⁹

Little is known of Israel's command, control, and communications (C3) systems which would attempt to manage use of nuclear weapons during a conflict. Most observers surmise that the prime minister, in consultation with other cabinet members and the armed forces chiefs, would have the sole responsibility for a decision to use any part of the arsenal. The initial situation, involving a small arsenal and no nearby weapons of mass destruction, did not pose great complications, but today, with chemical

¹⁷Pry, 80-81; Rogers, 90; and on Gabriel, see Dan Raviv and Yossi Melman, "The Mideast Goes MAD," Washington Post 15 July 1990, B1-2.

¹⁸Pry, 82-83.

¹⁹Shyam Bhatia, Nuclear Rivals in the Middle East (New York: Routledge, 1988), 37-38.

weapons and nuclear programs in the region, and greater Arab ballistic missile options, C3 challenges are becoming quite significant.

Prospects. Israel is developing an indigenous fighter-bomber, the Lavie, based on the F-16 program. It has been troubled by technical problems and insufficient funds, however, and has an uncertain future. If deployed, the Lavie will eventually replace Israel's A-4s and Kfirs.²⁰ The most recent word on the Lavie is cancellation, which may force Israel to shop for available aircraft.

Other weapons under development include intermediate range cruise missiles (possibly to be based on newly-ordered submarines), further improvements of Jericho, and possibly full-scale thermonuclear warheads. Forthcoming satellite launches can be expected to include one or two orbiters with reconnaissance capabilities to improve C3, also.²¹

Summary. Israel possesses an arsenal of between fifty and two hundred warheads (many analysts estimate one hundred). Some of these warheads are boosted fission designs. The warheads are deliverable by a variety of aircraft and by several missile systems with ranges throughout the region. Even an arsenal of a hundred weapons is larger by dozens than was thought to exist before the 1986 revelations, and that number gives planners great flexibility in nuclear strategy and targeting.

²⁰Rogers, 89, 116.

²¹Raviv and Melman, B2.

While Israel acquired its arsenal primarily through reprocessing, Pakistan succeeded through uranium enrichment. Their methods, however, bear considerable resemblance, as the next chapter will begin to show.

TABLE 4-1. Israel's Nuclear Weapon Delivery Systems

Missiles	Number	Range	Payload (lbs.)	Stages/Fuel
Lance	12	45-80	450	1 / solid
Jericho I	?	250-300	550	2 / solid
Jericho II	?	300-450	1,000-1,500	2 / solid
Jericho IIB	?*	900	1,650	2 / solid

—An ICBM or IRBM similar to the space launcher Shavit II may be forthcoming.

* Some sources maintain that about 100 Jericho missiles (all versions) have been deployed.

Aircraft	Number #	Combat Radius (miles)	In-Air Refuel.	Max Speed (mach)
A-4 @	121	920	yes	0.9
Kfir	95	737	some	2 +
F-4E	112	712	yes	2.4
F-15	47	660 +	yes	2 +
F-16	139	575 +	yes	2 +

These figures include only deployed aircraft and not those in storage.

@ These older aircraft are nuclear capable but are unlikely to be used in that role.

Sources: Fred Donovan, "Mideast Missile Flexing," Arms Control Today Vol. 20 No. 4 (May 1990): 30-31; International Institute for Strategic Studies, The

Military Balance 1990-1991 (London: Brassey's for the IISS, 1990): 107, 217;
Paul Rogers, Guide to Nuclear Weapons, Bradford Peace Studies Papers:
New Series No. 2 (New York: St. Martin's Press for Berg, 1988): 88-89, 116;
and Leonard Spector, The Undeclared Bomb: The Spread of Nuclear Weapons
1987-1988 (Cambridge, MA: Ballinger Publishing Co., 1988): 48, 336 note 66.

CHAPTER 5

PAKISTAN'S ACQUISITION OF NUCLEAR ARMS

Pakistan acquired nuclear weapons primarily through the enrichment of uranium. It capitalized on the willingness of a major control regime non-participant to assist in nuclear and weapon-design technology, stole and illegally imported many materials, and evaded the enforcement of agreements it signed both with nations and international agencies. Like Israel, Pakistan stopped at nothing. And, like Israel, Pakistan was strongly motivated to take the obstructed nuclear path to security.

Motivations

Though Pakistan's strategic environment is different than Israel's in a number of ways, similarities there and in the security mindset have produced comparable results—a pro-nuclear decision and a successful weapons program in the face of daunting strategic challenges.

Strategic Environment

Pakistan's quest for the atomic bomb began in earnest as Israel started deploying its arsenal in the early 1970s. The impetus was India. Reeling from its decisive defeat by its neighbor in the 1971 war, Pakistan sought to counter New Delhi's unquestioned conventional superiority by building upon its civilian nuclear power program. Prime Minister Zulfikar Ali Bhutto launched his campaign for the bomb at a meeting with top scientists at

Multan in 1972.¹ The program also received a jolt of adrenalin in 1974 with the Indian nuclear test.

Pakistan and India have fought innumerable times, often in major conflicts (notably in 1947, 1965, and 1971). The two subcontinent powers were born from the battle of partition and retain bitter ethnic and religious hatred for each other. Both nations contain political parties which include the absorption of the enemy state in their platforms. In India's case, such a threat is not idle. New Delhi's attempts to gain great power status and to dominate the region are not the fictions of alarmist Pakistanis; those efforts are real, and many of them aim at a South Asia with a subordinate, powerless Islamabad.²

Since the mid-1960s, India has held military superiority over Pakistan. Its USSR-supplied armed forces are considerably more capable, on balance, than those of its smaller neighbor, and far more numerous. Additionally, India's nuclear weapons program has produced enough fissile material for between forty and sixty warheads since the mid-1980s, some in the form of deliverable bombs.³ New Delhi is also pursuing thermonuclear ("hydrogen")

¹Steve Weissman and Herbert Krosney, The Islamic Bomb (New York: Times Books, 1981), 43-46.

²For details on India's regional aspirations, see Jean Leclerc du Sablon and Jean Francois Leven, "Trying to Join the Club of Great Nations," World Press Review June 1988, 26-28.

³This is based on projections of Indian fissile materials production in David Albright and Tom Zamora, "India, Pakistan's Nuclear Weapons: All the Pieces in Place," Bulletin of the Atomic Scientists Vol. 45 No. 5 (June 1989): 20-26. On deliverable bombs, see Leonard Spector with Jacqueline Smith, Nuclear Ambitions: The Spread of Nuclear Weapons 1989-1990 (Boulder, CO: Westview Press, 1990), 63.

bomb technology⁴ and is stepping up its missile program, which has already produced an SRBM (Prithvi), ICBM (Agni), and a satellite launch vehicle which might be adapted for military use.⁵ Further, India deploys a variety of nuclear-capable aircraft, including excellent Jaguar, Mirage 2000, and MiG-29 fighter-bombers.⁶ Pakistani numbers and overall technical quality cannot match India's either now or in the future. It is no wonder, then, that prominent Pakistanis call their nuclear program "primarily a response to India's own nuclear ambitions" and "a credible deterrent against its principal adversary, whose intentions toward its smaller and weaker neighbor are suspect."⁷ With nuclear powers on either side, the tense, disputed Kashmir border looms as perhaps the most likely site for a nuclear war in the world today.⁸ With India in mind, several strategic doctrines are likely in Pakistani planning circles.

⁴David B. Ottaway, "Signs Found India Building an H-Bomb," Washington Post 19 May 1989, A29.

⁵Gary Milhollin, "India's Missiles—With a Little Help From Our Friends," Bulletin of the Atomic Scientists Vol. 45 No. 9 (Nov. 1989): 31-41; "Earthshaker," The Economist 26 March 1988, 31-32; and Barbara Crossette, "India Reports Successful Test of Mid-Range Missile," New York Times 23 May 1989, A9.

⁶For numbers of all military aircraft, and other Indian forces, see the International Institute for Strategic Studies (IISS), The Military Balance 1990-1991 (London: Brassey's for the IISS), 162-170.

⁷Mushahid Hussain, "Why Pakistan Needs a Nuclear Option," Washington Post 29 July 1987, Opinion page.

⁸For one of many examples of this assertion, see Holger Jensen, "A Threat of Nuclear War," Maclean's 11 June 1990, 52-53.

First, nuclear weapons are weapons of last resort which could be used to save Pakistan from catastrophic military defeat and occupation. This option was probably highest in Zulfikar Bhutto's mind at the 1972 meeting which inaugurated his nation's military use of the atom.

Second, they are a deterrent against Indian nuclear weapons use (and this deterrence gains credibility as Pakistan builds more bombs and diversifies delivery systems).

Third, nuclear arms might be used in a tactical (battlefield) role in a critical but not necessarily state ending defense crisis, perhaps in a future pivotal battle for control of Kashmir.

Fourth, Pakistan's small arsenal is a psychological weapon tearing at India's regional aspirations while enhancing Pakistan's confidence and its prestige in the Islamic community.

Other applications might include deterrence of India's ally, the USSR (would Moscow trade an army, for example, or the Tadzhik capital of Dushanbe for an incursion into the Hindu Kush). Blackmail of the USA or China (forcing continued support by privately threatening to start a nuclear war) also seems remotely possible.⁹

As with Israel, Pakistan's central concern is its survival as a state, a survival it believes is gravely threatened.

⁹Much of this section was inspired by Robert Harkavay's comments on Israeli strategic options (see Chapter 3 note 3). On deterrence of the USSR, see Ram R. Subramanian, Nuclear Competition in South Asia and U.S. Policy (Berkeley, CA, Institute of International Studies, UC-Berkeley, 1987), 43.

Garrison State Mindset

This belief in an all-encompassing threat is the central ingredient of a garrison state mindset. Although Pakistan does not fit this category as precisely as Israel, it does fit it well, and (more importantly) its perceptions cause it to act like a garrison state.

To reprise the criteria in Pakistan's case, it is nearly surrounded by hostile states (India, the USSR, and the Soviet-backed Afghan regime); it is comparatively a small state, especially vis-a-vis India; it has limited physical resources; it is significantly isolated diplomatically; and it has relied on the USA and China as outside security guarantors. Pakistan, faced with an Indian juggernaut, perceives itself as outnumbered, vulnerable (especially because it has a limited ability to arm itself), and painfully reliant on only one or two outside sources of support. India's nuclear capability completes the frightening picture. Pakistan believes, in essence, that it is a garrison state.¹⁰

Islamabad is not nearly as isolated diplomatically as Israel, but Indian prominence both in the region and in nonaligned international politics has limited Pakistan's close ties to a handful. A symptom of this relative isolation was the international silence in 1971 when Pakistan lost its eastern province in warfare with India, a breach of territorial integrity that the Third World would have protested elsewhere.¹¹ Generally good relations with the

¹⁰See Pierre Lellouche, "The Garrison States," in Nuclear Proliferation in the 1980s, ed. William H. Kincade and Christoph Bertram (New York: St. Martin's Press, 1982), 71-73.

¹¹*Ibid.*, 99-100 (note 11).

moderate Islamic nations have been undercut on several occasions by Pakistan's focus on India, the kind of focus other Moslem states have placed on Israel. Also, Pakistan's crucial ties to the USA have been strained time and again by its pursuit of a nuclear option. In fact, America suspended all aid (and a sale of advanced military aircraft) in late 1990 as a direct result of Pakistani nuclear endeavors, adding to Islamabad's subjective sense of isolation as well as to its very real vulnerability to disruption of military supply. This event must also underscore for Pakistan the reality that none of its alliances (with the USA, China, SEATO, and CENTO) has ever resulted in bilateral or multilateral military action against its huge neighbor. Pakistan is in many ways alone.

The strategic environment and garrison mindset have resulted in a nuclear weapons program which, like Israel's, ran the obstacle course of the international control regime by a variety of means. It featured the novel tactic of leaving the course altogether.

Thwarting the Control Regime

Pakistan's civilian nuclear power and research program served as the foundation for its nuclear weapons program after the 1972 decision to build the bomb. Methods of acquisition are detailed below (for a chronological outline see Appendix 3).

Indigenous technology and materials. Pakistan possesses a small uranium mine, near Dera Ghazi Khan (see Figure 5-1 at the end of this chapter), with an output sufficient to supply the Kahuta enrichment plant. Just as important is the large number of excellent scientists Pakistan has

produced, including a number in the fields of nuclear science and physics. Zulfikar Bhutto recruited many of them for the bomb program at Multan in 1972, including Abdul Qadeer Khan, who would later head the program, and S. A. Butt, who would soon lead the network of Pakistanis in Europe in the collection of nuclear hardware (more below).¹²

Open acquisition of technology and materials. With civilian goals of power production and research, Pakistan received a research LWR from the USA (operational in 1965) and a power HWR from Canada (start-up in 1971). With these came nuclear knowledge and experience, but no confirmed diversions of fissile material. Both the USA and Canada also supplied related materials for their reactors, such as fuel rods and heavy water (in the case of the KANUPP power reactor). Both of these facilities are under safeguards, though the status of KANUPP has changed twice (more below).

Under international agreements, many Pakistani scientists were trained at nuclear plants abroad from the mid-1950s through the late 1970s. They brought home expertise acquired legally and often at the expense of the host governments. The most noteworthy example is A. Q. Khan, who was trained in West Germany, worked at an enrichment plant in the Netherlands, and directed Pakistan's nuclear weapons search after 1975.¹³

¹²On the mine, see Ashok Kapur, Pakistan's Nuclear Development (London: Croom Helm, 1987), 207. On the scientists, see Weissman and Krosney, 45.

¹³For a detailed account of Pakistan's civilian nuclear program, see Kapur, Chapters 3 and 4.

Pakistan received the blueprints for a plutonium reprocessing plant as the first step in its purchase of the plant from a French company in the mid-1970s. Though France later stopped work on the project under American pressure, Pakistan kept the plans and built its own reprocessing facility in the 1980s (at New Labs in Rawalpindi). Also, Pakistan may have continued construction of the original plant (at Chashma) using the French design. Islamabad also built an experimental-scale reprocessing facility (at PINSTECH, in Rawalpindi) using plans acquired openly from the UK. These reprocessing facilities are not believed to be operating currently but could supply plutonium soon after start-up.¹⁴

European suppliers sold Pakistan a large number of small components for enrichment machinery and other nuclear-related uses legally in the 1970s and 1980s. Most of these small components did not appear on the NSG Trigger List; nonetheless, they could help build plants which could produce fissile material. To cite one recent example, several West German companies exported milling machines and presses useful in shaping enriched uranium into nuclear bomb cores, and mass spectrometers for verification of enrichment levels, with appropriate licenses in the late 1980s. These dual use (suitable for both nuclear and non-nuclear processes) items were approved for export by Bonn based on Pakistani assurances that they were intended for non-nuclear uses. United States protests did not stop the sales.¹⁵

¹⁴Weissman and Krosney, 80-84; Spector with Smith, 114-115.

¹⁵"Nuclear Exports to Pakistan Reported," Der Spiegel 20 Feb. 1989, translated in Congressional Record 16 May 1989, S5441-S5442. See also

Additionally, Pakistan received open Chinese help on its new research reactor at Rawalpindi (start-up 1989), and announced its purchase of a power LWR from Beijing in 1989 (the first reactor sale to Pakistan since its nuclear ambitions became clear in the 1970s). Also, France approved the sale of a large low-enriched uranium LWR in early 1990. Both of these sales will be under safeguards, but neither requires the full-scope safeguards which would force Pakistan to open all nuclear facilities to IAEA inspection.¹⁶ Both will be a potential source of fissile materials when constructed.

Finally, Pakistan has purchased hundreds of tons of yellowcake openly on the world market, mostly from Niger.¹⁷

Covert acquisitions. Three confirmed acquisitions have been made secretly from willing parties (though many more may be unreported). First, China provided assistance in the operation of the Kahuta enrichment plant starting in the early 1980s. In response, the USA delayed a major nuclear trade agreement with China for almost a year.¹⁸

Second, China gave Pakistan a proven fission bomb design and possibly also testing data in 1983. This may explain in part why Pakistan

Mark Hibbs, "U.S. Repeatedly Warned Germany on Nuclear Exports to Pakistan," Nuclear Fuel 6 March 1989, 12-13.

¹⁶On the Chinese sale, see Shahid-ur-Rehman Khan, "China Agrees to Supply 300-MW PWR to Pakistan," Nucleonics Week Vol. 30 No. 47 (23 Nov. 1989): 1-2. On the French sale, see Steve Coll, "France to Sell Nuclear Power Plant to Pakistan," Washington Post 22 Feb. 1990, A-25, A31.

¹⁷Kapur, 207.

¹⁸Leslie H. Gelb, "Pakistan Tie Imperils U.S.-China Nuclear Pact," New York Times 22 Jan. 1984, A1, A3; and Leslie H. Gelb, "Peking Said to Balk at Nuclear Pledges," New York Times 23 Jan. 1984, A3.

has refrained from conducting a nuclear test to date.¹⁹ Third, in November 1979, Pakistan quietly purchased up to one hundred metric tons of yellowcake outside of IAEA safeguards from Libya. Some of this may have been a re-export of material from Niger. This amount of yellowcake could yield, after enrichment, several nuclear warheads (or, without enrichment, a number of KANUPP fuel rods).²⁰

Clandestine acquisitions. Pakistan in many instances beat the regime obstacle course by leaving it completely and stealing what it wanted. Since literally dozens of clandestine operations have been reported, only a representative sample of egregious cases will be listed here.

When Dr. Abdul Qadeer Khan left his assignment at the sensitive Almelo gas centrifuge enrichment plant in the Netherlands in 1974, he took with him legally-acquired expertise. He also took enough illegal notes and design information to construct a version of Almelo at Kahuta in Pakistan. His employment at the Dutch firm FDO gained him access to Almelo and to classified centrifuge data from colleagues, expertise crucial to Pakistan's future bomb. The Dutch security service had run a check on Khan prior to his employment and approved his participation, believing that he intended to

¹⁹Ibid.; and Senator Alan Cranston, "Nuclear Proliferation and U.S. National Security Interests," Congressional Record 21 June 1984, S7902. For an overview of the Pakistan-China relationship, see Kapur, Appendix Two: "The China Connection."

²⁰John J. Fialka, "West Concerned by Signs of Libyan Pakistan A-Effort," Washington Star 25 Nov. 1978, 3.

remain in the West.²¹ Khan was tried in absentia in a Dutch court in 1983 and convicted of soliciting classified nuclear data from FDO sources (though this ruling was later overturned on procedural grounds).

In 1975, Khan gave Pakistani Officials lists of suppliers and components, and soon thereafter an energetic team of agents directed by S. A. Butt began smuggling the parts for conversion and enrichment plants out of Europe. Using front corporations and a labyrinth of shipping routes, the agents illegally exported both items on the Trigger List and items covered by national export laws. The most astonishing case featured the smuggling of an entire conversion plant (which would produce the feedstock for Kahuta) from West Germany in the late 1970s. The man who sold the plant, Albrecht Migule, was later fined \$10,000, given a six-month suspended sentence, and allowed to remain in business; the conversion plant has been in operation at Dera Ghazi Khan since 1980. The Kahuta enrichment plant, built largely with clandestine acquisitions, started producing enriched uranium in 1984.²²

Other smuggling successes demonstrate the broad scope of these activities. Starting in 1983, two West German firms provided Pakistan with uranium hexafluoride transport containers, tons of specialized aluminum for centrifuge housings, a variety of materials for the production of tritium (for use in advanced nuclear warheads), a reactor design for the irradiation of

²¹For details, see Weissman and Krosney, Chapter 12: "The Kindly Dr. Khan."

²²Shyam Bhatia, Nuclear Rivals in the Middle East (New York: Routledge, 1988), 99-100. On Kahuta, see Leonard S. Spector, The New Nuclear Nations (New York: Vintage Books, 1985), Chapter II: "The Nuclear Netherworld."

lithium (which creates tritium), fuel rod fabrication equipment, and zirconium (used for fuel rod casings). Many of these items were exported without licenses or with incorrect labeling; Bonn's investigation led to indictments in 1990. The tritium plant began test operations in 1987.²³

Two American cases reveal that Islamabad was indeed willing to bite the hand that supplied aid. In 1984, three Pakistanis were indicted for trying to smuggle fifty krytrons for the PAEC. One of the three, Nazir Vaid, was convicted and quickly deported.²⁴ Pakistan seems to have been successful in getting krytrons elsewhere, as the non-nuclear portions of its warhead design have been tested.²⁵ In 1987, Arshad Pervez, a Pakistani-born Canadian, was convicted of conspiracy to engage in nuclear-related smuggling. Pervez attempted to export maraging steel, a specially strengthened alloy used in gas centrifuges, and beryllium, used to enhance fission reactions by reflecting neutrons, using bribery and falsified documents. He was later sentenced to five years in prison though USA economic and military aid to Pakistan was unaffected.²⁶

²³John J. Fialka and Thomas F. O'Boyle, "West German Firms Admit Supplying Nuclear-Weapons Material to Pakistan," Wall Street Journal 21 April 1989, 20; Gary Milhollin, "Asia's Nuclear Nightmare: The German Connection," Washington Post 10 June 1990, C1-2; on the tritium plant, see Mark Hibbs, "German Firms Exported Tritium Purification Plant to Pakistan," Nuclear Fuel 6 Feb. 1989, 6-7.

²⁴Seymour M. Hersh, "Pakistani in U.S. Sought to Ship A-Bomb Trigger," New York Times 25 Feb. 1985, A1, A8.

²⁵Bob Woodward, "Pakistan Reported Near Atom Arms Production," Washington Post 4 Nov. 1986, A1, A6.

²⁶Mark Honigsbaum, "Jury Finds Conspiracy in Nuclear Metal Case," American Metal Market Vol. 95 No. 21 (Dec. 1987): 2, 8; and David K.

Pakistan's clandestine activities have not been exclusively based in Germany and the United States, however. By the late 1980s, Pakistan had illegally exported enrichment materials and technology from companies in Canada, the UK, the Netherlands, and Switzerland, too. These acquisitions were apparently intended to aid an expansion of enrichment capabilities.²⁷ The Netherlands and Sweden found themselves the unwitting suppliers of flash x-ray machines and specialized oscilloscopes, equipment used in the development and testing of warhead designs, in the mid-1980s.²⁸

Many more examples of Pakistani clandestine acquisition exist, a dozen in Germany alone. Of course, these citations represent only the cases in which Pakistan was caught.

Evasion of international controls. Pakistan disregards the proliferation control regime by avoiding safeguards arrangements when possible, and has never accepted full-scope safeguards (in which its entire nuclear system would be placed under IAEA accountancy). This evasion has caused difficulty for Islamabad in several instances. When Canada asked for stringent, full-scope safeguards on the KANUPP reactor (following India's use of safeguarded Canadian supplies in its 1974 nuclear test), Pakistan refused outright, and began programs to supply its own heavy water and fuel

Shipler, "Pakistan Tied to Atom Shipping Plot," New York Times 14 Jan. 1988, A3.

²⁷Spector, The New Nuclear Nations, 38-39; and Weissman and Krosney, 183-84.

²⁸Spector, The Undeclared Bomb: The Spread of Nuclear Weapons 1987-1988 (Cambridge, MA: Ballinger Publishing Company, 1988), 368; and Spector, The New Nuclear Nations, 26.

rods. Canada stopped supplying KANUPP in 1975. The IAEA attempted to place Pakistan's uncontrolled reactor supplies under safeguards in the late 1970s, but Islamabad protested on the grounds that this was not foreseen in the original bilateral safeguards agreement. Gradually, Pakistan accepted the IAEA position (under American pressure), but for a period of about two years the IAEA was unable to verify that Pakistan was not diverting material from KANUPP. The possibility of diversion cannot be dismissed.²⁹ Another safeguards confusion, over the blueprints for the French reprocessing plant, has already been mentioned.

Pakistan's chief evasion, however, is in avoidance of the regime entirely. It is not an NPT signatory and does not have a comprehensive safeguards agreement with the IAEA (though it is a member of that agency).³⁰ Further, most of its nuclear program exists outside the IAEA's purview, including: the conversion plant at Dera Ghazi Khan, heavy water plants at Multan and Karachi, the Kahuta and Sihala enrichment plants, the fuel fabrication and reprocessing facilities at Chasma, smaller reprocessing operations at Rawalpindi, a tritium production plant south of that city, and possibly a research reactor at an uncertain location (some reports say Golra).³¹ Of course, Pakistan's clandestine efforts to acquire parts for these

²⁹David Fischer and Paul Szasz, Safeguarding the Atom: A Critical Appraisal (London and Philadelphia: Taylor and Francis, 1985), 16-17.

³⁰For a typical South Asian view of the NPT, see K. Subrahmanyam, "Regional Conflicts and Nuclear Fears," Bulletin of the Atomic Scientists Vol. 40 No. 5 (May 1984): 18.

³¹See Spector with Smith, 114-116, for a summary of Pakistani nuclear installations.

factories involved evasion of NSG guidelines and national export laws in scores of cases.

Pakistan has refused, on at least one occasion, to allow the USA to inspect its nuclear facilities. This Nixon-era rebuff demonstrates the priority Islamabad assigns to its nuclear program, even in the face of the control regime leader.³²

Should the Islamic Republic provide nuclear assistance to any of the Moslem nations which helped fund its bomb, such aid would almost certainly be covert and outside control regime boundaries. An isolated Pakistan might indeed become a supplier for its few friends. Certain past actions support this likelihood. The burning of the USA Embassy in Islamabad in 1979 by a mob was tolerated (and, many suspect, instigated) by Zia's government as a means of reaching out to Khomeini's Iran. According to one respected source, another reason for the attack was the destruction of nuclear monitoring equipment the embassy housed. The same kind of evasion and desperation could someday lead to nuclear aid to an Islamic friend.³³

Apparently, minor aid has already been rendered. Pakistan has disregarded the international control regime by assisting a potential proliferator, Iran, which hosted Pakistani advisors and received technical information from Islamabad's nuclear scientists in the late 1980s.³⁴

³²Kapur, 217.

³³On Arab states which gave Pakistan money for its bomb project, see Weissman and Krosney, 28, 314. On the embassy attack, see Kapur, 190.

³⁴Spector with Smith, 211.

Policy supporting acquisition—nuclear ambiguity. Taking a page directly from Israel's handbook, Pakistan has carefully cultivated an ambiguous public stance on its nuclear activities. Denials have kept American aid flowing while suggestions have warned India that it now faces a nuclear adversary. As with Israel, the United States has been (until recently) quite willing to play along.

Denials of weapon intent began with Zia's coup in 1977, years before warheads were produced. Even as Kahuta was being built in 1982, Zia proclaimed during a visit to the USA that "Pakistan has no capability at present to achieve a nuclear device" and "no intention" of ever building a bomb. The American response? As an official put it, "We have to take him at his word."³⁵

In 1987, amidst press reports of Pakistani nuclear weapon status, A. Q. Khan revealed to a startled Indian journalist:

They told us Pakistan could never produce the bomb, and they doubted my capabilities, but they know we have done it America knows it. What the CIA has been saying about our possessing the bomb is correct.³⁶

³⁵Both quoted in Kim Rogal, "Worries About the Bomb," Newsweek 20 Dec 1982, 50.

³⁶From an interview with Kuldip Nayar originally published simultaneously in newspapers in Pakistan, India, and London. Quoted in Spector with Smith, 334 (note 40). See also Steven R. Weisman, "Report of Pakistani A-Bomb Causes a Stir in the Region," New York Times, 2 March, 1987, 42-43.

Though Khan and the Pakistani government issued denials of the interview's authenticity almost immediately, a Pakistani journalist confirmed Khan's comments as an eyewitness.

Quickly, Zia moved to ensure ambiguity by emphasizing capability and denying the bomb's existence. He asked Time journalists a few weeks later,

What's the difficulty about building a bomb? We have never said we are incapable of doing this. We have said we have neither the intention nor the desire. I will say that Pakistan has not enriched uranium above the normal grade level required for peaceful purposes.³⁷

The American response? Aid continued as "concern" was expressed by officials such as the State Department's Assistant Secretary for Near Eastern and South Asian Affairs, Richard W. Murphy:

We wish to believe the assurances of a good and deserving friend such as Pakistan, but under present circumstances [including the Pervez smuggling case], these assurances must be matched by their actions We hope for the best.³⁸

In fact, according to one press report, USA officials learned of the Khan interview in advance and urged Islamabad to suppress it, fearing it would endanger a Pakistan aid proposal before Congress.³⁹

³⁷See William R. Doerner, "Knocking at the Nuclear Door," Time 30 March 1987, 42-43.

³⁸Richard W. Murphy, "Pakistan and the Nuclear Issue," Department of State Bulletin Vol. 87 No. 2127 (Oct. 1987): 54.

³⁹Nayan Chanda, "Yes, We Have No Bomb," Far Eastern Economic Review 12 March 1987, 34.

The Indian response was best summed up by the journalist who interviewed Khan: "He was trying to send a message to India."⁴⁰

Little changed under Zia's successor, Benazir Bhutto, who held only partial control over the nuclear weapons program. Though she told Congress, "I can declare that we do not possess nor do we intend to make a nuclear device," she told an interviewer a month later that "any one-sided action by any country in the subcontinent can trigger off a nuclear arms race."⁴¹ Meanwhile, Gen. Mirza Beg, the Pakistani Army Chief of Staff (with more say in things nuclear than Bhutto) directed another comment India's way: "Both the nuclear option and the missiles [that Pakistan is developing] act as a deterrence."⁴²

By October 1990, all parties had wearied of the ambiguity game. The fall elections in Pakistan featured a competition between party leaders Bhutto and eventual winner Nawaz Sharif to make the most pro-nuclear statement. As Bhutto put it, "We prefer to lay down our lives for the vital nuclear program instead of compromising on it."⁴³ Though Sharif tried to retrench to ambiguity after his inauguration, his assurances that he was

⁴⁰Quoted in Rod Nordland, "A Pakistan Bombshell," Newsweek 16 March 1987, 45.

⁴¹Mohtrama Benazir Bhutto, "The Policies of Pakistan," Vital Speeches 1 July 1989, 553; and "Bhutto Claims Nuclear 'Knowledge' Available," Agence France Press (Hong Kong), 1108 GMT, 29 August 1989—reprinted in FBIS-NES, 29 August 1989, 47.

⁴²Quoted in Mushahid Hussain, "Pakistan 'Responding' to Change," Jane's Defense Weekly 14 Oct. 1989, 279.

⁴³Quoted in Bob Drogin, "U.S. Officials Reportedly Conclude That Pakistan Has a Nuclear Bomb," Los Angeles Times 24 Oct. 1990, A6.

“against the destructive use of atomic power”⁴⁴ fell on deaf ears in Washington. Bush’s request for a waiver of certification was dismissed on Capitol Hill as lawmakers concluded the same thing that proliferation experts had said years earlier—“For all intents and purposes, they’re over the hump.”⁴⁵

Policy supporting acquisition—disarmament initiatives.

Another means of retaining USA support, Pakistan’s arms control initiatives have played to a willing audience in the United States and a hostile one in India. Whether or not the proposals were serious, they helped American legislators vote for aid and harmed India by making that nation seem intransigent. Beginning in the early 1970s, Pakistan proposed a number of bilateral measures, including a test ban, a subcontinent nuclear-weapons-free zone, and full NPT/IAEA participation, but India has always objected because the proposals treat the two nations as equals and fail to take into account other regional powers (especially China). Pakistan may be quite serious about this security track, however; it cannot hope to match India in a South Asian arms race.⁴⁶

Purchases of delivery systems. Pakistan can deliver the bomb with American and French dual-capable aircraft—F-16, Mirage V, and Mirage III fighter-bombers. These aircraft were purchased openly, and even with frank

⁴⁴Quoted in Barbara Crossette, “Pakistani Offers Atom Issue Talks,” New York Times 30 Nov. 1990, A7.

⁴⁵Leonard Spector, quoted in Nordland.

⁴⁶For a summary of arms control proposals, see Spector, The Undeclared Bomb, 139-140, 142-48.

admission that they would provide Pakistan with a nuclear delivery option.⁴⁷ The sale of sixty more F-16s has been frozen in the wake of Bush's failure to certify, but Pakistan already has well over a hundred nuclear-capable planes.

Also, pending Pakistani development of their own missiles (with suspected Chinese help), Islamabad may choose to buy a small number of nuclear-capable missiles to counter India's advanced program. China's M-series missiles have been marketed in the region and could someday carry Pakistani warheads. For more on delivery system capabilities, see Chapter 6.

Conclusion

To summarize, a garrison state mindset has led Pakistan to the acquisition of nuclear weapons. Its program developed with the open and covert cooperation of two nuclear powers, clandestine acquisition, evasion of international control regime measures, and support from the foreign policy establishment and diplomatic corp. Pakistan stopped at nothing, or rather, at nothing but the bomb.

How many bombs, and the ability of Pakistan to deliver them, will be covered in the next chapter.

⁴⁷Congress, Senate, Committee on Foreign Relations, "Consideration of Resolution of Disapproval of the Sale to Pakistan of 40 F-16 Aircraft," Report, 97th Cong., 1st sess., 19 Nov. 1981, 9.

Fig. 5-1. Pakistan's Nuclear Sites. Map by Victor L. Kundargi

CHAPTER 6

PAKISTAN'S NUCLEAR FORCES AND CAPABILITIES

The current size and composition of Pakistan's nuclear force are not known precisely, though a consensus of expert opinion has emerged on its general characteristics. The key variable for arsenal size is the output of the Kahuta enrichment facility.

Arsenal size. Based on an output of between twenty-five and seventy-five kilograms of weapons-grade uranium a year, the Kahuta plant could provide for at least one and at most four nuclear warheads annually. Pakistan started producing highly-enriched uranium sometime in 1986. If Kahuta has been operating at or near capacity since that time, Pakistan could have enough fissile material for between five and twenty bombs (as of early 1991).¹ The acquisition of a Chinese nuclear weapon design, reports that Pakistan has tested an aerodynamic bomb casing, and President Bush's inability to certify in the fall of 1990 all indicate that at least one bomb is fully assembled and deliverable.²

The arsenal may consist of up to twenty completed weapons, though ten is a more likely figure. One variable which is at present indefinite is a

¹David Albright, "Pakistan's Bomb-Making Capacity," Bulletin of the Atomic Scientists Vol. 43 No. 5 (June 1987): 30-33; and David Albright and Tom Zamora, "India, Pakistan's Nuclear Weapons: All the Pieces in Place," Bulletin of the Atomic Scientists Vol. 45 No. 5 (June 1989): 20-26.

²On the Chinese design, see Leslie H. Gelb, "Pakistan Tie Imperils U.S.-China Nuclear Pact," New York Times 22 Jan. 1984, A1, A3; and Leslie H. Gelb, "Peking Said to Balk at Nuclear Pledges," New York Times 23 Jan. 1984, A3. On the bomb casing, see "Bonn Unhappy with U.S. F-16 Deal with Country," Der Spiegel 24 July 1989, translated in FBIS-NES 16 Aug. 1989, 56.

possible slow-down in the enrichment program, arranged by Benazir Bhutto to keep American aid following her visit to Washington in 1989. It is possible that Pakistan began stockpiling uranium enriched to an intermediate level (not weapons-grade), and may have assured the USA on other points as well (that it would stop short of assembling the warhead packages it had on hand, for example).³

This stop-gap agreement seems to have collapsed (if it was ever effective) in early 1990. With tension high in Kashmir, press reports said that Pakistan had deployed nuclear arms for possible use and readied F-16s to carry the atomic gravity bombs.⁴ Bhutto's ouster in August and Bush's noncertification also indicate that the slow-down was at best brief.

Most analysts cite a figure of about ten weapons for Pakistan's small nuclear force (SNF). Whether most of the warheads are assembled or most require a few hours or days for completion is unknown, though recent tensions make arsenal readiness more likely.

Kahuta is the only source for nuclear bomb cores presently. Plutonium reprocessing plants are not believed to be operating (as they would almost certainly use safeguarded KANUPP fuel rods), although their future

³For a summary of this possible accommodation, see Leonard S. Spector with Jacqueline Smith, Nuclear Ambitions: The Spread of Nuclear Weapons 1989-1990 (Boulder, CO: Westview Press, 1990), 104-106.

⁴James Adams, "Pakistan's 'Nuclear War Threat,'" Sunday Times (London) 27 May 1990, 1; and James M. Dorsey, "Pakistan Able to Equip F-16s For Nuclear Bombs," Washington Times 31 May 1990, A7. A senior State Department official would not confirm these details, but did say that the Kashmir situation was provoking "extreme concern" in both Washington and Moscow; Holger Jensen, "A Threat of Nuclear War," Macleans 11 June 1990, 52.

production (and planned expansions of enrichment capabilities) could add substantially to Pakistan's arsenal in a few years.⁵

Types of nuclear warheads. Pakistan's bomb is a sophisticated first-generation fission design, and weighs only about four hundred pounds.⁶ This design, or a version planned for the near-term, will use beryllium, a neutron reflector which enhances fission reactions and reduces the amount of fissile material needed to produce a desired yield. Pakistan managed to import beryllium illegally from West Germany in the 1980s.⁷

Pakistan is also developing boosted warheads, and has acquired tritium production equipment (clandestinely) for that purpose. A warhead requires only four to five grams of tritium (mixed with small amounts of deuterium, which is readily available in Multan's heavy water) to boost its yield several times. Pakistan probably has not constructed any boosted warheads yet, but is headed rapidly in that direction.⁸

Currently, gravity bombs are the only likely form for Pakistan's nuclear warheads.

Delivery systems. (See also Table 6-1.) Pakistan can deliver its bombs with several kinds of aircraft. Most likely for this role are USA-

⁵Spector with Smith, 102.

⁶Hedrick Smith, "A Bomb Ticks in Pakistan," New York Times Magazine 6 March 1988, 38. See also Ashok Kapur, *Pakistan's Nuclear Development* (London: Croom, Helm, 1987), 245; Gelb, "Pakistan Tie"; and Gelb, "Peking Said to Balk."

⁷Albright and Zamora, 22.

⁸Mark Hibbs, "German Firm's Exports Raise Concerns About Pakistan's Nuclear Capabilities," Nuclear Fuel 6 March 1989, 13-14.

supplied F-16s and French supplied Mirage Vs, both excellent attack aircraft with superior penetration abilities. Older Mirage III, as well as Chinese Q-5 and J-6 planes, could also conceivably be used. Pakistan's F-16 force is equipped with electronic counter measures which provide an edge over India's Soviet supplied MiGs and air defenses, making the F-16 the delivery system of choice. Along this line, press reports in mid-1990 said that some Pakistani F-16s had been adapted for nuclear delivery by adding specialized external bomb racks and relatively uncomplicated electronics (for on-board arming and for triggering).⁹

Islamabad is trying to expand its delivery options by developing missiles. General Beg announced successful flight tests of both the Haft I and Haft II (with ranges of fifty and 185 miles respectively) in early 1989. According to one source, some Haft I SRBMs may be deployed, though no source claims nuclear warheads for them yet. Both Haft missiles are powerful enough to carry such a warhead. Beg has also announced a new development program for a missile with a range just under four hundred miles. Reportedly, China is aiding its ally's missile programs, though the nature of its help is not yet public knowledge.¹⁰

⁹Dorsey, "Washington Whispers," U.S. News and World Report 12 Feb. 1990, 20; and Paul Rogers, Guide to Nuclear Weapons, Bradford Peace Studies Papers: New Series No. 2 (New York: St. Martin's Press for Berg, 1988), 98-99.

¹⁰"Pakistan in Missile Build Claim," Jane's Defense Weekly 18 Feb. 1989, 267. On Haft I deployment, see International Institute for Strategic Studies (IISS), The Military Balance 1990-1991 (London: Brassey's for the IISS, 1990), 173. On Chinese help, see Kapur, Appendix Two: "The China Connection."

No other delivery systems are thought plausible at this time.

Deployment. Details about the deployment of Pakistan's SNF are not available, although presumably the bombs are kept at a high-security military facility and would be dispersed to several locations in time of crisis to prevent their destruction by an Indian first strike.

Superstructure. The Pakistan Atomic Energy Commission (PAEC) coordinates many of its nation's nuclear activities, and has been headed by former IAEA staff member Munir Ahmed Khan since his appointment by Zulfikar Bhutto in 1972. Munir Khan headed early efforts to acquire reprocessing technology, but his unwillingness to strain ties with Western organizations and colleagues, his inability to produce a plutonium bomb, and his personal association with Bhutto lessened his role in the late 1970s. He is still in charge of Pakistan's nuclear power program.¹¹

The enrichment program is conducted through the Engineering Research Laboratories, an autonomous division of the PAEC headed since the late 1970s by Zia appointee Abdul Qadeer Khan. He reports to military superiors. During the Zia era, Abdul Khan gained considerable clout, which he kept and exercised even after Zia's death.¹²

Though Benazir Bhutto and Nawaz Sharif have been popularly elected since Zia died, USA government sources believe that the prime minister's office is not in control of the country's nuclear weapons program, though it has some influence. The Army, currently headed by Chief of Staff Mirza Beg,

¹¹Kapur, 200-201.

¹²Shyam Bhatia, Nuclear Rivals in the Middle East (New York: Routledge, 1988), 99-102.

directs that program; decisions about deployment (and perhaps nuclear use) rest largely with the generals.¹³

The C3 systems relating to Pakistan's nuclear weapons are still in their infancy and may be confused at times because of internal politics. This does not bode well for regional crisis management and leaves the threshold of nuclear use uncertain.

Prospects. The termination of the American sale of sixty additional F-16s may force the Pakistanis to look at other nuclear-capable aircraft. France, which agreed to build a safeguarded nuclear reactor for Pakistan in 1990, might also be willing to sell some late-model Mirages should it not mind alienating India further. Chinese aircraft are available but are not desirable for nuclear bombing roles. The forty or so F-16s Pakistan already has certainly do not seem sufficient to the armed forces in light of Indian numerical superiority.

Missile development will continue, but if it is delayed or falters, Pakistan may choose to purchase Chinese M-9 (375-mile range, similar to Haft II) missiles, possibly covertly. Past Chinese disregard for MTCR standards and its relationship with Islamabad make it the probable supplier.¹⁴

Presumably work will also continue on boosted warheads, with deployment (conceivably on missiles) within the next several years.

¹³Albright and Zamora, 20, 85

¹⁴Leonard S. Spector, The Undeclared Bomb: The Spread of Nuclear Weapons 1987-1988 (Cambridge, MA: Ballinger Publishing Company, 1988), 43.

Thermonuclear warheads will occupy at least a few researchers but would require a testing program and are not, therefore, certain to appear this decade.

Summary. Pakistan owns a rudimentary nuclear force of up to ten warheads, all in the form of fission gravity bombs. These bombs are deliverable by several kinds of aircraft with ranges encompassing much of India. While arsenal first-strike survivability is by no means assured, crisis dispersal and limited numbers of superb aircraft do provide for possible retaliation following such a strike or in the face of catastrophic military defeat. The immediate future should feature the continued construction of bombs, delivery diversification, and attention to survivability. The region must also hope that C3 systems evolve as well.

Though Pakistan's arsenal is not as large or as sophisticated as Israel's, many common threads run through their bomb programs. The next chapter will assess those similarities.

TABLE 6-1. Pakistan's Nuclear Weapon Delivery Systems

Aircraft	Number*	Combat Radius (miles)	In-Air Refuel.	Max Speed (mach)
Q-5 @	135	400	no	1.5
J-6 @	150	426	no	1.45
Mirage III @	15	745	no?	1.8
Mirage 5	58	808	no?	2.2
F-16	39	575 +	yes	2 +

* These figures include only deployed aircraft and not those in storage.

@ These older aircraft are nuclear capable but are unlikely to be used in that role. Q-5 and J-6 are Chinese adaptations of the USSR's MiG-19. Mirage III is less capable than its upgraded version, Mirage 5.

Missiles	Number	Range/Payload (miles/lbs.)	Comments
Haft I	a few	60 / 1,000 +	if deployed, not yet with nuclear warheads
Haft II	?	185 / 1,000 +	soon to be deployed

—Another missile (375-mile range) is in research and development, probably with Chinese assistance.

Sources: International Institute for Strategic Studies, The Military Balance 1990-1991 (London: Brassey's for the IISS, 1990): 173; John W. R. Taylor, ed.,

Jane's All the World's Aircraft (London and New York: Jane's Publishing, 1985): 33-35, 60-61; Leonard S. Spector, The Undeclared Bomb—The Spread of Nuclear Weapons 1989-1990 (Cambridge, MA: Ballinger Publishing Co., 1988): 337; Leonard S. Spector with Jacqueline Smith, Nuclear Ambitions: The Spread of Nuclear Weapons 1989-1990 (Boulder, CO: Westview Press, 1990): 102-103.

CHAPTER 7

PROGRAM COMPARISON AND CONTRAST

The similarity between the Pakistani and Israeli programs is by design Pakistani officials closely studied the Israeli-U.S. connection and utilized the loopholes created for Israel to shield their own program.

Steven Philip Cohen¹

The nuclear programs of Israel and Pakistan have much in common, far more than might be expected from two largely dissimilar countries. The first proliferator (after the NPT fixed the status of the original five NWS by international agreement) and the most recent share highly similar mindsets, methods, and program outcomes. To a significant extent, Pakistan appears to have learned from the earlier Israeli experience, particularly in its relationship with the USA. Contrasts between the two programs are fewer and often represent matters of degree rather than qualitative differences. This chapter will catalog first the multitude of likenesses, and then discuss the distinctions between the two programs.

Similar Mindsets

Arguably the most important shared element of the two programs is the driving garrison state mindset. Both Israel and Pakistan are relatively small (in comparison to key antagonists), outnumbered, politically isolated (more so in Israel), vulnerable to isolation because of limited resources and

¹Steven Philip Cohen, "Solving Proliferation Problems in a Regional Context: South Asia," in New Threats: Responding to the Proliferation of Nuclear, Chemical, and Delivery Capabilities in the Third World, the Aspen Strategy Group (Lanham, MD: University Press of America, 1990), 194 note 10.

abilities, and anxious about their near constant security crises. Both believe they face challenges to the legitimacy and existence of the state. Both have relied heavily on one or two outside security guarantors despite distrust of the reliability of their patrons. Both face internal unrest based on ethnic tensions which exacerbate security concerns, and both face enemies which encourage that internal discord. Both have violated international behavioral norms, contributing to their isolation (one shared example is the ruthless suppression of internal unrest, in Israel recently and in Pakistan in 1971; both actions provoked outrage from the international community). Clearly, the garrison mindset drives both countries' security quests and therefore both nuclear weapons programs.²

One aspect of this shared mindset is a willingness to pursue a nuclear weapon option even at the risk of alienating the primary security guarantor. For both nations, that patron has been the United States. Israeli provocations have included misrepresenting the Dimona facility, hiding much of its operation during American inspections, stealing American highly-enriched uranium, and smuggling USA krytrons. Each episode has strained the USA-Israeli friendship, though that unique relationship features an almost gymnastic flexibility in Washington. Still, United States aid packages to Israel are now subject to a debate unheard of in past decades. Pakistan's provocations have been similarly serious and persistent; the convictions of Nazir Vaid and Arshad Pervez for nuclear smuggling in the USA are just two of many examples. Not having Israel's special ties to the United States,

²For more detailed discussion, see Chapters 3 and 5. Differences of degree, especially in diplomatic isolation, will be dealt with below.

Pakistan lost aid for a short time in the late 1970s and possibly for all time in the fall of 1990. Both aid cut-offs resulted directly from Pakistan's nuclear weapon efforts. This increase in Islamabad's isolation can be attributed to the garrison mentality, which has spurred a search for security solutions even at high cost.³

Both Pakistan and Israel have engaged in a kind of nuclear poker with the USA, hinting heavily that reductions in aid would force them to rely on their nuclear option.⁴ None of this would be possible, of course, unless America was willing to play along. Indeed, Washington has tried to purchase nuclear good behavior from the two with arms deals on several occasions.⁵ The winners of this game, with nuclear weapons and military aid in hand, are the two American "clients."

Curiously, Pakistan directly benefited from the USA-Israel relationship once. In late 1981, Representatives Solarz and Bingham proposed a law which would cut off American aid to any NNWS building

³On Israeli provocations, see Gerard C. Smith and Helena Cobban, "A Blind Eye to Nuclear Proliferation," Foreign Affairs Vol. 68 (Summer 1989): 59-65. On Pakistani provocations, see Pierre Lellouche, "The Garrison States," in Nuclear Proliferation in the 1980s, ed. William H. Kincade and Christoph Bertram (New York: St. Martin's Press, 1982), 65.

⁴Ashok Kapur, as quoted in Frank Barnaby, The Invisible Bomb: The Nuclear Arms Race in the Middle East (London: I.B. Tauris and Co., 1989), 122; and Mary Curtius, "Israel Needs More US Aid to Spur Economy and Immigration, Economist Says," Christian Science Monitor 20 Jan. 1987, 9, 14.

⁵See Theodore Winkler, "Nuclear Proliferation in the 1980s: Perceptions and Proposals," in Nuclear Proliferation in the 1980s, ed. William H. Kincade and Christoph Bertram (New York: St. Martin's Press, 1982), 150. He cites the sale of Hawk ABMs to Israel in 1963, and "carrots" of A-7 and F-5 aircraft offered to Pakistan in 1977 and 1979 respectively.

nuclear arms. Pakistan was clearly the target. State Department officials told the two legislators that enactment of the bill could stop aid to Israel; they soon withdrew it.⁶ (American actions will be discussed further in the next chapter.)

Thus, a garrison mindset leads to risks even in the most important bilateral security relationship, risks deemed acceptable in a desperate security search centered on acquisition of nuclear arms.

Similar Methods of Acquisition

Once the garrison states of Israel and Pakistan decided to build the bomb, they chose similar means. As analyst Ashok Kapur puts it, "Israel continues to be the role model" for the Islamic Republic in nuclear weapons development.⁷ A brief recap of acquisition similarities follows (for details, see Chapters 3 and 5).

Indigenous resources. Both Israel and Pakistan have small reserves of uranium within their borders. Both relied early on a pool of capable nuclear and physical scientists. Neither had nearly enough resources at first for production of an atomic arsenal.

Open acquisition. Both nations secured Western nuclear expertise via training programs for their scientists (such as "Atoms for Peace") and safeguarded research reactors. Both purchased yellowcake on the

⁶Judith Miller, "2 in House Withdraw Atom Curb," New York Times 9 Dec. 1981, A8.

⁷Ashok Kapur, Pakistan's Nuclear Development (London: Croom Helm, 1987), 220; see also 216 and 225 note 97.

international market. Both also purchased nuclear-capable aircraft from the West (and in Pakistan's case, from China). These acquisitions were public and largely unrestricted.

Covert acquisitions. Both countries got key expertise and equipment secretly, most vitally in fissile materials production and in warhead design. The partners in these transactions, regime abstainers France and China, also sold missile technology. Other quiet purchases (for example, by Pakistan of small components not on the NSG Trigger List) demonstrate that both states relied on this method for crucial items.

Clandestine acquisitions. Both Jerusalem and Islamabad stole or illegally exported equipment from supplier nations. Coincidentally, both were caught smuggling krytrons for the USA in the 1980s, though their programs were at quite different stages.

Evasion of the control regime. Neither country is a party to the NPT. Neither has a full-scope safeguards agreement with the IAEA, though both own some safeguarded facilities. Both have dodged inspections by the USA. Both have violated NSG regulations and supporting national export laws. And both have aided potential nuclear proliferators in defiance of the regime (Israel has helped South Africa and Taiwan; Pakistan has sent nuclear advisors to Iran).

Policy of ambiguity. Both have supported nuclear weapons acquisition by denying nuclear ambitions while suggesting capability and the will to exercise it. Pakistan, like Israel, used this tactic in part to persuade the American Congress to continue aid (successful for a decade). And, like Israel, the Islamic Republic simultaneously flaunted nuclear assets to warn

its adversaries.⁸ One notable feature of this policy is that it has been employed in two democratic nations (Pakistan can be so identified at some, but not all, points in the past two decades) with no official debate and preponderant public support.⁹

Dual track. Also, both nations have walked a two track technological path. Israel gained the bomb through reprocessing, but also developed enrichment techniques, apparently intending high-enriched uranium as a supplement for Dimona's plutonium production. Similarly, Pakistan got its bomb through enrichment but continued to pursue reprocessing (even after American and French opposition). It holds reprocessing capability as a backup for use if circumstances warrant.

Similar Results

Pakistan and Israel are at different stages in their nuclear weapons programs, but a simple comparison reveals that they both have achieved key goals. Both have constructed (or could construct in a very short time) nuclear warheads. Both are able to deploy those warheads and have at least some chance of delivery to a target should they chose to do so. Also, neither Israel nor Pakistan rested after achieving a first-generation warhead; both are researching and developing advanced, "boosted" designs. Similarly, both have attempted to diversify delivery modes from the outset.

⁸Barnaby, 114; and Kapur, 221.

⁹For a citation of nuclear program popularity, see Robert S. Greenberger, "Pakistan's Growing Anti-Americanism Spurs Its Nuclear Weapons Program," Wall Street Journal 4 Feb. 1991, A8.

The two *de facto* NWS have also encountered at least two defense planning problems as a result of their new weapons. Both must now develop C3 systems to ensure against unwanted use and to improve crisis safety. And, both countries face the question of strategic doctrine; they must decide when, and in what manner, their nuclear explosives would be used in a variety of complex scenarios.

Differences

Contrasts in the two programs are evident in four areas: original basis, stage of development, resources, and strategic situation. While a few of these differences are significant, most of them have had no discernible impact on program conduct or results.

First, the basis of the two nuclear programs differ in that Israel from the start intended a military product while Pakistan operated an exclusively civilian power program until 1972. Still, this distinction is largely technical since the two countries acquired the same resources (a research reactor, training) in the process, Israel under the guise of a legitimate research and power program. Therefore, "Atoms for Peace" supplied much of the foundational knowledge in both cases.

Second, Israel and Pakistan are at different stages of arsenal development, a difference arising from the ages of their programs. Israel gained nuclear weapons capability in about 1966; Pakistan achieved it twenty years later. Naturally Israel's arsenal is larger, more sophisticated, and more readily deliverable. It is instructive to note, however, that in 1971 (after five years of capability), Israel had between ten and twenty warheads; boosted

weapons were far off, and delivery options included only small numbers of aircraft and a few inaccurate missiles. Today, five years after Pakistan crossed the capability threshold, it has enough fissile material for about ten warheads; its delivery options are poorer than Israel's were, but it is ahead of Israel's pace in advanced warhead design. If the programs are compared from the point of capability, differences in result diminish.

In one way, Israel's prior example made it harder for Pakistan. Because of publicity about Israel's covert and clandestine methods of acquisition, the NSG tightened restrictions in many instances and several NSG states clamped down even more on their own.¹⁰ Thus, Pakistan was forced to run a more difficult obstacle course than its predecessor, and has had to rely more heavily on illegalities and deception. While Israel's example often helped, here it hindered the Islamic Republic.

Third, the two countries' dissimilar resources affected their programs at several points. Israel had a better base of scientists and industrial ability at the outset than Pakistan; this is another reason why Pakistan had to rely on clandestine acquisitions to a greater degree. Another resource Jerusalem has that Islamabad does not is highly competent military and intelligence support for its program. Israeli efforts to stymie the Iraqi bomb program in the late 1970s and early 1980s were not matched by comparable Pakistani efforts against India in large part because Pakistan is incapable of mounting such a campaign.

¹⁰In fact, the NSG formed (from more casual consultation) in part as a response to the proliferation activities of Israel and others.

One other Israeli asset may be regarded as a resource, also. That nations' governmental stability has helped it to pursue the bomb steadily, while changes in Pakistan's course derive in part from governmental upheavals (especially from Bhutto to Zia in 1977). Stability and the clear control of the Israeli Atomic Energy Commission by elected officials also suggests that Israel's C3 and crisis management planning has been easier than in Pakistan, where the military shares power and several individuals determine the nuclear program's course. This may prove to be the greatest practical difference between the two programs, with sobering ramifications for South Asian crisis decision-making.

Fourth, several differences arise from dissimilar strategic situations. Pakistan held a tenuous lead in conventional weaponry over India only until the early 1960s, and was thereafter at a decided disadvantage in nearly all categories. Israel still holds a qualitative edge, though its numbers are as worrisome as Pakistan's. Also, from the early days of its bomb effort, Pakistan has faced a nuclear-capable foe. Israel fears one, but thus far only as a future possibility. These distinctions boil down to the same garrison state mindset, however, in which state security is believed to be in mortal danger. Pakistan has had the "advantage" of citing the Indian atomic threat as a justification for its endeavors, but Israel has not had a comparable justification (especially since the Osiraq bombing).

Also, Pakistan's diplomatic isolation is not as severe as Israel's. This has provided a certain amount of leeway, and has allowed the Islamic Republic to purchase arms from several suppliers (Israel is limited almost exclusively to the USA and its own restricted production). China's role as

nuclear godfather has also encouraged Pakistan to pursue its own goals despite Washington; whether China will assume the role of primary security guarantor now being vacated by the USA remains to be seen. Other diplomatic ties include good relations with many Arab states. Still, Pakistan is isolated militarily. No one will stand with their ally against India in combat, not even Pakistan's patrons. In this sense, Pakistan and Israel share a solitude which makes nuclear weapons quite appealing.

Finally, Pakistan has pursued arms control as a second security track, probably in good faith, while Israel has not. Israel's experience in the region leaves it cynical about agreements with its neighbors, which (it charges) ignore international accords. And Jerusalem is understandably dubious about the three states nearby which adhere to the NPT but openly reach for the bomb (Libya, Iraq, and Iran). Israel's sole foray into arms control has been a general call for a nuclear-free zone in the Middle East, a proposal viewed as hypocritical and flippant by Arab leaders. Pakistan's proposals, in contrast, have been numerous and detailed, and could (if China's lurking presence to the north is considered) lead to useful bilateral controls someday when the subcontinent tires of the tension and expense of an arms race.

Conclusion

The nuclear weapons programs of Israel and Pakistan share a common motivation, the same end, highly similar means, and comparable problems. To an indefinable extent, Pakistan used Israel's earlier example as its model for program conduct, particularly in maintaining American aid and in techniques of acquisition. Though differences between the two programs

exist, most are superficial and do not significantly alter program drives and goals. Importantly, the two nations relied strongly on the same acquisition techniques (covert purchases and regime evasion) despite different original nuclear bases and resources.

And, for better or worse, both programs resulted in the bomb. Israel, the first undeclared NWS, and Pakistan, the most recent, have run the obstacle course successfully, a lesson which has not been lost on potential proliferators. Perhaps those countries will also see that a nuclear security solution carries with it dangers at least as potent as the threats which inspired the quest for the bomb.

The final chapter will discuss ramifications of the Israeli and Pakistani experiences.

CHAPTER 8

CONCLUSION

Proliferation is a set of symptoms with a number of causes. It is both a political and technical problem. Therefore no single cure, or set of cures, will work.

Leonard Weiss¹

The nuclear programs of Israel and Pakistan have much in common. They also share much with programs in other garrison states, such as South Africa (another de facto NWS) and several threshold states (Taiwan, the Koreas). An understanding of the Israeli and Pakistani programs, then, could well inform attempts to stop proliferation in other like-minded nations. This chapter will suggest some ramifications of the Israeli-Pakistani programs for the control regime and particularly for the United States.²

Problems of Supply

The international nonproliferation regime is far from perfect, as the four undeclared NWS have demonstrated. Each major manifestation of the regime (which attempts to set a norm diplomatically while constraining technical supply) has been criticized for inadequacies. A synopsis of these complaints follows.

¹Quoted in George Russell, "Who Has the Bomb," Time 3 June 1985, 37. Weiss is an expert who has served on the staff of the Senate.

²This thesis cannot include a discussion of proliferation management in the Middle East and South Asia; many sources address this (rather than the prevention) aspect, though. See for example John J. Weltman, "Managing Nuclear Multipolarity," International Security Vol. 6 No. 3 (Winter 1981/1982): 182-194.

The NPT is inherently discriminatory and has been undermined by the willful non-participation of a small set of important nations (France, China, India, Israel, South Africa, Pakistan, and several threshold states). Also, it is easy to abrogate and may be a cover for the nuclear weapons programs of several members (Libya, Iraq, North Korea). Both Israel and Pakistan got major covert assistance from non-NPT supplier states.

The IAEA lacks clout. It has no substantial enforcement power, and little investigative authority. It also needs more money and a larger staff. Diversions of fissile materials remain feasible (as shown by the KANUPP case) despite agency activities.

The NSG is lax. That is, a minority of members are, a fact exploited by all the *de facto* NWS. As one analyst asserts:

Any NNWS, such as Pakistan which is in the mode of acquiring a weapon capability, is able to do so only because of the Nelson's eye turned upon such activities by powerful supplier states, despite their own laws to the contrary and despite agreed-upon international restraints in such matters.³

The MTCR is late and incomplete. While it has slowed or stopped nuclear-capable missile acquisition in several places, it was too late to address Israeli, Indian, and South African programs. And Pakistan continues to receive help from MTCR non-participant China.

National export laws are in many cases excellent, but they have not been applied with rigor. Recent examples in Germany are disquieting, but

³Onkar Marwah, "The Non-Proliferation Policies of the Non-Nuclear-Weapon States," in Nuclear Non-Proliferation and Global Security, ed. David B. Dewitt (New York: St. Martin's Press, 1987), 109.

perhaps the worst offender is the United States itself. According to American law, all aid to Israel has been illegal since 1977 (when the NNPA was enacted). “We have the great difficulty of a double standard,” Gerard Smith has commented. “We know the Israelis have nuclear weapons and we never did anything about it.”⁴

Pakistan might argue that the USA took action, but against it, and not against fellow proliferators Israel and India. Many of the laws passed by Congress concerning nonproliferation have been directed at Pakistan, and one of them—the 1985 Pressler Amendment—forced the 1990 aid cut-off. Despite Pakistan’s feelings of persecution, the United States waived laws for it many times in the 1980s to continue the flow of arms to the Afghan rebels next door. Other pressures by the USA on its ally, such as urging NPT ratification, have failed in part because of the double standard. “We will sign the NPT the day you get Israel to sign it,” said a Pakistani official in 1987.⁵

As this history shows, American policy makers have persistently placed proliferation at lower priority than other concerns. Emotional and strategic ties to Israel plus anti-Soviet containment in South Asia have proven more substantial in Washington than nonproliferation commitments. Many analysts believe that “American permissiveness toward the acquisition of nuclear weapons by its friends is against its own best interest and should

⁴Quoted in Rod Nordland, “The Bombs in the Basement,” Newsweek 11 July 1988, 45.

⁵Quoted in Nayan Chanda, “Yes, We Have No Bomb,” Far Eastern Economic Review 12 March 1987, 35

be stopped.”⁶ Sen. John Glenn, a staunch anti-proliferation voice on Capitol Hill, expressed his frustration during hearings on this topic in 1989:

I know these policies are very tough to work, and I know we have other interests with Pakistan. We certainly have other interests with regard to Israel, and overlook that and continue aid. We overlook things in a lot of countries. We have [sold] F-16s to Pakistan and Israel. We have [sent] Air Force assistance to Brazil’s space program. We have a whole host of things that we overlook when these matters come up then about what kind of assistance we are going to give these various countries, and I think that if we are ever going to have a chance . . . to really cut back on nuclear proliferation, we just have to have a policy that [is] much tougher than it has been to date.⁷

Clearly, supply must be tightened both in America and elsewhere. Membership in the NSG and MTCR must also be expanded, and additional incentives provided for regime participation. Many other helpful measures have been proposed. But what has been most crucially absent is the resolute will to halt proliferation. Both Israel and Pakistan had the determination to run the course, but their will was unmatched by the opposition.

Problems of Security

The *de facto* NWS have sought a technological fix for complex and deep-seated security problems. They have done so largely because no other solutions to those problems were thought to be forthcoming. If the control

⁶Gerard C. Smith and Helena Cobban, “A Blind Eye to Nuclear Proliferation,” Foreign Affairs Vol. 68, (Summer 1989): 54.

⁷Congress, Senate, Committee on Governmental Affairs, Nuclear and Missile Proliferation: Hearing Before the Committee on Governmental Affairs, 101st Cong., 1st. sess., 18 May 1989, 44.

regime is serious about stopping the spread of nuclear weapons, its members must address the security issues which make the bomb desirable in the first place. The NWS, in particular, must regard security solutions in the Middle East, South Asia, and South Africa as worthy of effort to the same extent that regional nuclear wars are worthy of prevention. The undeclared NWS cannot defend themselves or provide for national safety alone—their bombs say so. Obviously, these are complex issues and solutions may be difficult. The current state of proliferation, however, cannot be acceptable to any country which desires a future free of nuclear violence. This choice is growing ever more stark.

Importantly, also, the NWS must provide a security example by careful nuclear disarmament. The reliance on atomic arsenals for military security cannot be acceptable for the great powers if it is also not acceptable for lesser powers. So says the NPT, which could collapse unless the USA and USSR accomplish much more in this arena by the 1995 treaty review conference.

For the undeclared NWS, the central, thorny issue is the deterrence of the state-ending threat. Any use of nuclear weapons, however, could well pour fuel on an already dangerous fire, inciting the jihad the bomb was intended to prevent. Undeclared SNFs, therefore, compound the security problem instead of solving it.⁸ Perhaps the control regime can communicate this message successfully to other garrison states, and add multilateral arrangements which will lessen their desire for the bomb. Selling weapons and sending aid will not suffice, as the examples of Israel and Pakistan show.

⁸For an in-depth treatment of SNF risks, see Rodney W. Jones, Small Nuclear Forces (New York: Praeger Publishers, 1984), 51-57.

Problems of the Atom

Ultimately, the world must decide if widespread nuclear power and research is worth the price of nuclear proliferation. Even Pakistan's own Dr. Strangelove, A. Q. Khan, has mentioned the connection:

The word 'peaceful' associated with a nuclear program is humbug. There is no peaceful bomb. After all, there is only a weak, transparent screen between the two. Once you know how to produce plutonium—all that Pakistan has mastered as well—it becomes rather easy to produce nuclear weapons.⁹

More and more countries will find it easy in the coming years.

Whether they will find it desirable is not yet certain; probably the garrison states among them will. For they, like Israel and Pakistan, echo the two murderers of Banquo in Macbeth:

Second Murderer: I am one, my liege,
Whom the vile blows and buffets of the world
Hath so incensed that I am reckless what
I do to spite the world.

First Murderer: And I another
So weary with disasters, tugged with fortune,
That I would set [risk] my life on any chance,
To mend it or be rid on't.¹⁰

⁹Quoted in Steven R. Weisman, "Report of Pakistani A-Bomb Causes a Stir in the Region," New York Times 2 March 1987, A3.

¹⁰Macbeth 3.2.108-115.

SOURCES CONSULTED

The sources consulted for this thesis have been divided into four sections: Books, Journal Articles, Newspaper Articles, and Other Sources.

Books

- Barnaby, Frank. The Invisible Bomb. London: I. B. Tauris, 1989.
- Bhatia, Shyam. Nuclear Rivals in the Middle East. New York: Routledge, 1988.
- Brzoska, Michael, and Thomas Olson, ed. Arms Production in the Third World. London and Philadelphia: Taylor and Francis, 1986.
- Davenport, Elanie, Paul Eddy, and Peter Gillman. The Plumbat Affair. Philadelphia and New York: J. B. Lippincott Co., 1978.
- Dror, Yehezkel. Crazy States. Lexington, MA: D. C. Heath Lexington Books, 1971.
- Feldman, Shai. Israeli Nuclear Deterrence: A Strategy for the 1980s. New York: Columbia University Press, 1982.
- Fischer, David, and Paul Szasz. Safeguarding the Atom: A Critical Appraisal, ed. Jozef Goldblat. London and Philadelphia: Taylor and Francis, 1985.
- Harkavy, Robert. Spectre of a Middle Eastern Holocaust: The Strategic and Diplomatic Implications of the Israeli Nuclear Weapons Program. Denver: University of Denver for the Monograph Series in World Affairs, 1977.
- International Institute for Strategic Studies. The Military Balance 1988-1989. London: International Institute for Strategic Studies, 1988.
- Jones, Rodney W. Small Nuclear Forces. New York: Praeger Publishers, 1984.
- Kapur, Ashok. Pakistan's Nuclear Development. London: Croom Helm Ltd., 1987.
- Nakdimon, Shlomo. First Strike. New York: Summit Books, 1987.

- Ostrovsky, Victor, and Clair Hoy. By Way of Deception. New York: St. Martin's Press, 1990.
- Pean, Pierre. Les deux bombes. Paris: Fayard, 1981.
- Pry, Peter. Israel's Nuclear Arsenal. Boulder, CO: West View Press, 1984.
- Reiss, Mitchell. Without the Bomb: The Politics of Nuclear Nonproliferation. New York: Columbia University Press, 1988.
- Rogers, Paul. Guide to Nuclear Weapons, Bradford Peace Studies Papers: New Series No. 2. New York: St. Martin's Press for Berg, 1988.
- Sax, N. Irving, and Richard J. Lewis Sr., revisors. Hawley's Condensed Chemical Dictionary, 11th ed. New York: Van Nostrand Reinhold Co., 1987.
- Spector, Leonard S. The New Nuclear Nations: The Spread of Nuclear Weapons 1985. New York: Vintage Books, 1985.
- _____. The Undeclared Bomb: The Spread of Nuclear Weapons 1987-1988. Cambridge, MA: Ballinger Publishing Co., 1988.
- Spector, Leonard S., with Jacqueline R. Smith. Nuclear Ambitions: The Spread of Nuclear Weapons 1989-1990. Boulder, CO: Westview Press, 1990.
- Subramanian, Ram R. Nuclear Competition in South Asia and U.S. Policy. Berkeley, CA: Institute of International Studies, University of California—Berkeley, 1987.
- Taylor, John W. P., ed. Jane's All the World's Aircraft. London and New York: Jane's Publishing, 1985.
- U.S. Arms Control and Disarmament Agency. Arms Control and Disarmament Agreements, Text and History of Negotiations. Washington: Government Printing Office, 1982.
- Vital, David. The Inequality of States: A Study of the Small Power in International Relations. Oxford: Clarendon Press, 1967.
- Weissman, Steve, and Herbert Krosney. The Islamic Bomb: The Nuclear Threat to Israel and the Middle East. New York: Times Books, 1981.

Journal Articles

Albright, David. "Pakistan's Bomb-Making Capacity." Bulletin of the Atomic Scientists Vol. 43 No. 5 (June 1987): 30-33.

Albright, David, and Tom Zamora. "India, Pakistan's Nuclear Weapons: All the Pieces in Place." Bulletin of the Atomic Scientists Vol. 45 No. 5 (June 1989): 20-26.

"South Africa Flirts with the NPT." Bulletin of the Atomic Scientists Vol. 47 No. 1 (Jan./Feb. 1991): 27-31.

Aronson, Shlomo. "The Nuclear Dimension of the Arab-Israeli Conflict: The Case of the Yom Kippur War." The Jerusalem Journal of International Relations Vol. 7 No. 1-2 1984): 107-142.

"Arrows and Spears." Arms Control Today Vol. 20 No. 7 (Sept. 1990): 21.

Betts, Richard K. "Paranoids, Pygmies, Pariahs, and Nonproliferation." Foreign Policy No. 26 (Spring 1977): 157-183.

Bhutto, Mohtrama Benazir. "The Policies of Pakistan." Vital Speeches 1 July 1989, 551-553.

"Bhutto Claims Nuclear 'Knowledge' Available." Agence France Press (Hong Kong), 1108 GMT, 29 Aug. 1989. Reprinted in FBIS-NES, 29 Aug. 1989, 47.

Bolt, Richard. "Plutonium For All: Leaks in Global Safeguards." Bulletin of the Atomic Scientists Vol. 44 No.10 (Dec. 1988): 14-19.

"Bonn Unhappy with U.S. F-16 Deal With Country." Der Spiegel 24 July 1989. Translated in FBIS-NES, 16 Aug. 1989, 56.

Chanda, Nayan. "Yes, We Have No Bomb." Far Eastern Economic Review 12 Mar. 1987, 34.

Cochran, Thomas B., William A. Arkin, and Robert S. Norris. "U.S. Nuclear Weapons Production: An Overview." Bulletin of the Atomic Scientists Vol. 44 No. 1 (Jan./Feb. 1988): 12-16.

Cohen, Avner, and Benjamin Frankel. "Israel's Nuclear Ambiguity." Bulletin of the Atomic Scientists Vol. 43 No. 2 (Mar. 1987): 15-19.

- Cranston, Sen. Alan. "Nuclear Proliferation and U.S. National Security Interests." Congressional Record Vol. 130 No. 86 (21 June 1984): S7901-S7906.
- Deutsch, Karl W., and J. David Singer. "Multipolar Power Systems and International Stability." World Politics Vol. 16 (1964): 390-406.
- Doerner, William R. "Knocking at the Nuclear Door." Time 30 Mar. 1987, 42-43.
- Donnelly, Warren H. "Managing Proliferation in the 1990s, 'Something Borrowed, Something New...'" Social Education Vol. 54 No. 3 (Mar. 1990): 156-158.
- Donovan, Fred. "Mideast Missile Flexing." Arms Control Today Vol. 20 No. 4 (May 1990): 30-31.
- "Earthshaker." The Economist 26 Mar. 1988, 31-32.
- Feiveson, Harold A., Frank von Hippel, and David Albright. "Breaking the Fuel-Weapons Connection." Bulletin of the Atomic Scientists Vol. 42 No. 3 (Mar. 1986): 26-31.
- Fialka, John J. "The American Connection: How Israel Got the Bomb." The Washington Quarterly Vol. 10 No. 10 (Jan. 1979): 50-58.
- Flournoy, Michelle, and Kurt M. Campbell. "South Africa's Bomb: A Military Option?" Orbis Vol. 32 No. 3 (Summer 1988): 385-401.
- Harkavy, Robert E. "The Pariah State Syndrome." Orbis Vol. 21 No. 3 (Fall 1977): 623-649.
- Hibbs, Mark. "German Firm's Exports Raise Concerns About Pakistan's Nuclear Capabilities." Nuclear Fuel 6 Mar. 1989, 13-14.
- _____. "German Firms Exported Tritium Purification Plant to Pakistan." Nuclear Fuel 6 Feb. 1985, 6-7.
- _____. "U.S. Repeatedly Warned Germany on Nuclear Exports to Pakistan." Nuclear Fuel 6 Mar. 1989, 12-13.
- Honigsbaum, Mark. "Jury Finds Conspiracy in Nuclear Metal Case." American Metal Market Vol. 95 No. 21 (Dec. 1987): 2, 8.
- "How Israel Got the Bomb." Time 12-Apr. 1976, 39-40.
- Hussain, Mushahid. "Pakistan 'Responding' to Change." Jane's Defense Weekly 14 Oct. 1989, 279.

- "Israeli Satellite Launch Sparks Concerns About Middle East Missile Buildup." Aviation Week and Space Technology 26 Sept. 1988, 21.
- Jensen, Holger. "A Threat of Nuclear War." Maclean's 11 June 1990, 52-53.
- Karp, Aaron. "The Frantic Third World Quest for Ballistic Missiles." Bulletin of the Atomic Scientists Vol. 44 No. 5 (June 1988): 14-20.
- Khan, Shahid-ur-Rehman. "China Agrees to Supply 300-MW PWR to Pakistan." Nucleonics Week Vol. 30 No. 47 (23 Nov. 1989): 1-2.
- Leclerc du Sablon Jean, and Jean Francois Leven. "Trying to Join the-Club of Great Nations." World Press Review June 1988, 26-28.
- Leventhal, Paul. "The Nuclear Power and Nuclear Weapons Connection." Social Education Vol. 54 No. 3 (Mar. 1990): 146.
- Marshall, Eliot. "Navy Lab Concludes the Vela Saw a Bomb." Science Vol. 209 (29 Aug. 1980): 996-997.
- Milhollin, Gary. "Heavy Water Cheaters." Foreign Policy No. 69 (Winter 1987-88): 100-119.
- _____. "India's Missiles—With a Little Help From Our Friends." Bulletin of the Atomic Scientists Vol. 45 No. 9 (Nov. 1989): 31-35.
- Moss, Norman. "Vanunu, Israel's Bombs, and U.S. Aid." Bulletin of the Atomic Scientists Vol. 44 No. 4 (May 1988): 7-8.
- Murphy, Richard W. "Pakistan and the Nuclear Issue." Department of State Bulletin Vol. 87 No. 2127 (Oct. 1987): 53-54.
- Nolan, Janne E., and Albert D. Wheelon. "Third World Ballistic Missiles." Scientific American Vol. 263 No. 2 (Aug. 1990): 34-40.
- Nordland, Rod. "The Bombs in the Basement." Newsweek 11 July 1988, 42-45.
- _____. "A Pakistan Bombshell." Newsweek 16 Mar. 1987, 45.
- Norman, Colin. "Dispute Reopened on Mysterious 1979 Flash." Science Vol. 228 (7 June 1985): 1180.
- North, David M. "Seven Nations Curb Nuclear Weapon Launch System Exports." Aviation Week and Space Technology Vol. 126 No. 16 (20 Apr. 1987): 28-29.

- "Nuclear Exports to Pakistan Reported." Der Spiegel 20 Feb. 1989.
Translated in Congressional Record, 16 May 1989, S5441-S5442.
- "Pakistan in Missile Build Claim." Jane's Defense Weekly 18 Feb. 1989, 267.
- Rogal, Kim. "Worries About the Bomb." Newsweek Dec. 1982, 50.
- Rose, David J., and Richard K. Lester. "Nuclear Power, Nuclear Weapons, and International Stability." Scientific American Vol. 238 No. 4 (Apr. 1978): 45-57.
- Rosecrance, Richard N. "Bipolarity, Multipolarity, and the Future." Journal of Conflict Resolution Vol. 120 (1966): 314-327.
- Russell, George. "Who Has the Bomb." Time 3 June 1985, 36-52.
- Sanders, Ben. "Non-Proliferation Treaty: A Broken Record?" Bulletin of the Atomic Scientists Vol. 68 (Summer 1989): 53-70.
- Smith, Hedrick. "A Bomb Ticks in Pakistan." New York Times Magazine 6 Mar. 1988, 38-40.
- Subrahmanyam, K. "Regional Conflicts and Nuclear Fears." Bulletin of the Atomic Scientists Vol. 40 No. 5 (May 1984): 16-19.
- "Unfriendly Skies." Bulletin of the Atomic Scientists Vol. 45 No. 9 (Nov. 1989): 52.
- "Washington Whispers." U.S. News and World Report 12 Feb. 1990, 20.
- Watson, Russell, and John Barry. "Israel's Deal with the Devil?" Newsweek 6 Nov. 1989, 52.
- Weltman, John J. "Managing Nuclear Multipolarity." International Security Vol. 6 No. 3 (Winter 1981/1982): 182-194.
- "What is Known About Israeli Missiles." Bulletin of the Atomic Scientists Vol. 46 No. 1 (Jan./Feb. 1990): 48.
- Wohlstetter, Albert. "Spreading the Bomb Without Quite Breaking the Rules." Foreign Policy No. 25 (Winter 1976-77): 88-96, 145-179.

Newspaper Articles

- Adams, James. "Pakistan's 'Nuclear War Threat.'" Sunday Times (London) 27 May 1990, 1-2.
- Babcock, Charles R. "Norway Eyes Israel's Use of Nuclear Ingredient." Washington Post 10 Nov. 1986, A26.
- Beres, Louis Rene. "Israel's Tough Nuclear Choice: Ambiguity Vs. Disclosure." Christian Science Monitor 3 Feb. 1988, 11.
- Brinkley, Joel. "Israel Fears that Peace in the Persian Gulf Will Unleash a Bitter Foe." New York Times 24 July 1988, E2.
- "C.I.A. Concluded, Ex-Aid Says, That Israel Made Nuclear Arms." New York Times 2 May 1981, 2.
- "Californian Indicted in Export of Triggers to Israel." New York Times 17 May 1985, A8.
- "Capabilities of Israeli Missiles Cited." Washington Post 15 Nov. 1989, A14.
- Coll, Steve. "France to Sell Nuclear Power Plant to Pakistan." Washington Post 22 Feb. 1990, A25, A31.
- Crossette, Barbara. "India Reports Successful Test of Mid Range Missiles." New York Times 23 May 1989, A9.
- _____. "Pakistani Offers Atom Issue Talks." New York Times 30 Nov. 1990, A7.
- Curtius, Mary. "Israel Needs More US Aid to Spur Economy and Immigration, Economist Says." Christian Science Monitor 20 Jan. 1987, 9, 14.
- Cushman, John H., Jr. "U.S. Sent Liquid to Israel for Reactor." New York Times 10 Nov. 1986, A10.
- Dorsey, James M. "Pakistan Able to Equip F-16s for Nuclear Bombs." Washington Times 31 May 1990, A7.
- Drogin, Bob. "U.S. Officials Reportedly Conclude That Pakistan Has a Nuclear Bomb." Los Angeles Times 24 Oct. 1990, A6.
- Fialka, John J. "West Concerned by Signs of Libyan-Pakistan A-Effort." Washington Star 25 Nov. 1978, 3.

- Failka, John J., and Thomas F. O'Boyle. "West German Firms Admit Supplying Nuclear-Weapons Material to Pakistan." Wall Street Journal 21 Apr. 1989, 20.
- Gelb, Leslie H. "Pakistan Tie Imperils U.S.-China Nuclear Pact." New York Times 22 Jan. 1984, A1, A3.
- _____. "Peking Said to Balk at Nuclear Pledges." New York Times 23 Jan. 1984, A3.
- Greenberger, Robert S. "Pakistan's Growing Anti-Americanism Spurs Its Nuclear Weapons Program." Wall Street Journal 4 Feb. 1991, A8.
- Hersh, Seymour M. "Pakistani in U.S. Sought to Ship A-Bomb Trigger." New York Times 25 Feb. 1986, A1, A6.
- Hussain, Mushahid. "Why Pakistan Needs a Nuclear Option." Washington Post 29 July 1987, Opinion page.
- Melman, Yossi. "Why Israel May Show Its Nuclear Hand." New York Times 6 Aug. 1990, A13. 148
- Milhollin, Gary. "Asia's Nuclear Nightmare: The German Connection." Washington Post 10 June 1990, C1-C2.
- _____. "Why Are We Helping the Third World Go Nuclear?" Washington Post 1 Apr. 1990, C1, C4.
- Miller, Judith. "2 in House Withdraw Atom Curb." New York Times 9 Dec. 1981, A8.
- Ottaway, David B. "Signs Found India Building An H-Bomb." Washington Post 11 Jan. 1987, C7.
- Raviv, Dan, and Yossi Melman. "The Mideast Goes MAD." Washington Post 15 July 1990, B1-B2.
- "Revealed: The Secrets of Israel's Nuclear Arsenal." Sunday Times (London), 5 Oct. 1986, 1.
- Shipler, David K. "Pakistan Tied to Atom Shipping Plot." New York Times 14 Jan. 1988, A3.
- "U.S. Worried That Israel Has Illegal A-Bomb Devices." San Francisco Chronicle 15 May 1984, 11.
- Weisman, Steven R. "Report of Pakistan A-Bomb Causes a Stir in the Region." New York Times 2 Mar. 1987, A3.

Other Sources

"C.B.S. Evening News with Walter Cronkite." C.B.S. Television Network, 21 Feb. 1980.

Cohen, Stephen Philip. "Solving Proliferation Problems in a Regional Context: South Asia." In New Threats: Responding to the Proliferation of Nuclear, Chemical and Delivery Capabilities in the Third World, the Aspen Strategy Group, 163-196. Lanham, MD: University Press of America, 1990.

Freier, S. "The NPT and the Middle East." In Nuclear Nonproliferation and Global Security, ed. David B. Dewitt, 189-200. New York: St. Martin's Press, 1987.

Ing, Stanley. "Emergent Suppliers, the Non-Proliferation Regime and Regional Security." In Nuclear Non-Proliferation and Global Security, ed. David B. Dewitt, 119-130. New York: St. Martin's Press, 1987.

Jennekens, Jan. "The IAEA, International Safeguards and the Future of the NPT." In Nuclear Non-Proliferation and Global Security, ed. David B. Dewitt, 73-84. New York: St. Martin's Press, 1987.

Kaplan, Morton A. "Variants on Six Models of the International System." In International Politics and Foreign Policy, ed. James N. Rosenau, 291-303. New York: The Free Press, 1969.

Lellouche, Pierre. "The Garrison States." In Nuclear Proliferation in the 1980s, ed. William H. Kincade and Christoph Bertram, 63-111. New York: St. Martin's Press, 1982.

Marwah, Onkar. "The Non-Proliferation Policies of the Non Nuclear-Weapon States." In Nuclear Non-Proliferation and Global Security, ed. David B. Dewitt, 105-117. New York: St. Martin's Press, 1987.

"N.B.C. Nightly News." National Broadcasting Company, 25 Oct. 1989.

Strong, Robert A. "The Nuclear Weapon States: Why They Went Nuclear." In Nuclear Proliferation in the 1980s, ed. William H. Kincade and Christoph Bertram, 3-26. New York: St. Martin's Press, 1982.

U.S. Congress. Senate. Committee on Foreign Relations. Consideration of Resolution of Disapproval of the Sale to Pakistan of 40 F-16 Aircraft:

Report of the Committee on Foreign Relations. 97th Cong., 1st sess., 19 Nov. 1981.

U.S. Congress. Senate. Committee on Governmental Affairs. Nuclear and Missile Proliferation: Hearing Before the Committee on Governmental Affairs. 101st Cong., 1st sess. 18 May 1989.

U.S. General Accounting Office. Nuclear Proliferation: Major Weaknesses in Foreign Visitor Controls at Weapons Laboratories. Oct. 1988. GAO/RCED 89-31.

United Nations. Centre for Disarmament. South Africa's Plan and Capability in the Nuclear Field. New York: United Nations, 1981. AN/35/402.

Winkler, Theodor. "Nuclear Proliferation in the 1980s: Perceptions and Proposals." In Nuclear Proliferation in the 1980s, ed. William H. Kincade and Christoph Bertram, 139-157. New York: St. Martin's Press, 1982.

APPENDIX 1

GLOSSARY

BERYLLIUM (Be). A hard brittle metal, used in the better first-generation nuclear warheads to reflect neutrons back into the fission reaction to increase its efficiency. It is on the NSG Trigger List.

BOOSTED WARHEAD. A fission warhead in which the fission reaction is enhanced by the presence of tritium, a radioactive isotope of hydrogen. Boosted warheads produce substantially larger yields than fission warheads using the same amount of fissile material.

CHAIN REACTION. The continuing process of nuclear fission in which the neutrons released by one fission (split) cause at least one other fission. In a nuclear weapon an extremely rapid, multiplying chain reaction causes the explosive release of energy. In a reactor the pace of the chain reaction is controlled to produce heat for power or neutrons for research purposes.

CORE (reactor core). The central portion of a reactor, containing the fuel elements and, usually, the moderator.

DEUTERIUM (D). A heavy isotope of hydrogen. In a crystalline compound with lithium, it is used to enhance fission reactions. In combination with oxygen (as heavy water), it can serve as a nuclear reactor moderator.

DUAL CAPABLE. Able to be used in either a conventional or nuclear role. Many aircraft and missiles may be referred to as dual-capable because they can carry either conventional or atomic bombs or warheads.

ENRICHMENT. A process designed to increase the proportion of a specified isotope. For example, natural uranium is enriched in one of several processes to increase the amount of U-235 (a fissile isotope).

FERTILE. Material composed of atoms which easily absorb (or "capture") neutrons and turn into fissile material. Both uranium-238 and thorium-232 are fertile materials.

FISSILE. Able to be split by a low-energy neutron. A plutonium-239 atom, for example, is fissile. Nuclear weapons use fissile material to generate an explosion.

FISSION. The process in which a neutron strikes the nucleus of an atom and splits it into fragments. Several neutrons are emitted at high speed, and heat and radiation are released.

FUSION. The process in which the nuclei of light atoms (chiefly the hydrogen isotopes deuterium and tritium) unite, or fuse, to form helium; this reaction yields enormous amounts of energy.

FLASH X-RAY MACHINE. A camera that takes split-second photographs through solid materials. It is used to study the performance of the non-nuclear triggering and explosive packages in atomic warheads, is valuable in warhead design, and may help a program maintain confidence in simple fission weapons without testing. It is a Trigger List item.

GARRISON STATE. A state characterized by relative smallness compared to surrounding nations, by the adversary nature of relations with neighbors, by vulnerability to international isolation due to limited resources and size, by reliance on one or two outside security guarantors, by total or extensive isolation diplomatically, and by a siege mentality resulting from and feeding the sense of strategic isolation. Garrison states are inclined to violate international behavioral norms in the pursuit of security goals, and are likely proliferators.

HEAVY WATER (D_2O ; also called deuterium oxide, D_2O). Water containing predominantly deuterium, a heavy isotope of hydrogen. It is used as a moderator in some nuclear reactors because it can reduce the energy of fast neutrons, enabling fertile material to absorb them or enabling fissile material to chain react.

HEAVY-WATER REACTOR (HWR). A reactor that uses heavy water as moderator. Heavy water is a more effective moderator than light water and makes it possible to produce a self-sustaining chain reaction with unenriched uranium.

HIGHLY-ENRICHED URANIUM. Uranium enriched to over twenty percent U-235.

INTERNATIONAL ATOMIC ENERGY AGENCY (IAEA). An autonomous inter-governmental organization affiliated with the UN. Its goals are to promote the peaceful uses of nuclear energy, particularly for developing nations, and to discourage the application of nuclear materials to military uses. Parties to the Non-Proliferation Treaty (NPT) and Treaty of Tlatelolco are required to enter into safeguards

agreements with the IAEA; non NPT states often also do so as a requirement of nuclear-related transactions.

IRRADIATION. Exposure to radiation, particularly in a reactor core. Fertile materials may be irradiated to produce fissile products such as plutonium.

ISOTOPE. Atoms having the same number of protons in their nuclei, and hence the same atomic number, but differing in the number of neutrons, and therefore, in atomic weight. For example, U-235 and U-238 are isotopes of uranium.

KILOTON. A measure of nuclear explosive power; one kiloton is equivalent to a thousand tons of TNT explosive.

KRYTRON. A small, high-voltage electrical switch used for many applications, one of which is as the trigger for the conventional high explosive portion of nuclear warheads. The export of krytrons is controlled.

LITHIUM-6. An isotope of lithium. When bombarded with neutrons, lithium-6 produces tritium, which can be used in boosted fission warheads. It is also used in production of the compound lithium deuteride, which is employed in super-boosted and staged thermonuclear fusion warheads.

LITHIUM DEUTRIDE (LiD). A compound of lithium and deuterium (a heavy isotope of hydrogen) often used in super boosted and staged thermonuclear warheads. This material is especially useful in warhead design because it is a solid at room temperature and is easy to handle.

LIGHT-WATER REACTOR (LWR). The most common type of power and research reactor, moderated and cooled by ordinary, "light" water. These reactors usually use lightly enriched uranium as fuel.

LOW-ENRICHED URANIUM. Uranium enriched to less than twenty percent U-235 (most often between three and six percent). Fuel elements in LWRs are usually enriched to about three percent U-235.

MARAGING STEEL. An especially strong alloy used in uranium enrichment centrifuges (on the Trigger List).

MEGATON. A measure of nuclear explosive power; one megaton is equivalent to a million tons of TNT explosive.

MISSILE TECHNOLOGY CONTROL REGIME (MTCR). A regime begun in 1987 by seven Western nations. Its purpose is to limit exports of missile technology or equipment which could be used to produce unmanned delivery systems for nuclear warheads.

MODERATOR. A material used in a nuclear reactor to slow neutrons, thus increasing the chances that neutrons will be absorbed by fissile atoms (creating and sustaining a chain reaction). Most reactors use ordinary, or "light" water or graphite as moderator. Some reactors employ heavy water.

NON-PROLIFERATION TREATY (NPT). A treaty with over 130 signatories, intended to constrain nuclear weapons proliferation. Three NWS (the UK, the USA, and the USSR) are primary sponsors, and pledge to aid other parties in nuclear power and research programs. The many NNWS in turn pledge not to develop or acquire nuclear weapons or help other states do so.

NUCLEAR MATERIALS. Any fertile or fissile product of uranium ore; most especially yellowcake, uranium hexafluoride, uranium oxide, fuel rods of any composition, radioactive waste, and plutonium. Also any material used as a moderator which inevitably carries traces of radioactivity (light water, heavy-water, and graphite used in reactor cores).

NUCLEAR SUPPLIERS GROUP (NSG). Also called the London Suppliers Group after the site of its initial meetings. A group of major suppliers of nuclear technology which organized in the mid-1970s to delineate guidelines to control the spread of sensitive hardware and information with potential weapon applications. The original 1978 guidelines are updated and appended periodically.

PLUTONIUM. An artificial element created almost exclusively in nuclear reactors. When the nucleus of an atom of U-238 captures an extra neutron, it is eventually transformed into plutonium-239, a fissile material. Another isotope, Pu-240, is produced when a Pu-239 atom captures a neutron instead of fissioning. The longer the nuclear fuel is irradiated, the more Pu-240 is produced; it is not useful in weapon construction.

REPROCESSING. The means by which spent fuel from a nuclear reactor is separated into waste material for disposal and material to be reused, such as unburnt U-235 and newly-created Pu-239.

SAFEGUARDS. Activities, especially by the IAEA, designed to provide accountancy for nuclear materials in terms of quantity and location through audits, inspections, surveillance, and facility design review. Safeguards are intended to verify compliance with the NPT and other agreements, or to provide a timely warning to the world that such verification is not possible.

SPENT FUEL. Also called burned fuel. Used fuel elements that can no longer readily sustain a chain reaction. Spent fuel typically contains depleted uranium (with less than 0.7 percent U-235), transuranic waste products, unburned uranium, and plutonium isotopes.

TREATY OF TLATELOLCO. Originally signed in 1967, this treaty seeks to limit nuclear proliferation by preventing the introduction of nuclear weapons into Latin America. Signatories agree to prohibit the testing, production, use, acquisition, or storage of nuclear weapons, and to use nuclear facilities and materials only for peaceful purposes. It is currently in effect in all but four Latin American states. Argentina, Brazil, Chile, and Cuba.

TRIGGER LIST. A list of nuclear hardware tightly controlled by the NSG, so called because a sale of an item on the list “triggers” NSG restrictions to be implemented by the seller. This list was first formulated and published in 1974, and has been reviewed and updated periodically. Also called the Zangger List after the chairman of the committee which wrote it (Claude Zangger, a Swiss professor and expert on nuclear energy).

TRITIUM. A radioactive isotope of hydrogen, used to enhance or “boost” fission explosions. When exposed to a fission explosion, tritium fuses, emitting high-energy neutrons which in turn strike additional Pu-240 or U-235 atoms and cause more fission to occur. Tritium makes a fission reaction more efficient; hence, a higher yield.

USA NUCLEAR NON-PROLIFERATION ACT (NNPA). A 1978 law requiring a) full-scope safeguards as a condition of nuclear technology sale, b) American prior consent to reprocessing (even with EEC countries), c) a cut-off of military and economic aid to any country that builds or receives a reprocessing plant under less than full-scope safeguards (the Symington Amendment), and d) the renegotiation of all existing nuclear supply agreements. The Reagan Administration did not always interpret provisions of this law tightly, and granted some notable exceptions to a few nations (with congressional approval).

URANIUM (U). The natural element upon which nuclear reactors and explosives are ultimately based. U-238, the isotope most common in nature, is fertile material; U-235, extant at about 0.7 percent in nature, is fissile material.

URANIUM HEXAFLUORIDE (UF₆). Produced from yellowcake at a conversion plant, usually as a gas, in preparation for the enrichment process.

WEAPON-GRADE PLUTONIUM. Plutonium composed of ninety-three percent or more Pu-239. Bulky weapons can also be fabricated from lower-grade material. The bomb dropped on Nagasaki used weapon-grade plutonium.

WEAPON-GRADE URANIUM. Uranium composed of over ninety percent U-235. Less efficient nuclear explosives can be made with any high-enriched uranium (over twenty percent U-235). The bomb dropped on Hiroshima used weapon-grade uranium.

YELLOWCAKE. A concentrate of eighty percent or more uranium oxide (U₃O₈), produced by mills which process uranium ore (which typically contains only about 0.1 percent uranium oxide).

ZIRCONIUM (Zr). A hard metal, used to sheathe reactor fuel rods (on the Trigger List).

APPENDIX 2

CHRONOLOGY OF ISRAELI ACQUISITION AND STRATEGIC ENVIRONMENT

Israel's acquisition of nuclear weapons is detailed below in chronological order. A number of other events which have impacted Israel's strategic environment and mindset have also been selected for inclusion. The focus remains, however, on the nuclear program. Dates are given as precisely as possible; some specifics are not available. Sources for this appendix include most of the entries in the bibliography. No single source served as guide.

1948	May 14	Israel declares independence and the first Arab-Israeli war erupts.
1950s	early	A nuclear research facility is established at Rehovot near Tel Aviv.
1954	Nov.	Israel acknowledges that it has constructed a pilot plant for the production of heavy water.
1955	?	The USA begins training Israeli scientists in the "Atoms for Peace" program.
1956	?	French and Israeli officials begin their nuclear cooperation as France pledges to assist the Israeli bomb effort.
	Oct. 29	Israel invades Egypt in response to Egyptian seizure of the Suez canal.
1957	mid	A French company signs an agreement to construct a large reactor and related facilities at Dimona in the Negev.
1950s	late	Israel begins purchasing uranium openly on the world market from several sources. This continues in the early 1960s.

1950s	late	France and Israel collaborate on the development of the Jericho missile (through the early 1960s).
1958	early	Construction begins at the Dimona nuclear plant site. Charles de Gaulle attempts to slow construction of the reprocessing plant, but his instructions are undermined by French officials.
1959	?	Israel purchases twenty-two tons of heavy water from Norway.
1960	?	Earliest possible date for laboratory-scale reprocessing of plutonium, at Nahal Soreq.
	?	A small research reactor supplied by the USA starts up; the fully-safeguarded facility is at Nahal Soreq, south of Tel Aviv.
	?	A French shipment of several tons of heavy water is probably sent to Israel, some possibly re-exported from the USA and Norway.
	Feb. 13	France conducts its first nuclear test in the Sahara. Israel may have received data from this event.
	Dec. 19	The USA discovers the secret Dimona reactor and a diplomatic imbroglio ensues. This is the date of public disclosure.
	Dec. 21	David Ben-Gurion addresses the Knesset, acknowledging the existence of the Dimona reactor and promising it will be used for peaceful purposes. Two days later he agrees to American inspections.
	late	France withdraws from the Dimona project under American pressure, but leaves Israel the plans; French subcontractors eventually complete the job.
1961	?	Norway exercises its inspection rights on the heavy water sold to Israel for the only time.
1962	?	Earliest possible date for the start-up of the Dimona reactor (perhaps as late as 1964).
1963		The USA ships 3.9 tons of heavy water to Israel, ostensibly under IAEA safeguards. It may go to Dimona for a time; IAEA records are ambiguous.

1963	Aug. 8	The State of Israel signs the Limited Test Ban Treaty.
1964	?	The USA begins annual visits to the Dimona reactor, never discovering the reprocessing plant on site. The American team is also shown (reportedly) a false reactor control room on at least one visit.
	Jan. 15	The State of Israel deposits ratification documents for the Limited Test Ban Treaty.
1965	?	Earliest possible date for the startup of the reprocessing plant at Dimona (perhaps as late as 1969).
1966	?	Earliest possible date for production of the first Israeli nuclear warhead (perhaps as late as 1969).
	?	According to the CIA, Israeli agents steal about 220 pounds of highly-enriched uranium from a fabrication plant in Apollo, Pennsylvania, by this year (when the discrepancy is discovered).
1967	?	Earliest possible date for deployment of Jericho missiles (perhaps as late as 1969).
	June 5-10	Israel defeats several Arab opponents in the Six-Day War. Nuclear weapons may have been available but are not known to have been a factor in the conflict. Israel occupies the West Bank, Gaza Strip, Sinai Peninsula, and Golan Heights.
1968	July 1	The Nuclear Non-Proliferation Treaty is opened for signature. Israel has never acceded to the NPT.
1968	Oct.	President Johnson authorizes the sale of F-4E nuclear-capable fighter/bombers to Israel.
	Nov.	A shipment of yellowcake "disappears" in route from Antwerp to Genoa; Israeli agents redirect it to Dimona.
1969	?	The USA drops annual inspections of the Dimona reactor.
1970s	early	According to Mordechai Vanunu (Dimona nuclear technician), the Dimona reactor is enlarged from

		twenty-four to about seventy megawatts (thus increasing plutonium output).
	early	The USSR begins selling Scud-B missiles to Iraq, Egypt, Libya, Syria, and Southern Yemen.
1970	July	Norway authorizes the sale of an additional 1.1 tons of heavy water to Israel (refusing a concurrent request for another 4.4 tons).
1972	?	Israel's three phosphoric acid plants (able to extract uranium as a by-product) are all producing by this year.
1973	Oct. 9	Israel deploys nuclear warheads on Jericho missiles and Phantom fighters early in the Yom Kippur War (following a coordinated attack by Egypt and Syria). Later military successes result in a stand-down, and a cease-fire is established in November.
	Oct. 25	The USA and USSR implement high levels of nuclear alert during the war between their client states in the Middle East.
1974	Sept. 4	A secret CIA analysis concludes that "Israel has already produced nuclear weapons."
1975	Sept. 4	Israel signs an interim agreement with Egypt finalizing the end of the 1973 hostilities. Israeli forces begin withdrawing from the Sinai in stages soon after.
1977	?	Israel begins limited production of lithium-6, an early step in the production of both "boosted" fission and thermonuclear warheads, at Dimona.
1977	Aug.	Mordechai Vanunu's employment as a nuclear technician at Dimona begins.
1979	?	Earliest possible date for the enrichment of uranium using gas centrifuges at Dimona (perhaps 1980).
	Mar. 31	The Camp David Accord with Egypt is signed. The Palestinian issue is not fully addressed, which

		increases the hostility of other Arab states to Israel and Egypt.
	Apr. 6	The core structure for the French-built Iraqi Osiraq reactor is destroyed in a warehouse explosion in La Seyne-sur-Mer, France.
	Sept. 22	A USA Vela satellite detects a flash in the ocean near South Africa. Many in the American intelligence services conclude that the flash is a joint Israeli-South African nuclear test.
1980s	early/mid	Israel enjoys almost wide-open access to several kinds of weapons-related research at United States nuclear weapons labs.
	early	Israel develops "boosted" fission and possibly thermonuclear warheads.
	early	Israel provides design assistance to Taiwan for its Green Bee missile; it is similar to USA-supplied Lance missiles in Israeli possession.
1980	June 14	Egyptian nuclear scientist Yahya el-Meshad, who was working on the Osiraq project, is found murdered in Paris. Some observers suspect Israeli agents.
	Aug. 7	Bombs explode in both France and Italy, intended for subcontractors of the Osiraq project; threats follow. Again, the Israelis are suspected, but proof is lacking.
1982	?	Israel deploys an improved version of the Jericho missile (with a range of over four hundred miles), possibly in Negev caves.
	?	A laser technique for enriching uranium begins operation at Dimona; its scale is unknown.
	June 7	Two squadrons of Israeli F-16s bomb and destroy the Osiraq reactor near Baghdad. This operation had been planned for over a year, and was designed to cripple the Iraqi nuclear program.

	Dec. 14	Israel proclaims legal and political authority over the Golan Heights. Syria does not recognize this <i>de facto</i> annexation. The USA soon suspends an arms deal with Jerusalem in protest.
1982	?	Richard K. Smyth obtains materials for the Jericho II missile and smuggles them out of the United States to Israel (according to two reports).
	?	Israel's credentials are not recognized by IAEA officials at the annual meeting; this resulted from the Osiraq bombing and Arab pressure. The USA subsequently walks out of the conference, a move which eventually restores Israel's seating but not its official status as a member of the agency (by September 1983).
	Apr. 25	Israel completes its withdrawal from the Sinai. Other aspects of the Camp David Accords, such as self-government for Gaza and the West Bank, are not implemented.
	June 6	Israel invades Lebanon, battling Palestinian and Syrian forces. The stated goal is to punish the PLO for frequent attacks on Israel from Lebanese bases.
1984	?	Full-scale production of lithium-6 and tritium (the latter for thermonuclear warheads) begins at Dimona.]
	Mar. 5	The State Department announces that Iraq has used "chemical weapons in the form of aerial bombs" against Iran in that three-year-old war. The UN confirms the report on March 26.
	May 26	Richard K. Smyth is indicted in Los Angeles for illegally exporting over eight hundred krytrons to Israel earlier in the decade. Smyth disappears before his trial.
1985	June 10	Israel begins withdrawing all combat forces from Lebanon. A thousand troops will remain in a "security zone" in southernmost Lebanon along the Israeli border.

	Sept.	Israel is permitted to resume full participation in the IAEA after pledging not to attack safeguarded facilities. American pressure on the IAEA is also involved.
	Oct. 1	Israeli planes bomb PLO headquarters in Tunisia, about 1500 miles from Israel.
	Nov.	Mordechai Vanunu's employment at Dimona ends when he and many others are laid off.
1986	mid	Norway's laxness in enforcing its inspection rights on the heavy water sold to Israel is made public in several magazine articles.
	Oct. 5	Mordechai Vanunu reveals details of the operation at Dimona (including photographs) in an interview published by the <u>Sunday Times</u> of London. Reprocessing and enrichment there are revealed for the first time.
	Oct. 12	A French official confirms that his nation collaborated with Israel on nuclear weapons and delivery systems in another <u>Sunday Times</u> article.
	Nov. 9	Israel confirms that it is holding Vanunu, who had vanished from London, in custody in Israel.
1980s	late	Israeli nuclear ambiguity wanes as several leaders refer to their arsenal in lightly-veiled terms.
	late	Libya conducts research and development of one or possibly two ballistic missile systems. The longest range cited is three hundred miles.
1987	Apr.	Israel refuses to permit IAEA inspection of the heavy water sold by Norway in 1959 and 1970.
	May	Israel conducts a test flight of what most observers believe is an improved version of the Jericho II. The medium range missile is dubbed Jericho IIB by the Western press.
	mid July	Israel tests the Jericho IIB again. The USSR complains in Hebrew-language broadcasts from

		Radio Moscow soon after about the missile, which includes the southern USSR in its range.
	late	The Palestinian uprising begins, reinforcing Israeli concerns about territorial security (especially regarding the West Bank and Gaza Strip).
1988	?	The USA and Israel begin joint development of the Arrow ATBM (with SDI funding).
	?	West German companies assist in the construction of a nerve gas production plant in Libya.
	early	Libya signs an arms agreement with Brazil, including the purchase of a 625-mile-range missile still under development.
	Mar.	Iraq employs chemical weapons in attacks on the Kurd rebels. Other such attacks occur in September, also.
	Mar.	Vanunu is convicted of treason in a closed-door trial and is sentenced to eighteen years in prison.
	Apr.	Saudi Arabia acquires conventionally-armed Chinese CSS-2 IRBMs; Israel and the USA express grave concern. The Saudis also announce their accession to the NPT.
	Apr. 15	Norway and Israel agree that the IAEA will inspect the heavy water Israel says remains from their transactions. Norway's parliament rejects this on October 10.
	Sept. 19	Israel orbits a satellite using the three-stage Shavit II launcher (a potential IRBM or ICBM). It is the tenth space program to orbit a satellite.
	Nov.	Another reported test of Jericho IIB occurs.
1989	Jan.	At the Paris Conference on Chemical Weapons, Arab states oppose measures to slow the spread of chemical arms because of Israel's nuclear arsenal.
	July 5	South Africa conducts a test of a missile developed in collaboration with Israel, to a range of nine hundred miles.

	Sept. 14	Israel tests the Jericho IIB to a range of nine hundred miles, a range which puts the bulk of the Middle East and parts of Europe and the USSR within reach.
	Nov.	The USSR advises that it will no longer support Syria's effort to achieve "strategic parity" with Israel.
	Dec.	Iraq tests the first stage of a long- range missile, the Al-Abid. It also announces that two different IRBMs have been developed.
1990	early	Increasing evidence indicates that Iraq has revitalized its nuclear weapons program. In April, Saddam Hussein declares that a preemptive strike by Israel on Iraq's nuclear program would be answered with Iraqi chemical weapons.
	Apr.	Norway agrees to purchase the heavy water Israel claimed remained from the 1959 and 1970 sales. Most of its history is still unaccounted for.
	Apr. 3	Israel orbits a second satellite with the Shavit II.
	Aug. 2	Iraq invades and quickly occupies Kuwait. A coalition of Western and Arab states begins sending troops and equipment to the Saudi-Kuwaiti border. Iraqi threats against Israel increase, though Israel remains officially neutral.
	Sept.	The NPT Review Conference levels moderate criticism at Israel, which (along with South Africa) is singled out for having an unsafeguarded nuclear program. Arab and African states push the statement.
	late Dec.	Israel flight tests a Jericho IIB missile for the first time in over a year. Iraq had tested three missiles on Dec. 2.
1991	Jan. 16	An American-led coalition attacks Iraqi positions in Kuwait and Iraq in the first day of thorough air strikes. Iraq responds by launching Scud-Bs with conventional warheads at Israel and Saudi-Arabia. Some of the Scud-Bs are intercepted and destroyed

by the USA's Patriot ATBMs. Israel refrains from a military response despite civilian casualties. Iraq's nuclear program sustains undetermined damage.

Feb. 17 Western and Arab forces push into Kuwait and Iraq, meeting light resistance and recapturing Kuwait City within a few days. Iraqi chemical weapons are not used, and missile attacks cease.

APPENDIX 3

CHRONOLOGY OF PAKISTANI ACQUISITION AND STRATEGIC ENVIRONMENT

Pakistan's acquisition of nuclear weapons is detailed below in chronological order. A number of other events which have impacted Pakistan's strategic environment and mindset have also been selected for inclusion. The focus remains, however, on the nuclear program. Dates are given as precisely as possible; some specifics are not available. Sources for this appendix include many of the entries in the bibliography. No single source served as guide.

1947	Aug. 14	The UK officially withdraws from the subcontinent; India and Pakistan form as Commonwealth members. Mass migrations of millions of Hindus and Moslems accompany independence; over 200,000 are killed in internecine fighting.
	Oct 26	Marharajah Hari Singh, ruler of Kashmir, unites his land with India despite the pro-Pakistan feelings among his mostly Moslem subjects. This dispute lingers as a point of contention between the two nations.
1948	Jan. 30	Mohandas K. Gandhi is assassinated by a member of the Hindu Mahasabha, an extreme anti-Moslem group. Rioting and bloodshed follow.
1948	Jan. 1	A UN-negotiated cease-fire takes effect in Kashmir. Pakistan retains control of about a third of the area.
1954	Feb. 6	The Kashmir Assembly accepts "reunification" with India; Pakistan protests. The Indian-controlled portion of Kashmir will become a state in early 1957.
	Sept. 8	The Southeast Asia Treaty Organization (SEATO) is formed as part of the American containment effort against the USSR. The other members are Australia, France, the UK, New Zealand, the

		Philippines, Thailand, and Pakistan. The latter withdraws in 1973.
	Oct.	Pakistan announces plans to create an atomic research organization.
1955	Nov. 21	The UK, Pakistan, Iraq, Iran, and Turkey announce that they will set up a common defense organization to deter the USSR. It is later called CENTO (the Central Treaty Organization) and will also include informal USA participation. It dissolves in 1979.
1956	Mar.	Pakistan establishes its Atomic Energy Commission. This organization will support civilian projects exclusively until the early 1970s.
1959	mid/late	Chinese and Indian troops clash at Ladakh in Kashmir.
1962	Oct./Nov.	China pushes back Indian troops in extended Tibetan border fighting. The USA pledges to send arms to India, as do the UK and USSR. China announces a cease-fire on November 21.
	late	Following Sino-Indian border clashes, Pakistan and China increase commercial ties and aid agreements.
1963	Oct. 10	India ratifies the Limited Test Ban Treaty.
1964	Oct. 16	China conducts its first nuclear test. Though Chinese concerns are primarily directed at the USSR, India is prodded to launch a nuclear weapons program.
1965	?	A USA-supplied five megawatt research reactor under safeguards starts up at Rawalpindi.
	Sept. 1	Clashes break out over territory on the Assam-East Pakistan border and over ownership of the Rann (swamp) of Kutch on the Gujarat-West Pakistan border near the Arabian Sea. A UN-monitored cease-fire finally holds in October. The USA suspends military aid to both countries on September 7.

1967	June 17	China conducts its first thermonuclear, or "hydrogen" bomb test.
1968	Feb. 19	An international arbitration commission assigns over ninety percent of the Rann of Kutch to India.
	July 1	The NPT opens for signature. Neither Pakistan nor India have signed the treaty to date.
1971	?	The KANUPP power HWR (125 megawatts), constructed by Canada, starts up. It is safeguarded, as is heavy water sent there from the USA and Canada.
	Mar. 25	Pakistan government troops launch attacks on East Pakistan, which has been attempting to gain autonomy. The East renames itself Bangladesh and fights back with Indian logistical help.
	Dec. 3	Full-scale war on both eastern and western fronts erupts between Pakistan and India.
	Dec. 16	Pakistani troops in the east surrender as Dacca falls to Indian forces. Commanders in the west agree to a cease-fire the next day. Zulfikar Ali Bhutto soon emerges as Pakistan's leader.
1972	Jan.	Prime Minister Bhutto announces his plan to develop nuclear arms at a secret meeting with top scientists in Multan.
	July 28	Pakistan and India sign the Simla Pact for troop withdrawals; Bangladesh retains independence.
1974	May 18	India tests a "peaceful" nuclear device, with a yield of about 20 kt, at Pokaran in the desert near Pakistan.
	mid	According to some reports, India begins producing nuclear weapons, stopping in 1977 (when Moraji Desai becomes prime minister) with a handful of warheads.
	Oct. 18	The Pakistan Atomic Energy Commission and a French company sign an agreement for the construction of a plutonium reprocessing plant.

1975	Feb. 24	The USA lifts its ten-year aid embargo against Pakistan.
	Dec.	Canada cuts off all spare parts and shipments of natural uranium fuel for the KANUPP reactor following a Pakistani rejection of Canadian demands for full-scope safeguards and a non-nuclear-weapon pledge. Canadian materials were used by India for its 1974 nuclear test.
	Dec. 15	Dr. A. Q. Khan moves back to Pakistan from the Netherlands, where he has worked at an enrichment plant. He soon heads up the bomb effort.
1976	May 14	Pakistan and India agree to resume diplomatic ties.
	June	Congress enacts the Symington Amendment (to the Foreign Assistance Act), prohibiting American aid to any NNWS that imports or exports enrichment equipment or technology unless that country accepts full-scope safeguards. It is aimed primarily at Pakistan.
	Aug.	Secretary of State Kissinger travels to Islamabad and Paris in an attempt to head off the sale of the reprocessing plant.
1970s	late	An extensive network of Pakistani operatives procures nuclear-related items (both legally and illegally) for Dr. Khan's weapons program. This process continues to the present day.
1977	Mar. 7	Bhutto's party wins parliamentary elections.
	Mar. 24	Moraji Desai, the only Indian prime minister to oppose development of nuclear capability, is elected.
	Mar.	Pakistan begins the smuggling of an entire hexafluoride conversion plant from West Germany (with the aid of two companies there); the facility is completed in April 1980 at Dera Ghazi Khan.
	mid	Congress passes the Glenn Amendment, banning aid to countries that import plutonium reprocessing

		technology or equipment. Pakistan's actions helped spur passage of this law.
	July 5	Zulfikar Ali Bhutto is overthrown in a military coup led by Gen. Muhammad Zia ul-Haq. The nuclear program continues.
	Aug.	France suspends deliveries for the reprocessing plant when confronted with American intelligence data on Pakistan's nuclear weapons program.
	Sept.	The USA cuts off economic and military aid to Islamabad over Pakistan's reach for reprocessing technology.
1978	?	Construction begins on a pilot-scale enrichment plant at Sihala and a full-scale plant at Kahuta.
	Apr. 27	Pro-Soviet leftists take power in Afghanistan in a bloody coup. The new government soon signs an economic and military treaty with the USSR.
	June 15	France's Council on Foreign Nuclear Policy terminates the contract between a French company and Pakistan for the reprocessing plant at Chashma.
	Aug.	The USA restores aid to Pakistan as the French cease work at Chasma. The blueprints for the plant remain in Pakistan, but because neither France nor Pakistan notify the IAEA that a transfer has occurred, a legal limbo envelops the project; the IAEA is powerless to act.
1979	?	The pilot-scale enrichment plant at Sihala begins operations (unsafeguarded).
	Jan. 16	The Shah of Iran leaves the country permanently, to be replaced by a Shiite Moslem regime wholly hostile to the USA (which loses a strategic ally).
	May	In accordance with the Symington Amendment, the USA stops aid to Pakistan over its pursuit of enrichment technology, which it identifies as weapons-related.

	Nov.	Pakistan purchases about one hundred metric tons of yellowcake from Libya. Some of the shipment may be a Libyan re-export of material from Niger.
	Dec. 25	Soviet forces begin their occupation of Afghanistan, giving greater significance to American ties with neighboring Pakistan.
1980s	early	Indira Gandhi begins enlarging India's capability to produce nuclear arms, and refuses to place several key facilities under IAEA safeguards.
1980	?	The Multan heavy water production plant begins operation (under safeguards). It will help supply the KANUPP reactor.
	?	The unsafeguarded conversion plant at Dera Ghazi Khan begins operation. It will produce the feedstock for the Sihala and Kahuta gas centrifuge enrichment plants.
	?	The fuel fabrication plant at Chasma begins operation. It can produce enough fuel rods to power the safeguarded KANUPP reactor.
	Jan. 13	The USA offers renewed aid to Pakistan at increased levels, hoping to relocate Iranian listening posts there and to shore up its anti-Soviet posture in the region.
	July 18	India becomes the sixth nation to launch its own satellite into orbit.
	Sept.	Beginning this month, the IAEA is unable to verify that no diversion of spent fuel from KANUPP is occurring; this state of affairs will continue until March, 1983.
1981	early	Pakistan accepts a six-year, \$3.2 billion aid package from the USA. The agreement also provides for the sale of forty F-16 nuclear-capable aircraft. Congress waives the Symington Amendment for a six-year period.
1982	?	Cold tests of a pilot reprocessing plant at New Labs in Rawalpindi are conducted. This plant may have

		been "replicated" from French plans for the Chashma plant. It is not thought to be operating currently.
	Feb.	President Reagan determines that termination of aid to Pakistan would "be seriously prejudicial to the achievement of US non-proliferation objectives or otherwise jeopardize the common defense and security"; he thereby waives the Glenn Amendment.
1983	?	Two firms in West Germany cooperate with Pakistan in the illegal export of conversion equipment and enrichment centrifuge housings (through 1987). They also provide a tritium purification and storage plant and the design for a reactor useful in tritium production. A dummy corporation is used.
	Feb.	Indian election riots kill six hundred Moslems in Assam.
	Oct.	A Dutch court tries A. Q. Khan in absentia for soliciting classified centrifuge enrichment information from two former colleagues at the Dutch company FDO. He is convicted on November 14 and sentenced to four years in prison, but the trial is later overturned on procedural grounds.
	Aug.	Pakistan accuses India of aiding an up-rising of separatists in Pakistan's Sind province.
1984	?	The unsafeguarded enrichment plant at Kahuta begins partial operations. It will first enrich uranium to weapons grade in 1986.
	Feb.	Dr. A. Q. Khan announces that the Kahuta facility has produced enriched uranium. Later, Zia confirms this but emphasizes that only low levels have been achieved.
	June	Three Pakistanis are indicted for attempting to smuggle fifty krytrons out of the USA. One, Nazir Vaid, serves three months in jail before being deported to Pakistan. Islamabad is implicated as a party to the operation.

	June 21	Sen. Alan Cranston details Pakistani nuclear advances in a speech before the Senate.
	mid	The USA reveals that China is assisting Pakistan with the operation of the Kahuta plant and has given its ally the design of a nuclear warhead. Washington halts approval of a nuclear trade pact with China for nearly a year.
	mid	India accuses Pakistan of aiding Sikh nationalists in the Punjab and of making incursions into Kashmir.
	fall	An additional 40,000 Soviet troops are deployed in Afghanistan, some close to the Pakistani border. Soviet planes begin frequent violations of Pakistani air space.
	Sept.	Reagan sends a letter to Zia to voice American concerns over Pakistan's nuclear endeavors; the letter threatens unnamed "grave consequences" if Kahuta enriches uranium to more than five percent U-235. Pakistan supplies written assurances that this limit will be respected.
	Oct. 31	Indian Prime Minister Indira Gandhi is assassinated. Zia and new Prime Minister Rajiv Gandhi briefly attempt cordial relations.
1980s	mid	Pakistan obtains machinery for the production of nuclear weapon cores and other nuclear-related items from West Germany, claiming non-nuclear intent. The USA privately protests Bonn's granting of export licenses.
	mid	Pakistan starts construction of a large "research" reactor (unsafeguarded) at an unknown location using equipment clandestinely acquired from several Western nations. It may be intended to produce tritium.
	mid	Pakistan illegally obtains flash x-ray machines and specialized oscilloscopes (needed in the manufacture of nuclear warheads) from Sweden and the Netherlands.

1985	Mar. 6	A West German court convicts Albrecht Migule for his role in the smuggling of a conversion plant in the late 1970s. He is fined \$10,000 and allowed to stay in business.
	June	Pakistan successfully tests the non-nuclear triggering package for a nuclear warhead.
	June	Pakistan accuses India of provoking a nuclear arms race by increasing its nuclear capabilities while ignoring Pakistan's arms control offers.
	July	Congress votes to continue Pakistan's aid, but also enacts the Pressler Amendment, which requires the President to certify annually that Pakistan does not "possess a nuclear explosive device" before aid or arms can be provided to that country.
	July 11	Pakistan receives a hundred anti-aircraft missiles from the USA, which is concerned about Afghan incursions.
	Aug.	Congress enacts the Solarz Amendment, which prohibits aid to any NNWS found smuggling items from the USA for use in a nuclear explosive.
	Oct.	Prior to this month, Pakistan begins enriching uranium to levels higher than five percent. The Reagan Administration is aware of this development by October.
	Oct.	Reagan and Zia meet at the UN, but Reagan does not challenge his counterpart about the violation of Pakistan's assurances that it would maintain low enrichment levels.
	late	India begins to separate plutonium at the Tarapur reprocessing plant from unsafeguarded reactor fuel rods. This is the first plutonium stockpiled from such a source.
	Dec.	Zia and Gandhi meet in New Delhi, and agree that their nations will not attack each other's nuclear facilities.

1986	Mar.	The USA announces that it will provide Pakistan with a second six-year aid package starting in October, 1987. It will be worth \$4.02 billion.
	July	The Soviet ambassador to Pakistan delivers a strongly-worded warning to Islamabad about its nuclear activities. The USA, in turn, privately reaffirms to Moscow its strong commitment to Pakistan's security.
	July	Several press reports state that Pakistan has the capacity to build nuclear arms.
	fall	A "Special National Intelligence Estimate" for high-ranking American officials states that Pakistan has produced weapons-grade uranium.
	Sept.	Pakistan tests the non-nuclear explosive package which would create the implosion needed to trigger fission in a nuclear warhead. It is the second such test this year.
	Oct. 27	Reagan certifies to Congress, in accordance with the Pressler Amendment, that Pakistan does not possess a nuclear explosive device (privately assuring that Pakistan has not yet fabricated some weapon components).
1987	Dec.	India and Pakistan narrowly avert war as an Indian military exercise near the border leads to a mobilization and both nations escalate troop levels. A mutual pull-back agreement stops the process in January 1987.
	?	Pakistan's unsafeguarded tritium production facility begins operation testing. Tritium is used in advanced nuclear warheads.
	Mar. 1	Dr. A. Q. Khan states in an interview that Pakistan has built nuclear arms with ninety percent enriched uranium. Denials and independent confirmations in the next several days blunt the interview's impact in the West.

- Mar. 30 Zia, in an interview with Time, states that Pakistan has nuclear capability only and denies that weapons-grade enrichment has occurred.
- Apr. The German weekly Stern details a major Pakistani smuggling operation in Switzerland and West Germany involving parts and plans for enrichment equipment.
- July 11 Arshad Pervez, a Canadian born in Pakistan, is arrested in Philadelphia for attempting the illegal export of maraging steel for centrifuges and of beryllium for warhead construction. Several key American legislators try to invoke the Solarz Amendment to cut off aid.
- Aug. A high State Department official visits Islamabad to express American concerns over nuclear developments. Zia and the Pakistani Parliament respond coldly.
- Sept. Pakistani Prime Minister Junejo announces in a UN speech that his nation has proposed a bilateral test ban to India. The latter rejects the offer as "not serious."
- Oct. 1 Delays in appropriations legislation cause a temporary suspension of new American aid to Pakistan.
- Oct. 22 Ambassador-at-Large for Non-Proliferation Richard Kennedy admits in public congressional testimony that Pakistan has exceeded the five-percent enrichment level. This is the first Reagan Administration acknowledgment.
- Dec. The construction of a second Pakistani enrichment plant is reported at Golra. If confirmed, it is likely that many items used in its construction were obtained clandestinely from Western states.
- Dec. 17 Reagan again certifies that Pakistan does not possess a nuclear device.
- Dec. 17 A House-Senate conference committee votes \$480 million in aid for Pakistan as negotiations for a

		Soviet pull-out from Afghanistan show promise. It also waives the Symington Amendment for two and a half years.
	Dec. 18	Arshad Pervez is convicted of nuclear smuggling. He is later sentenced to five years in prison plus five years probation.
	Dec. 22	Congress approves the conference committee's Pakistan aid package.
1988	Jan.	Reagan invokes and immediately waives the Solarz Amendment (regarding a cessation of aid for countries engaged in nuclear smuggling) following the Pervez affair.
	Jan.	Soviet forces begin withdrawing from Afghanistan.
	Feb.	India tests a short-range nuclear-capable missile, the Prithvi.
	Mar. 3	Pakistan ratifies the Limited Test Ban Treaty to match India's status (India signed on 14 August 1963).
	Mar. 6	Details of the Pakistani nuclear weapons program are published in the <u>New York Times Magazine</u> . The article states that Pakistan has four to six nuclear warheads based on a Chinese design and is able to deploy them rapidly in any future conflict. Privately, USA government sources confirm the article to expert Leonard Spector.
	Apr. 14	A UN-mediated agreement is signed, detailing the Soviet withdrawal from Afghanistan. Afghan rebels continue guerrilla attacks on USSR forces and the Afghan government it supports. American aid flows unabated through Pakistan.
	Aug. 17	Zia is killed in a suspicious plane crash. The Afghan secret police is suspected.
	late	Norway announces that it has traced an illicit 1983 transfer of fifteen tons of its heavy water to India.

	Nov. 16	Benazir Bhutto, daughter of executed Pakistani leader Zulfikar Ali Bhutto, wins the prime minister's office in Pakistan's first free elections in nearly two decades. She is American-educated and has many ties to the USA.
	Nov. 18	Nov. 18 Reagan certifies that Pakistan does not possess a nuclear device, but qualifies his statement by adding a cautionary note about Pakistani nuclear progress.
	Dec. 31	Pakistan and India sign a codification of the 1985 oral agreement not to attack each other's nuclear facilities. Final ratification has yet to take place.
1989	Feb. 11	Pakistani Army Chief of Staff Gen. Mirza Beg announces the successful test of two new ballistic missiles, the Haft I and Haft II (with ranges of fifty and 186 miles, respectively), each with a payload of over half a ton.
	Feb. 15	Soviet troop withdrawals from Afghanistan are completed.
	May 22	India conducts a successful test of the Agni IRBM (1,550-mile range) with a payload of over a ton. Both China and Pakistan express concern.
	June 7	In a speech before Congress, Benazir Bhutto says that Pakistan does not have and does not intend to make a nuclear device. She convinces the Bush Administration that she has slowed some aspects of weapon development.
	mid June	Bush approves the sale of 60 F-16s to Pakistan, plus other military equipment, following Bhutto's assurances.
	July	Congress reviews the F-16 sale and raises no objections.
	July	The German magazine <u>Der Spiegel</u> reports that Pakistan is conducting wind-tunnel tests of the casing for a nuclear bomb.

	Oct.	Pakistan announces a new missile development program aimed at production of a ballistic missile with a 375-mile range.
	Oct. 5	Bush certifies to Congress that Pakistan does not possess a nuclear device, repeating Reagan's note of caution from 1988.
	late	A West German parliamentary investigation exposes an operation which smuggled hundreds of tons of heavy water to India during the 1980s.
	late	A very small, pool-type reactor under safeguards begins operation at Rawalpindi. It was constructed with Chinese help.
	Nov.	Rajiv Gandhi is succeeded as Prime Minister by V. P. Singh as subcontinent relations deteriorate. No change in India's nuclear program is detected.
	Nov.	With no debate, Congress extends Pakistan's waiver from the Symington Amendment through April 1991 (as part of the foreign aid appropriations bill).
	Nov. 16	Chinese Premier Li Peng announces that his country will sell a three hundred megawatt nuclear power reactor to Pakistan under IAEA safeguards (not full-scope).
1990	early	Tensions escalate in Kashmir as Moslem separatists in the Indian portion revolt. India accuses Pakistan of aiding the revolt and threats fly in both directions.
	Feb. 21	French President Francois Mitterand announces that his country will authorize the sale of a nine hundred megawatt nuclear power plant to Pakistan under safeguards (not full-scope). Mitterand dismisses USA protests.
	Apr.	Romanian President Iliescu announces that the previous regime headed by Nicolai Ceausescu had diverted 12.5 tons of heavy water to India.

May	According to press reports, Pakistan has equipped some of its F-16s with nuclear bomb racks, in violation of the original sales agreement with the USA.
mid	According to expert Leonard Spector, India has enough plutonium to construct from forty to sixty nuclear warheads.
Aug. 6	Prime Minister Bhutto is dismissed on corruption charges in a move thought to have army support (or instigation).
Oct. 1	Aid to Pakistan is suspended by the USA when Bush is unable to certify that Pakistan does not possess a nuclear device (as specified by the Pressler Amendment). Bush asks Congress to waive certification and continue aid until the new government of Pakistan (to be elected on Oct. 24) has time to make changes.
mid-Oct.	Secretary of State James Baker informs the Pakistani foreign minister that American law will not allow the continuation of aid (set at \$564 million for Fiscal Year 1991). The sale of sixty F-16s, set for 1991, is also frozen.
Oct. 23	American officials confirm privately that Pakistan has at least one fully-assembled nuclear weapon; they believe it was produced in the spring during Kashmir tensions.
Nov. 6	Nawaz Sharif takes office as Prime Minister of Pakistan. Though he offers talks with the USA on his nation's nuclear program, his party won election of a platform opposing "American interference" in Pakistani affairs. The military supports Sharif's Islamic Democratic Alliance.