

NUCLEAR PROLIFERATION:

DIMINISHING THREAT?

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FOREWORD

We are pleased to publish this sixth volume in the *Occasional Paper* series of the US Air Force Institute for National Security Studies (INSS). This monograph represents research first presented at the annual conference of the International Studies Association in Chicago in February 1995. We felt that its important and provocative message deserved broader dissemination as an *INSS Occasional Paper*.

INSS is co-sponsored by the National Security Negotiations Division, Plans and Operations Directorate, Headquarters US Air Force (USAF/XOXI) and the Dean of the Faculty, US Air Force Academy. The primary purpose of the Institute is to promote research done within the DOD community in the fields of arms control, proliferation, national security, regional studies, the revolution in military affairs, information warfare, and environmental security. INSS coordinates and focuses outside thinking in various disciplines and across services to develop new ideas for USAF policy making. The Institute develops topics, selects researchers from within the military academic community, and administers sponsored research. We also host conferences and workshops which facilitate the dissemination of information to a wide range of private and government organizations. INSS is in its fourth year of providing valuable, cost-effective research to meet the needs of the Air Staff and our other sponsors.

This paper proposes an unusual and more sanguine view of the problem of nuclear proliferation. Dr Kincade points out that the pace of nuclear weapons testing and deployment has slowed in recent decades, while there has concurrently been an increase in the availability of nuclear knowledge. While non-proliferation efforts by the supplier states may explain part of this success, he postulates that domestic political decisions by potential proliferators play an equal or greater role. Deciding whether or not to weaponize and deploy a

nuclear capability is certainly not the first step for a state wishing to achieve nuclear status, but it may be the most important. Here a number of domestic factors come into play that have little to do with international constraints or concerns about prestige: economics, internal politics, government learning, generational change, and so on. Kincade's findings are counter-intuitive in the proliferation literature, and, if true, suggest that the problem cannot be dealt with solely using traditional means.

Dr Kincade's thesis merits careful consideration by those involved in the proliferation debate as well as those in the policy making community. His ideas are his own, and do not necessarily represent those of INSS, the US Air Force, or the Department of Defense.

We appreciate your interest in INSS and its research products. We hope we are meeting a need for this type of analysis and reflection, and we look forward to publishing these papers on a regular basis.

JEFFREY A. LARSEN, Lt Colonel, USAF
Director, Institute for National Security Studies

EXECUTIVE SUMMARY

With the end of the Cold War, concern about the multiplication of nuclear-armed nations has made proliferation one of the leading issues on the international security agenda. Its prominence has been bolstered by related anxieties over the spread of advanced conventional weapons technologies, long-range delivery systems, and chemical and biological weapons. The collapse of the Soviet Union contributed to burgeoning fears of a possible epidemic of nuclear weapons. There is evidence suggesting, however, that the momentum of diffusion assumed in the epigraphs to this study may be abating, rather than accelerating. If true, this would be all the more surprising in light of the fact that the technical route to nuclear weapons now presents fewer obstacles than in the past.

An apparent paradox is emerging. On the one hand, the technical barriers to entry into the nuclear club have been progressively eroded; yet the drive to obtain nuclear weapons has been declining. This trend confounds the commonly-accepted systemic explanation for nuclear proliferation: to obtain the power and prestige perceived necessary to improve its security position, a state seeks nuclear weapons, creating in the process a pro-nuclear bureaucracy that augments the initial drive.

The anomaly of fewer potential proliferators despite reduced technical barriers suggests that decisions about acquiring nuclear weapons may now be influenced by a calculus different from traditional explanations for proliferation, and are less affected by strategies of denial.

The objective of this analysis is to illustrate that nuclear diffusion is a declining, though still dangerous, phenomenon that requires reevaluation in terms of basic concepts, research, and policy. The paper reviews the progress of proliferation and non-proliferation and examines the debate over both. It then

examines the evolution of anti-proliferation measures, chiefly those of denial. Emerging disincentives to diffusion are suggested and the broader implications of these disincentives and related nuclear postures are assessed, along with factors that might either explain or reverse them. The final section explores changes in approaches to non-proliferation that might be conducive to exploiting new conditions and thinking.

These observations illustrate a point that has been neglected in much of the non-proliferation literature: *the crucial demarcation line in the current phase of the nuclear era lies between nuclear weapons initiatives and viable, deployable nuclear forces*. Even as the problem of building a prototype becomes simpler, the challenge of fielding a fully-fledged nuclear force grows more daunting. The difficulty of meeting this challenge may be a primary reason fewer states are willing to undertake the effort.

The very way in which proliferation has been viewed in the past needs updating, both to take account of new factors that may be at play and also to prevent an outdated mindset from causing new non-proliferation opportunities or techniques to be missed. This would entail adopting a more differentiated perspective on possible proliferators to facilitate policies more tailored to the various stages of, and motivations for, nuclear weapons acquisition.

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Nuclear Proliferation: Diminishing Threat?

I am haunted by the feeling that by 1970...there may be ten nuclear powers instead of four, and by 1975, fifteen or twenty...

-- John F. Kennedy, March 1963¹

If Ukraine were to seize control of the weapons...it would immediately become the world's third-largest nuclear power...

-- Christopher Drew, May 1993²

I. Evolution of Proliferation

During the Cold War, the problem of nuclear proliferation tended to take a back seat to superpower competition and other priorities. Issues related to the spread of nuclear weapons were often decided by how potential proliferators were positioned in terms of the global power struggle. Thus, Pakistan and Iraq made significant progress in acquiring nuclear weapons technology during the 1980s, when the United States appeared to acquiesce in their activities, in part because Reagan Administration officials believed their assistance was needed to combat a Soviet strategic threat in the Persian Gulf.³

With the end of the Cold War, concern about the multiplication of nuclear-armed nations has made proliferation one of the leading issues on the international security agenda. Its prominence has been bolstered by related anxieties over the spread of advanced conventional weapons technologies, long-range delivery systems, and chemical and biological weapons. The collapse of the Soviet Union--combined with revelations about the extent of the Iraqi nuclear development program (1991) and the former existence of a small, South African nuclear arsenal (1993)--contributed to burgeoning fears of a possible epidemic of nuclear weapons. Once a concern of only a small subset of arms control specialists, nuclear proliferation became a front-page

issue and ominous tales of "loose nukes" provided a replacement for earlier stories about communist expansion.⁴

There is evidence suggesting, however, that the momentum of diffusion assumed in the epigraphs to this study may be abating, rather than accelerating.⁵ If true, this would be all the more surprising in light of the fact that the technical route to nuclear weapons now presents fewer obstacles than in the past, as evidenced by the growing availability of fissile material, bomb designs, and delivery systems. An apparent paradox is emerging. On the one hand, the technical barriers to entry into the nuclear club have been progressively eroded; yet the drive to obtain nuclear weapons has been declining. Stated another way, as civil and military technology has reached a more or less "homogeneous level" across national boundaries, the denial strategies developed to obstruct would-be proliferators have decreased in effectiveness. Nonetheless, the number of potential proliferators has leveled off, and begun to decline.⁶ This trend confounds the commonly-accepted systemic explanation for nuclear proliferation: to obtain power and prestige perceived to improve its security position, a state seeks nuclear weapons, creating in the process a pro-nuclear bureaucracy that augments the initial drive.⁷

The anomaly of fewer potential proliferators despite reduced technical barriers suggests that decisions about acquiring nuclear weapons may now be influenced by a calculus different from traditional explanations for proliferation, and are less affected by strategies of denial. A finding to this effect would have significant implications for proliferation research, arms control policy, and paradigms of both proliferation and non-proliferation. Current paradigms would need to be refined to incorporate new processes or factors at work. Research would have to be redirected from assessing "Why do states go nuclear?" to examining "Why do states eschew the nuclear path?" Finally, international non-proliferation policy would need to incorporate

support for local anti-proliferation dynamics to supplement the more traditional policies of technical denial.

The objective of this analysis is to illustrate that nuclear diffusion is a declining, though still dangerous, phenomenon that requires reevaluation in terms of basic concepts, research, and policy.⁸ The analysis reviews the progress of proliferation and non-proliferation and examines the debate over both. The paper then examines the evolution of anti-proliferation measures, chiefly those of denial. Emerging disincentives to diffusion are suggested and the broader implications of these disincentives and related nuclear postures are assessed, along with factors that might either explain or reverse them. The final section explores changes in approaches to non-proliferation that might be conducive to exploiting new conditions and thinking.

II. The Nth Country Problem Revisited

Little heard today, the term 'Nth country problem' was once central to the non-proliferation lexicon, standing for "the possibility of diffusion of nuclear weapons to an indeterminate [N] number of countries."⁹ The goal of non-proliferation was to confine that figure to the smallest number above zero that could be managed. Recalling President Kennedy's 1963 fears of as many as 20 nuclear weapon states by 1975, some satisfaction can perhaps be taken from the reflection that 32 years after he expressed this concern--and 20 years after the point when he expected N to equal 15 or 20--the number of nuclear powers stands at no more than nine and probably closer to six, only a few more than the four existing in 1963.¹⁰ Further, no nuclear weapons have been detonated in anger in 50 years.

More interesting than observance of what French analyst Raymond Aron called "the nuclear taboo" against use, is the slow pace of nuclear weapons diffusion in the last 50 years, as compared either to worst-case scenarios or in absolute terms.¹¹ According to the 1968 Nuclear Non-

Proliferation Treaty (NPT), status as an accepted nuclear weapon state (NWS) is conferred by a test of a nuclear explosive before 1967, as stated in Article IX: "...a nuclear-weapon State is one which has manufactured and exploded a nuclear weapon or other nuclear explosive device prior to January 1, 1967." This definition yielded five NWS.

Since 1967, four states have unofficially become NWS. India tested a nuclear device in 1974.¹² Although a nuclear test has not been fully confirmed, Israel is widely believed to have a nuclear arsenal. Pakistan acknowledges a "modest" but now-abated bomb-making program.¹³ And South Africa has provided abundant information on its now-defunct nuclear arms program and arsenal.¹⁴ Taking the known-test instances into account and estimating the non-test or unknown-test cases, the dates when states became nuclear-capable reflect the proliferation progression shown in Table 1.

Table 1. Presumed Nuclear-Weapon Nations: 1st Atomic Test or Prototype	
1. United States	July 1945
2. Union of Soviet Socialist Republics	August 1949
3. United Kingdom	October 1952
4. France	February 1960
5. Peoples Republic of China	October 1964
6. Israel	~1967 ¹⁵
7. India	May 1974
8. Union of South Africa	~1979
9. Pakistan	~1987

The periodization of nuclear weapons capability is perhaps more instructive if represented in the linear fashion of Figure 1. Discounting overblown claims that Ukraine, Belarus, or Kazakhstan were exploiting or could exploit, in any realistic sense, the former Soviet weapons stationed on their territory, it reveals a declining rate of diffusion in the last 20 years of the nuclear age as compared to the first 30.¹⁶

Proliferation: A Second Look

It is important to acknowledge that there are great disparities in the nuclear capabilities of the nine nations. Of the four most recent states to have acquired a nuclear weapons potential, only Israel is deemed to have deployable forces of any significance.¹⁷ South Africa has been at pains to demonstrate that it has destroyed its arsenal of some six bombs, as well as the plans to make them. Despite its 1974 test of a peaceful nuclear explosive, "India still does not appear close to building a nuclear arsenal," according to Mitchell Reiss and Robert Litwak.¹⁸ Announcing in February 1992 its ability to assemble a device, Pakistan also stated that it would halt production of fissile material and nuclear bomb cores. However, some reports suggest it would not dismantle the cores until India followed suit.¹⁹

Figure 1: NUCLEAR PROLIFERATION BY DECADE
1945-1995
(Date of First Nuclear Test)

1945		1st Decade:
USA	1945	3
USSR	1949	
UK	1952	
1955		2nd Decade:
France	1960	2
PRC	1964	
1965		3rd Decade:
Israel	1967	2
India	1974	
1975		4th Decade:
So. Africa	1979	1
1985		5th Decade:
Pakistan	1987	1
1995		

Thus, it seems reasonable to distinguish the six nuclear-armed nations--the five acknowledged, treaty-accepted nuclear-weapon states plus Israel--from the three other states that have, in various ways, suspended their nuclear weapons programs. The gap between the capabilities of these two groups--one possessing arsenals ranging from the low hundreds of weapons to several thousand, another one possessing technology but no known deployed or deployable weapons--illustrates the shortcomings that characterize much of the current discussion and analysis of nuclear proliferation. While it is certain that these analytic problems have understandable origins, it is necessary to eliminate them from conceptual frameworks, as they are ill-suited to present circumstances.

Greatest of the conceptual anomalies in proliferation is the use of a 1967 nuclear weapon test by the Non-Proliferation Treaty as the primary yardstick to determine the approved NWS. This definition and date make India an outlaw nuclear-weapon state, but does not address the status of either South Africa or Israel, as they have not tested. Arguably, Pakistan is also not an outlaw, if it has not tested a device. This testing criterion was appropriate earlier in the nuclear era, when a test was deemed an essential, visible milestone on the path to nuclear force development. More recently, however, testing is such that it may be neither visible nor essential.²⁰ Furthermore, the testing guideline creates invidious and largely irrelevant distinctions, as between India, on the one hand, and Israel, Pakistan, and South Africa on the other.²¹

Since all of the countries that undertook nuclear weapons programs in the first half of the nuclear age weaponized the products of these initiatives, it was naturally assumed that any state with such a program would automatically develop deployable forces.²² In the early 1990s, South Africa reversed this process. In addition, Brazil and Argentina mutually rescinded their development programs, and India and Pakistan halted on the threshold of a deployable force. The canonical proliferation code, however, scarcely

acknowledges important distinctions such as these, and therefore may be rejecting signs that the nuclear option may be losing its charm.

These observations illustrate a point that has been neglected in much of the non-proliferation literature: *the crucial demarcation line in the current phase of the nuclear era lies between nuclear weapons initiatives and viable, deployable nuclear forces.*²³ Another concept that is little noted is that, even as the problem of building a prototype becomes simpler, the challenge of fielding a fully-fledged nuclear force grows more daunting. The difficulty of meeting this challenge may be a primary reason fewer states are willing to undertake the effort.

Progress in Non-Proliferation

The apparently inexorable march of nuclear proliferation foreseen three decades ago may thus be a chimera.²⁴ If the criterion for status as a nuclear power was a strict military standard of retaining a viable and deployed or deployable nuclear force, rather than the technical standard of detonating a device and the informal benchmark of possessing a prototype, the pace of proliferation is even more moderate than indicated earlier, as shown in Figure 2.

Using this more precise and restrictive categorization yields the following proliferation head-count at the half-century mark: six nuclear powers, two nuclear-weapons-capable states with suspended production programs (India and Pakistan), one former nuclear power (South Africa), four former potential proliferants (Argentina, Brazil, Taiwan, and South Korea)²⁵ and three ex-Soviet republics currently in the process of meeting non-proliferation commitments.²⁶

Figure 2. STATES RETAINING DEPLOYED/DEPLOYABLE NUCLEAR WEAPONS, 1945-95

<i>1945</i>	1st Decade:
11	

USA	1945	3
USSR	1949	
UK	1952	
<hr/> 1955		2nd Decade:
France	1960	2
PRC	1964	
<hr/> 1965		3rd Decade:
Israel	67	1
<hr/> 1975		4th Decade:
		0
<hr/> 1985		5th Decade:
		0
<hr/> 1995		

This means a new nuclear power every seven years, on average, yet none in the 16 years since South Africa began producing its small arsenal. This might suggest a growing consensus on the disutility of nuclear forces.

The more important issue, however, is the list of *active* proliferators, i.e., states still seeking a prototype device and perhaps a viable nuclear force. The states commonly at the top of this list are Iran, Iraq, Libya, and North Korea.²⁷ It is a worrisome group; not only have these four nations sought the capacity to make nuclear weapons, as well as other weapons of mass destruction, their current governments are thought capable of employing them. Nonetheless, the list is shorter than was predicted in the late 1970s, when nuclear diffusion was also, briefly, a leading issue.²⁸ Such a short list could make diffusion prevention more manageable by allowing international energies to be concentrated on the fewer, though more difficult cases listed in Table 2.

Table 2. Potential Proliferators, Past and Present			
A. Former Potential Proliferators	B. Improbable Proliferators	C. Possible Proliferators	D. Plausible Proliferators
Argentina*	Belarus*	India	Iran*
Brazil	Kazakhstan*	Pakistan	Iraq*
South Korea*	Ukraine*		Libya*
Taiwan*			North Korea*
South Africa*			

* Party to the NPT

In the cases of the active or plausible proliferators, the picture is not totally bleak. The harsh treatment administered by the international community to Iraq after the full extent of its nuclear program was discovered in the wake of the Gulf War ought to be a cautionary lesson to any other state planning to develop a clandestine bomb or nuclear force.²⁹ Libya's much-publicized efforts to obtain nuclear capability or to facilitate a so-called Arab bomb in the 1970s and 1980s seem to have ground to a halt with the decline in Libya's oil wealth, and perhaps also as a result of Colonel Muammar Qadafi's reputation as an "international troublemaker."³⁰

The agreement reached in 1994 by the United States and North Korea--whereby Pyongyang will gain interim oil supplies and alternative nuclear power technology in return for dismantling its nuclear facility at Yongbyon, thereby maintaining adherence to the NPT--has elicited considerable skepticism in the West.³¹ However, it may prove to be a reflection of North Korea's attempt to join the nuclear disutility consensus suggested above. Finally, although Iran seems to be the one would-be proliferator not stymied or entertaining second thoughts, it remains a long way from reaching the bomb.³²

From the perspective of prevention achieved and the gap between proliferation expectations and outcomes, a case can certainly be made that the nuclear diffusion problem--while always serious--is manageable.³³ To be sure, this picture might change radically if significant global or regional

instability were to occur. However, the support for the NPT reflected in its indefinite extension in 1995 can be construed as a vote of confidence in the persistence of at least the current level of international stability (or as a vote of no confidence in nuclear weapons as a solution in an insecure world). What is less clear is whether the instruments for coping with proliferation are the most efficacious for the changing nature of the problem.

State of the Debate

A number of analysts have discerned this abatement of nuclear proliferation, though few have seen in it a possible trend and most have attributed it to a number of systemic forces, such as the end of the Cold War; the operation of the non-proliferation regime, or the higher precedence accorded to it; or the emerging goal of acquiring nuclear weapons without actually deploying nuclear forces. Leonard Spector notes, for example, that "traditional non-proliferation efforts are having their greatest success."³⁴ Mitchell Reiss is foremost among those seeing diminished diffusion largely as a product of external factors. In *Bridled Ambition*, an exhaustive study of nine cases, he identifies a generalized version of post-Cold War "new thinking" about nuclear forces and cites the trend toward offering economic rewards rather than imposing sanctions, U.S. non-proliferation policies, increased attention to the non-proliferation regime, and local political leadership as central to the slowing or curtailing of nuclear weapons programs.³⁵

Other analysts emphasize the impact of local decisions on proliferation postures as the primary rationale for curtailment. Rosalind Reynolds advances the thesis that India and Pakistan have achieved mutual deterrence without weaponizing their capability, while North Korea has effectively used its nuclear potential as a bargaining tool to gain concessions from the United States--another classic purpose of nuclear weapons.³⁶ Etel Solingen explains different internal proliferation postures by distinguishing between "internationally-minded, liberalizing economic coalitions," which

avoid nuclear initiatives owing to their cost and adverse impact on participation in transnational economic regimes, and "inward-looking, nationalist-confessionalist" governments that pursue state-driven economic growth and security self-reliance and tend for both reasons to support nuclear weapons initiatives.³⁷

Thus, somewhat unexpectedly, the consensus on the centrality of nuclear proliferation as an internal security issue has provoked contention in a policy area once regarded as the preserve of like-minded specialists. Whereas, in the past, the main fissure was between government officials, who deemed the problem a secondary one, and academics or public interest advocates who thought bureaucrats too tame, in the current environment the most fundamental premises of proliferation and non-proliferation paradigms, precedents, policy, and prospects are in dispute. The division between governmental and non-governmental specialists continues.³⁸

A sample of the issues in current contention includes the inevitability of technological determinism; the impact of the non-proliferation regime; the influence of the end of the Cold War; the efficacy of export controls; the impact of counterproliferation and its compatibility with classical non-proliferation efforts; changing concepts of security in the evolving international environment; and basic questions of whether the nuclear diffusion situation is improving or worsening and what should be done about it. Some, like Spector, see progress in the making, while others perceive the spread of nuclear weapons as the defining security issue of the decade.³⁹

Amidst this contention, one detects tendencies to overvalue external imperatives conducive to nuclear diffusion (e.g., security self-reliance in a system approaching anarchy) or favoring nuclear restraint (e.g., the non-proliferation regime). It is also possible to underrate complex political and policy-making processes within which international and domestic factors are becoming increasingly unfavorable to the deployment of nuclear capabilities.

III. The Nuclear Club: Technical Barriers to Entry

International diplomacy--amicable or coercive--combined with concrete incentives and disincentives has been central to the non-proliferation effort almost from the beginning and will remain so in the future. Complementing the diplomatic track has been the track of technical denial. As the nuclear age has unfolded, technical barriers to membership in the nuclear club (as shown in Table 3) have decreased in effectiveness, despite efforts to preserve them.⁴⁰

Table 3. Types and Examples of Nuclear Denial Strategies
<p style="text-align: center;">A. Fissionable and Fissile Material</p> <ul style="list-style-type: none">• Monopoly control of uranium deposits• Nuclear fuel accounting and diversion prevention under International Atomic Energy Agency safeguards program• Restrictions on recycling spent fuel rods• Vigilance regarding nuclear fuel or fissile material from former USSR
<p style="text-align: center;">B. Nuclear Weapon Design</p> <ul style="list-style-type: none">• Security classification of weapon designs and engineering details• Strict security control of nuclear weapons and components
<p style="text-align: center;">C. Plant Equipment and Weapon Components</p> <ul style="list-style-type: none">• Export restrictions on sensitive manufacturing equipment (e.g. calutrons) and system components (e.g. klystrons)• Multilateral coordination of exports through Nuclear Suppliers Group scrutiny of contracts
<p style="text-align: center;">D. Delivery Systems</p> <ul style="list-style-type: none">• Unilateral constraints on export of missiles and aircraft to certain regions or end-users• Multilateral restrictions on missiles or other delivery system technology through Missile Technology Control Regime (MTCR)

The first state to actively engage in non-proliferation activities was the United States, which, in a joint Anglo-American effort, attempted to gain monopoly control of sources of uranium worldwide even before the Manhattan Project produced a working bomb.⁴¹ Well ahead of the bombing of Hiroshima and Nagasaki, American and English officials also planned to acquaint the world with the known scientific principles of atomic explosives--but not the details of the many esoteric engineering problems solved in the Manhattan Project--through the release of the so-called "Smyth Report: Atomic Energy for Military Purposes."⁴²

The United States, however, had second thoughts about its wartime atomic partners, Britain and Canada. The Atomic Energy Act of 1946 imposed a total prohibition on sharing data on atomic weapons or the manufacture of fissionable substances from which fissile matter is produced with any nation.⁴³ Similar restrictions apply to weapons-related hardware, such as the calutrons used to enrich uranium to weapons grade or the klystrons that form part of the electronic triggers in nuclear weapons.

Later, following India's detonation of an atomic device developed from its civil nuclear power industry, states which sold nuclear power technology formed the London or Nuclear Suppliers Group (NSG). Its purpose was to constrain the transfer of dual-use technology--having both civil and military applications--to non-nuclear weapon states (NNWSs). By the 1980s, it had become increasingly apparent that restrictions on nuclear fuel and weapons technology were inadequate to prevent the making of nuclear weapons. The U.S. again took the lead in promoting the creation of the Missile Technology Control Regime (MTCR) to inhibit the transfer and diffusion of weapon delivery systems technology.

It may be that these and the other measures that constitute the international non-proliferation regime have slowed the diffusion of nuclear weapons technology. However, it is more certain that these restrictions were, and are, not always rigorously or uniformly enforced. When it became clear

that Britain was determined to acquire nuclear weapons, the U.S. offered assistance that continues to this day. Later, limited aid was also extended to France, which, while rejecting the initial offer, accepted U.S. tankers to refuel its nuclear bombers and computer technology used in making the French hydrogen weapon.⁴⁴

In addition to supplying direct assistance, the U.S. and other suppliers have at times looked the other way when potential proliferators were acquiring nuclear technology. This was particularly true if such behavior suited other policy objectives, such as the struggle with the communist states. The case of India and Pakistan clearly illustrates this policy; before U.S. aid to Pakistan was cut off in 1990 under the Pressler Amendment, Pakistan was thought to have the highly enriched uranium to make five or ten nuclear weapons, and India was estimated to have enough plutonium for 40 to 60 weapons.⁴⁵

Faustian Bargains

Ironically, perhaps one of the greatest long-term contributors to undermining technical barriers to the development of nuclear weapons was a U.S.-sponsored program that stressed the electric power potential of nuclear energy. The US assisted states in the acquisition of civil power production technology, in return for international inspection of their nuclear research and production facilities. Proposed by President Eisenhower in the UN General Assembly, December 1953, the "Atoms for Peace" initiative led to the 1957 creation of the International Atomic Energy Agency (IAEA).⁴⁶ While the concept and its implementation played an essential role in the international coordination of anti-proliferation efforts through the IAEA Safeguards program, it was bound to involve a Faustian bargain.

On the one hand, the creation of IAEA provided a forum for limited but essential superpower cooperation. It also fostered the spread of nuclear power technology in a manner permitting nations with limited weapon ambitions to acquire and exploit nuclear technology quickly, and without

endless outside concerns over their long-term objectives.⁴⁷ It is difficult to imagine a remotely effective international non-proliferation regime without the IAEA and its safeguards. A world of states with nationally-generated and unmonitored civil nuclear power programs would be one of limitless suspicion.

Despite its contributions to international stability, it is important to acknowledge that Atoms for Peace also had several potentially negative proliferation consequences. The program led to the training of tens of thousands of nuclear physicists and engineers, and it resulted in the provision of nuclear fuel, research and production reactors, and nuclear power plant technology to scores of countries. These human and material assets--initially provided for the most part by the NWS and advanced nuclear power countries--constitute a critical mass, not only for the exploitation of nuclear power but also, with sufficient interest and industry, for making nuclear weapons. Furthermore, the evolution of nuclear technology created new proliferation problems, such as reprocessing of spent nuclear fuel to obtain fissile material. Thus, Atoms for Peace spread the technology and the hardware which facilitated the steady circumvention of restraining barriers by states determined to gain nuclear weapons.

By 1980, when the U.S. began a systematic effort to constrain proliferation of advanced delivery technologies--chiefly ballistic and cruise missiles--the proverbial barn door was wide open. In a second Faustian bargain, the major arms-supplying states competed to sell such delivery systems to potential proliferators, sometimes justifying the sales as ways of satisfying the security appetites of the recipients and thereby reducing proliferation pressures. Thus, aircraft capable of carrying nuclear weapons are available on the international market; some non-nuclear states have acquired ballistic missiles (and, like Iraq, extended the range) or cruise missiles, ostensibly for use with conventional munitions; while others are developing both types of missiles indigenously.

India, for example, has the durable and adaptable British-made Canberra bomber and numerous Jaguar and MIG ground-attack fighters that could be rigged for nuclear weapons. India also deploys the Prithvi missile in versions with 90- and 150-mile ranges and 250 to 500 pound payloads; is developing the Agni I intermediate-range ballistic missile, and designing the longer-range Agni II; and has successfully tested the Lakshya unmanned vehicle that can also function as a cruise missile.⁴⁸ Pakistan, for its part, has U.S.-made F-16 attack fighters, thought to be its choice for a delivery vehicle, has bought the Chinese short-range M-11 ballistic missile, and is developing medium-range ballistic missiles (MRBMs).⁴⁹ North Korea is developing MRBMs and intermediate-range missiles (IRBMs).⁵⁰

Proliferation Paradox

The growing ability of would-be nuclear-weapon states to overcome technical barriers placed in their path does not necessarily mean that a determined nation can easily field a viable nuclear force. The gradual decline in the effectiveness of these obstacles signifies that the prerequisites for development of a nuclear device program are available with effort and that a delivery system--albeit with modest performance characteristics--is not beyond reach.

It is this condition which constitutes the proliferation paradox: as acquisition of basic nuclear-weapon materials and technology has become easier, fewer states are committing to or engaging in the nuclear option. From the standpoint of conventional proliferation thinking, this is counter-intuitive. It raises interesting questions about the nature and automaticity of diffusion; the dominance of security, prestige, and bureaucratic factors in contemporary proliferation motivation; the continuing efficacy of technical non-proliferation measures; and the current state of the diffusion threat.

IV. The Nuclear Club: Growing Disincentives to Join

The logic of nuclear proliferation derives mainly from the motivation seen in the cases of the current nuclear weapon states and Israel. From concerns of security, prestige, or both, a nation makes a commitment to go nuclear. In due course it fulfills that commitment, either deploying a significant and visible force or, as in the case of Israel, maintaining its force behind a veil. NWSs repose the deterrent or compellence power of their nuclear arsenals in uncertainty as to whether, or under what conditions, they might be used. Israel relies on this, as well as the additional ambiguity regarding the extent of its forces.

The logic of non-proliferation has been, for the most part, linear and universalistic in terms of its principles. It involves a mix of sticks (denial or punishment) and carrots (nuclear power, security assistance, etc.), with the emphasis often on sticks. The Clinton Administration's new recipe favoring rewards, as in the Ukrainian and North Korean cases, has been criticized because, among other things, it departs noticeably from the traditional approach stressing negative consequences. The prevailing paradigms of proliferation and non-proliferation are, in political culture jargon, reductionist and Western, as well as deeply embedded in the non-proliferation regime. They may therefore no longer be able to address changing international realities.

If the number of nuclear-armed states grew only to six in the 25 years between 1945 and 1970, while the number of nuclear-capable states has shrunk since 1980, causes of nuclear restraint not clearly addressed by these models seem to be at work. A number of country studies--most notably Mitchell Reiss's *Bridled Ambition*--have suggested possible causes of nuclear self-restraint. More theoretical analyses have also indicated several possibilities.⁵¹

This is not to say that dramatic new reasons to forgo the deployment of nuclear forces are being discovered. Rather, that there may be a reevaluation of the issues which influence nuclear proliferation decisions. The following pages speculate on the reasons for eschewing nuclear deployment.

The Deployment Decision

In most earlier cases of nuclear decision-making, including the South African case, the decision to field some kind of nuclear force appears to have been a foregone conclusion, one inherent in the original decision to embark on a program to develop a nuclear explosive device.⁵² Moreover, for the first three nuclear weapon states (U.S., USSR, and UK), developing deployment methods for the weapons was not a consideration, since World War II had produced bombers capable of delivering nuclear weapons (albeit not at intercontinental ranges).

While the development of nuclear technology and the acquisition of weapons required new handling, safety, and security measures associated with contemporary nuclear forces, other deployment-related decisions seemed relatively uncomplicated by today's standards. Until the advent of long-range ballistic missiles, for example, nuclear forces and other targets could be defended by relatively straightforward and readily available measures like dispersal, camouflage, interceptor aircraft, anti-aircraft artillery, and nuclear-tipped surface-to-air missiles like the American Bomarc.

Now, however, costly, highly complex and hardened early-warning, command and control, and interception systems are necessary to protect nuclear forces and the investment in them, as well as to ensure that they operate effectively. Where the prospective antagonists are cheek-by-jowl--as at the head of the Persian Gulf, in South Asia, or on the Korean Peninsula--no early-warning or protective system may adequately address the protective task.

In this environment, a small, vulnerable deterrent force may invite intervention and provoke instability rather than inhibit aggression.

The deployment decision is, of course, not a single decision. There is a myriad of decisions ranging from the seemingly trivial to the obviously crucial. The main categories of deployment decision-making include determining:

- the precise nature of the threat
- missions and targets
- allocation of mission to services
- size and types of forces
- the sequence of deployment
- the means of securing nuclear force against internal and external threats
- the availability of resources and opportunity costs
- the impact of deployment on allies and adversaries
- future expansion and modernization requirements
- required command and control facilities, authorities, and procedures.

In some situations, provisions for maintaining internal security--i.e., protecting the force from seizure, sabotage, or unauthorized use--might be almost as demanding as those for protecting it from external threats.

Depending on the political and economic system, the prevailing perceptions, and the regional power balance within which this sequence of decisions is to be made, different categories of decisions will have varying significance and salience. Overall, however, some aspects of decision-making are sure to raise profound issues and thus potential differences regarding the appropriate approach to deployment. These differences may in themselves block or seriously complicate the deployment step.

Although not significant in the programs of the current NWSs, competing views on deployment could assume greater importance in many of today's cases. In North Korea, the decision to create a nuclear weapon

capability appears to have split the leadership in Pyongyang. The case of Iraq, however, indicates such division is not necessarily the rule. The length of time it takes a clandestine proliferator to, first, create a nuclear device and then build a viable nuclear force also offers opportunities for revising the decision by means of a change in government, outside intervention, or both.

The important point is that while a nuclear weapon research and development program may escape serious domestic challenge, the contemporary reality of nuclear proliferation is that moving to the deployment phase--once seemingly automatic--involves steps likely to be highly controversial within a government or society. Such a move would likely entail an irrevocable commitment with high and continuing costs and social, political, and environmental burdens. It is also likely to be visible physically and fiscally. Some of the controversies latent in the process of deployment decision-making are suggested below.

Technology Constraints

By the 1970s, the technological requirements for fielding a nuclear force had become more demanding than 25 years earlier and would continue to present a greater challenge to would-be proliferators. Whereas the initial nuclear powers were able to 'grow up' with the technology, contenders for nuclear status today must catch up with the path-breakers. Earlier in the nuclear age, innovators suffered from the principle that it is simpler to be an imitator; the Soviet Union took advantage of this throughout the Cold War.⁵³ To realize this benefit, however, the imitator must pursue the innovator closely or fall too far behind to catch up.

This is the condition of most would-be nuclear-armed states, not in terms of bomb technology or of aircraft delivery systems, but in terms of the myriad technologies now needed for an effective nuclear force. It is not in the making of a bomb nor in the acquisition of a delivery system that the challenges lie, but in a host of associated systems. Rodney Jones and Steven

Hildreth note that for sophisticated systems the "technical obstacles are not trivial." They cite engineering challenges over physics problems and the costs of necessary infrastructure as among these obstacles that have led to what they term "no-first production" policies.⁵⁴

The problem is partly illustrated by the difference between developing a workable bomb and an effective missile. One physicist, writing on the current requirements for producing an explosive device, concluded that "...so far as is known, no nation which has attempted to detonate a nuclear explosive has failed on its first attempt."⁵⁵ In contrast, efforts to develop reliable and effective cruise and ballistic missiles have been plagued with problems, from Nazi Germany's V-1 and V-2 programs to India's Agni missile program, and even by the superpowers.

Owing to its special geopolitical situation, South Africa was able to circumvent most of these challenges by building a very simple bomb and adopting a simple strategy. In the event of an unmanageable challenge by the Soviet-backed forces then on its borders, Pretoria would detonate a nuclear weapon on the ground--followed by a bomb drop over the Atlantic, if necessary--to engage Western aid. If neither demonstration availed, the other bombs would be delivered by Buccaneer, Mirage, or Canberra aircraft.⁵⁶ Most potential proliferators will not be afforded the luxury of a simple weapon, simple delivery vehicle, and simple strategy because they are in closer proximity to major rivals with significant conventional retaliatory capability.

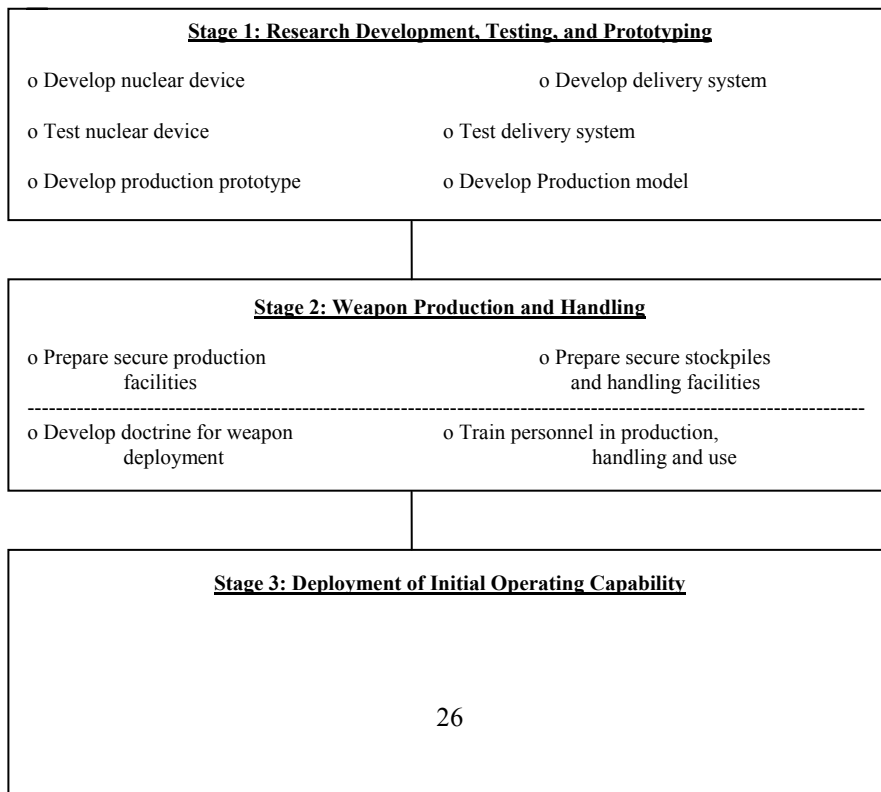
Less than the up-front technology of bombs and bombers, it is the follow-on technologies required for the deployment of a viable force that may discourage or inhibit proliferators. Presumably, the reason for the current proliferation of cruise and ballistic missile technology is that potential proliferators have come to understand that a nuclear bomber force is a vulnerable one, especially subject to a preemptive strike by contemporary conventional weapons. Indian efforts to buy a Soviet missile submarine seem

to indicate that at least one nuclear-capable state is thinking ahead along those lines, as well.

As missile technologies are mastered, proliferators must then contemplate the need for sophisticated ancillary technologies such as early-warning systems, launcher protection systems, satellite reconnaissance and positioning systems for target identification and location, hardened and redundant command-and-control systems, and weapon security and fail-safe systems.

Figure 3 is a simplified, notional depiction of the development and deployment stages and related decisions involved in acquiring an effective and viable force. It assumes that force development is driven, as it was for the nuclear super-powers, by specific threats that will improve technologically, requiring the proliferator to expand or modernize.⁵⁷ As a representation of some

Figure 3. MAJOR STAGES IN NUCLEAR FORCE DEVELOPMENT AND DEPLOYMENT



- o Provide personnel security procedures and systems
- o Develop secure, survivable command-and-control systems

- o Provide force security: hardening, redundancy, defense, and dispersion
- o Select and assign targets

Stage 4: Force Expansion and/or Modernization

- o Improve force capability: size, performance, etc.
- o Expand targeting and delivery options
- o Improve force and command-and-control capability
- o Revise employment doctrine for improved capability

of the decisions facing a proliferator downstream, Figure 3 illustrates the consequences of the initial decision to deploy.

If countries like India remain in the development stage, and are no further along than the dashed line in stage two, they are on the threshold of a series of decisions and tasks that were accepted almost automatically by the first nuclear powers. Yet, if taken by a contemporary proliferator, these decisions would necessitate greater exertions owing to the technology gap between small and relatively primitive nuclear forces and the forces deployed today by the leading nuclear weapon states. This is not to say that the proliferator must emulate the arsenal of the United States. Still, it would be unwise to ignore the technical possibilities and risks that the continuous expansion and modernization of American and Soviet forces reveal.

The modernization and expansion imperatives appear to be inevitable for existing or would-be nuclear-armed states not so well situated as South Africa. Britain and France are both involved in nuclear force modernization. A nuclear force effective against regional foes would not likely be so against the arsenals of the NWSs or, more realistically, against a counterstrike by advanced conventional forces. Indeed, an irony of the current era in weapons technology is that conventional arms--often heirs to improvements in range, accuracy, speed, and lethality pioneered for nuclear weapons--have increasingly been replacing nuclear arms for many missions.

Nonetheless, some would-be proliferators, as well as opponents of proliferation, seem to view the acquisition of a minimum force--a few bombs and a few bombers or missiles--as the end state. Such a force, however, might prove an invitation to preventive attack or preemption--perhaps by non-nuclear means --rather than as an effective instrument of local deterrence or hegemony.⁵⁸

An additional factor that may deter some would-be nuclear powers is that, in political terms, nuclear power is not only the product of an arsenal but also of territorial scale. As the arsenals of the NWSs grew and improved, the

ability to absorb a nuclear attack and respond with secure, second-strike weapons assumed an increasingly important role in the balance of terror. This capability was the product of sheer geographical size, the use of the opacity of the oceans to shield the second-strike weapons from attack, as well as the guarantees--actual or probable--that a medium nuclear power could call on the U.S. nuclear umbrella.

Three of the six nuclear-armed states have both the territory and ocean access to make a willingness to absorb a first strike and then retaliate seem credible. Additionally, Britain and, implicitly, Israel and France have an American nuclear guarantee to rely on. Among the candidates for the status of nuclear-armed state, only India has the territorial expanse and broad ocean access to be in the same league as China, Russia, and America. This may account for its pursuit of advanced sea-based delivery systems while holding back on weapons production.

Finally, the decision to deploy nuclear weapons may increasingly be influenced by the fact that advanced conventional weapons can perform most of the tasks once assigned to nuclear munitions. One reason the United States recently deactivated many tactical nuclear weapons is that their roles were usurped by conventional arms that are very accurate, lethal, and versatile. For technologically advanced armed forces, precision-guided conventional munitions are the weapons of choice. Thus, ironically, would-be nuclear proliferators may not be pursuing the technology of today but yesterday (though, in fact, most covet both).

Economic Implications

The bomb-at-any-cost approach was so much a part of initial programs and has figured in enough other cases (e.g., Pakistan and Iraq), that the economics of nuclear weapons decision-making received scant attention. Most would-be proliferators do not command the resources to fund a weapons development program without significant opportunity costs elsewhere in their

economies. However, the cost of a nuclear weapons R&D program--one that could produce the components for several bombs--need not be excessive, if the effort is undertaken in tandem with creating a commercial nuclear power industry, and if it is not a crash project like the U.S. and Soviet efforts.

For at least the last 20 years, though, the costs of a decision favoring deployment of a viable nuclear force have been a different matter. Taken together, the costs of the numerous programs associated with such a viable nuclear force will probably dwarf initial developmental investment.⁵⁹

In principle, the budgetary impact of these costs could be moderated by spreading delivery system acquisition, preparation of secure nuclear stockpiles and bases, training, and other essential expenditures over longer periods. Practically, though, this would entail the risks commonly related to concurrent decisions on interactive features of a planned force. Thus, a delivery system might have to be chosen before the final design of the nuclear device was proven, and fixed nuclear facilities might have to be designed before crucial features of the force were known with high certainty. Such activities might also signal deployment intentions sooner than desired.

In major U.S. weapons acquisition programs in the 1960s and 1970s, "excessive concurrency" due to program acceleration was found by the Government Accounting Office to be the largest single cause of cost overruns. An example of this would be beginning production of a new class of submarines before the prototype had been fully tested. This would lead to the requirement to redesign, remanufacture, and back-fit elements of the system in units that were in advanced stages of production.⁶⁰ At the beginning of the nuclear age, the penalties for wrong decisions were less severe, owing to relatively primitive early-generation technologies, or they seemed more tolerable. Inevitably, however, as technologies mature and become more complex, the margin for error declines.

The economic implications of a deployment decision are very high and fraught with risk. A decision to acquire a minimum force--for example,

one squadron of 24 fighter-bombers dispersed at four locations in hardened revetments, good early warning equipment, and a robust command-and-control system but no air defense against cruise or ballistic missiles--would reduce the budgetary impact but might also prove a tempting target for a preventive conventional attack. A more effective and viable force--including a mix of widely dispersed and hardened aircraft and missiles, state-of-the-art early warning and air defense, and robust and redundant command and control--would, require far more capital investment and increased annual operating costs.

Except in the case of authoritarian regimes like Iraq, Iran, and North Korea, the probability is that the costs of deploying a force of any capability or significance would provoke a debate over resource allocation, especially if the champions of alternative spending priorities were in any way informed about the long-term additional costs of force expansion and modernization. In times of economic uncertainty or transition, low national growth rates, trade or budget deficits, currency fluctuation or devaluation, or similar economic stress, fiscal arguments against weaponizing a nascent nuclear capability would be potent.⁶¹

The Politics of Weaponization

Many of the technical and economic disincentives to deployment cited above involve difficult domestic decisions or trade-offs, imposed or influenced by broad external developments, such as major changes in the global economy, or the emergence of patterns of technological innovation, evolution, and diffusion that discourage nuclear force proliferation. The degree of domestic political awareness of these international pattern changes is related to the openness of the polity or the strength of its democracy. The most likely proliferators in Table 2 (Iran, Iraq, Libya, North Korea) are the most closed and authoritarian states, as well as the ones with the greatest pretensions to international power or fear of their enemies. Brazil and

Argentina, on the other hand, as a result of their own achieved détente, agreed to a cessation in nuclear weapons rivalry after the 1983 election of Raul Alfonsin as Argentina's first democratic president in more than 10 years.⁶² South Africa gave up its small force as a result of the end of the Cold War, which lessened its security concerns, and of President F.W. de Klerk's effort to democratize the country.⁶³

As South Korea and Taiwan have moved hesitantly toward democracy, they have also proved susceptible to U.S. influence regarding nuclear proliferation. Presumably they count their security relations with Washington--explicit and tacit--as a better guarantee than independent nuclear forces.

Democracy is comparatively robust in India. In Pakistan, it has been the norm but not always the practice.⁶⁴ Both countries have paused on the threshold of deployment. If links between democratization and non-proliferation remain unclear or inconsistent, evidence of the nexus of highly authoritarian regimes, political ambition, and nuclear ambition is strong.⁶⁵

Military, technological, and economic considerations pertaining to nuclear decision-making merge in the political arena, even in authoritarian states where the arena may be very small. They are then subjected to political considerations at the international, regional, national, local, and party levels. Often this results in the emergence of contentious political issues and debate.

One such issue has already been indicated: differences over the allocation of resources, between nuclear forces and other national priorities (such as a stronger economy or avoiding international bankruptcy). Disputes might also arise as a result of inter-service competition for the nuclear force role. Few, if any, states today can afford, as could the U.S. and the USSR at the height of the Cold War, to let each of the major armed services have a significant nuclear role.

The deployment decision has additional bureaucratic implications. The proliferation paradigm tends to emphasize the role of powerful nuclear

agencies--energy ministries, atomic energy commissions, research facilities-- as driving forces in the decision chain leading to eventual deployment. The clout of such institutions is usually considerable during the R&D phases of a nuclear weapons program, but, depending on the organization or character of a government, its influence may be diluted when it comes to the actual deployment decision.⁶⁶ Other senior officials and cabinet members may ally against nuclear force deployment in an effort to protect or enlarge their own allocations.

The military services may also have joint or separate interests that would be at risk from a nuclear deployment decision, such as maintaining budget shares or avoiding diversion of funds from preferred programs. The 1949 admirals' revolt in Washington resulted from the cancellation of the Navy's new aircraft supercarrier to fund more B-36 nuclear bomber wings for the U.S. Air Force. This fueled Naval opposition to deterrence doctrine, and its labeling of the doctrine as "immoral."⁶⁷ Negative reevaluation of the contemporary deterrent value, military utility, and long-term costs of nuclear forces can as plausibly come from the military services as from political circles. Opposition of this kind could lead to postponement or avoidance of a decision favoring deployment, especially if the government suffers from weakness in its leadership, or internal divisions and factionalism.

Guarding the Guardians

A civil government contemplating deployment needs to have strong faith in the character of its military forces. A military government must have an equally strong faith that it will not be usurped. Nuclear force deployment further implies reposing great trust in the loyalty and judgment of specific personnel, both military and civilian, to ensure proper authority of units at several levels of command. All of these imperatives imply high degrees of social cohesion, consensus, and homogeneity or, in their absence, very effective social regimentation.

Reaching consensus on who should control nuclear forces might prove difficult in a polity with strong and unresolved ethnic, religious, class, or ideological differences. This is especially true if the cleavages have expressed themselves in violence and communal strife, as they have in Iraq, India, and Pakistan.⁶⁸ The control issues will be less contentious in states where the societies are relatively homogeneous and the recent history of relations with antagonists is not rife with conflict. Therefore, in more heterogeneous and strife-torn polities, additional considerations under the rubric of 'who-will-guard-the-guardians?' may raise further barriers to a deployment decision.

Histories of political instability may also inhibit nuclear proliferation, since few will want to commit to a very long-term program that might one day end up in 'the wrong hands.' Shahram Chubin notes:

...decisions made at one time can take effect at another. A new regime may look at the world differently, put a different priority on acquiring nuclear weapons and pursue them for quite different ends. Any progress made by its predecessor...may then contribute to new and unforeseen ends.⁶⁹

Perhaps in combination with other disincentives, inability to address the issue of weapons control in the face of domestic division and internal instability could provide a strong reason for halting on the threshold of force deployment.

V. Proliferation Implications

The proliferation paradigm tends to assume a single-minded and unitary governmental decision-making approach to nuclear weapons acquisition that is seen mainly among authoritarian regimes.⁷⁰ Economic, technical, military, and political disincentives to nuclear deployment may

cumulatively be enough to encourage political leaders to eschew nuclear capability and seek to harmonize their differences with rivals or sources of perceived threats. The cases reviewed earlier and the possible disincentives just summarized suggest the need for a better understanding of nuclear decision-making on a country-by-country basis, including behavior reflecting both nuclear reservations and nuclear ambitions.

Nuclear Maturity

Evidence of a subtle yet substantive change of views on the utility and legitimacy of nuclear forces may lie in the instances where the acquisition of nuclear weapons has been reversed, halted, or slowed. The factors contributing to such change might be of several kinds: (1) governmental learning, (2) generational change, and (3) several kinds of reverse demonstration effects.

Governmental Learning

Governmental learning describes a long-term, collective, and experiential process that bears strongly on policy change and innovation and has especially significant implications for security policy and arms limitation.⁷¹ The governmental learning concept suggests that, in varying ways and degrees, some of the potential proliferators have moved from starker representations of reality to richer ones and toward improved ways of harmonizing ends and means. Learning of this kind can be simple or complex, involve step-by-step or break-through acquisition of knowledge, and include solitary, parallel, or dynamic experiences. The nuclear diffusion chronologies illustrated earlier seem to indicate that proliferation abatement began before the end of the Cold War--though its end accelerated that process--and may reflect the process of governmental learning.

Generational Change

In aspects of nuclear decision-making such as governmental learning we may be witnessing the impact of generational change. The perspectives of today may have little in common with those of the decision-makers of the 1940s and 1950s. It should be more evident, for instance, that as means to ensure security, nuclear weapons are a highly problematic solution, at times creating insecurities at least as great as any they allay. Generational change, as seen in the Soviet case and perhaps detectable in others, probably abets the process of governmental learning.

Reverse Demonstration Effect

Among the factors that impel proliferators along their course is the demonstration effect. The demonstration effect drives imitation both among economic producers and military forces and can be reversed as well, so that emulated behavior becomes rejected behavior. Other possible influences include the partial but real delegitimization of nuclear weapons resulting from superpower declarations that nuclear war could not be won and must never be fought, and the nuclear reduction efforts of the U.S. and the USSR in the late 1980s and early 1990s. Thus, nuclear learning and the reverse demonstration effect of denuclearization may push in the same direction as prohibitive costs, unwelcome political divisions, and technical hurdles--against a deployment decision.

A related influence may be that the symbolism of nuclear accomplishment has steadily degraded in the last 10 to 20 years. Once nations pursued nuclear capability because they gained prestige from mastering the physics of nuclear explosions. Now the symbolic value of nuclear capability is more likely to be negative, associated with Chernobyl, Three Mile Island, Colorado's Rocky Flats arsenal, the Hanford nuclear waste site in Washington, and equivalent ex-Soviet weapon facilities.⁷²

This is not to suggest that proliferators are suddenly deciding to follow the new, uncertain path of denuclearization begun by the U.S. and the

former Soviet Union. Rather, the superpowers' retreat from long-standing competition in this area may have raised, or given new urgency to, questions about the usefulness of nuclear weapons in achieving broad national goals. Viewing it as a whole, U.S. and Russian analysts have been finding more fault with the dynamics and products of their forty-year arms rivalry. These lessons may induce others to consider where their programs could take them.⁷³

These possible motives point to a related factor which helps explain a notable decline in proliferation and the retreat of the superpowers from expansion of their atomic arsenals. The evolution of nuclear maturity seems clear in the cases of Argentina, Brazil, and South Africa, as well as the U.S. and Russia. It may be too soon to include India or Pakistan in this company, although the confidence-building measures they have taken in the 1990s provide hopeful signs. However, it is important to note, maturity of this kind is reversible. It is instructive, in the context of an apparent slowdown in nuclear diffusion, to reflect on commentaries on the Swedish decision not to select the nuclear option:

Sweden's decision to forgo the acquisition of nuclear weapons is a consequence of the cumulative effect of a number of small decisions and actions over two decades.⁷⁴

Because a procurement decision was not perceived to be especially urgent and the political situation favored the postponement of any decision, pro or con, valuable time was gained for reflection on the costs and benefits of acquiring nuclear weapons. At the same time, international thinking on the roles and utility of nuclear weapons matured. One result was that [in Sweden] broader security policy considerations triumphed over purely military and tactical arguments.⁷⁵

Alternative Scenarios

Considerations other than nascent maturity accompanied by the vexing decisions suggested earlier may yield a better explanation for the decline in diffusion. Pakistan and India may be 'lying-low' while their

delivery vehicle programs catch-up to their weapon efforts. Even so, the resulting pause might well be a long one, possibly offering a window of opportunity for policy change through a continuous demonstration effect or through the process of government learning. It may be that there is domestic consensus only for weapon and delivery system development, not deployment. Circumstantial and anecdotal evidence exists to support this inference in the case of South Asia.⁷⁶

The Israeli example and its strategy of nuclear ambiguity may also have encouraged others to develop their own variants. Bombs (or components) in the basement may have as much deterrent effect or bargaining leverage as is needed, yet run fewer risks of preventive attack, international condemnation, sanctions, or isolation. Rosalind Reynolds argues that in South Asia and North Korea nuclear-capable or would-be nuclear-capable states have effectively used their differing threshold conditions to achieve classic goals associated with actual nuclear forces. India and Pakistan have achieved reciprocal nuclear dissuasion, although the stability of this condition remains contentious, while North Korea has bartered its nuclear weapons potential for the oil and modern nuclear power technology its shrinking economy desperately needs.⁷⁷

Domestic disincentives to deploy nuclear forces may change, diminish, or vanish. For example, if having a nuclear capability without deployed forces is the point at which domestic political consensus can currently be sustained, a future conflict or threat could shift this consensus toward deployment.

Still other scenarios provide ample reason for continuing to be concerned about proliferation. It is conceivable that political leaders in states suspected as proliferators are waiting to determine the role of nuclear weapons after the Cold War. Will these weapons be viewed as decisive in terms of threat-making, military utility, or political power, as they were in the past? Or will they be seen as indecisive or unusable? If their former status is preserved,

proliferation may expand rather than contract. The spread of nuclear weapons (horizontal proliferation) could also slow the decade-long process of reversing vertical proliferation (the growth of the American and Soviet-Russian nuclear arsenals).

It is likely that differences in national goals between the nuclear haves and nuclear have-nots (and between the Cold War and the post-Cold War periods) have produced different evaluations of the utility of nuclear weapons. The leading NWSs have declared that a nuclear war cannot be won and must not be fought, and have also questioned the value of nuclear arms, considering their numerous costs and uncertain record of effectiveness coercion.⁷⁸

In the wake of the Cold War, however, those states that feel threatened (e.g. North Korea) or want to threaten (e.g. Iran) may see nuclear forces as attractive equalizers of the local, regional, or international military balance. Such nations need not even threaten to use a small nuclear force against a potential adversary. Instead, it could threaten to use it to retaliate against a third party, if its actions are contested or its demands not met. For example, a hypothetically nuclearized North Korea might vow, under international pressure, to destroy not Seoul, but a Japanese city if sanctions or other measures are not lifted, or if conventional counterforces are deployed.⁷⁹ It is far from clear how, or whether, an NWS could use its nuclear superiority to counter such a threat or whether international opinion would permit the use of nuclear weapons for such a purpose. Thus, the NWSs may be inhibited from employing their nuclear advantage, while others might not be.⁸⁰

Other motives and explanations for the seeming decline in prospective proliferation have been developed, most of them less sanguine than those hypothesized in these pages. These alternate interpretations for proliferation postures may not challenge, so much as complement, the explanation indicated here. It is plausible, on the one hand, that domestic disincentives to creating viable nuclear forces obliged decision-makers to

employ whatever diplomatic leverage a modest nuclear capability offered them. On the other hand, although significantly less plausible, is that decision-makers chose a strategy of ambiguity and found that it accorded well other international and domestic needs and interests.

VI. Future Non-Proliferation Policy

The counsel here is, therefore, not to neglect proliferation but to alter or supplement strategies for coping with it. To some degree, U.S. policy shifts already reflect this imperative of post-Cold War non-proliferation. In late 1993, the Clinton administration softened the largely threat-based approach it inherited from the Bush Administration in dealing with Ukraine on ex-Soviet nuclear weapons, and adopted a conciliatory policy that has been successful.⁸¹ The administration has used a mixed approach to North Korea, but with the emphasis increasingly placed on rewards rather than punishment.⁸² It has kept up pressure on Iraq, despite the continuing evidence that the Iraqi response to threats is usually only temporary or partial compliance with the demands.⁸³

The 'behaviorist' approach of conditioning conduct by reward and punishment holds that, as between the two, rewards are vastly more effective. This seems to hold true where the behavior is international rather than individual. In the post-Cold War era, in particular, when nuclear or conventional threats by NWSs have lost much of their credibility (as in Chechnya and Yugoslavia), emphasis on persuasive rather than coercive diplomacy seems more likely to yield the desired outcome.

In this connection, however, it is important not to confer too much credibility on the threat-making potential of possible or suspected proliferators, as the U.S. did in overrating Ukraine's nuclear option. Government officials, proliferation specialists, and news reporters who exaggerate nuclear capability or potential tempt states to keep or acquire

nuclear weapons and raise expectations of the rewards that can be attained, both by acquiring and by giving up nuclear capability or weapons.

Continuing efforts to reverse vertical proliferation remain essential to the campaign against horizontal proliferation. As the NWSs were the role models for proliferation, so must they now be the role models for denuclearization. A comprehensive test ban treaty and constraints on the accumulation of fissile materials would be effective in this regard. Similarly, while the progress of denuclearization by the U.S. and Russia has been slowed, in part by the very magnitude of the reductions to which they have already committed themselves, it would be useful to map out the desired course for future cuts. Developing a plan for reductions beyond START I and START II would be a useful exercise for scouting the nuclear terrain of the future and identifying the conditions under which further cut-backs would be more or less likely. This must include conditions relating to Britain, France, and China, the nuclear-armed and nuclear-capable states, and potential proliferators. Other measures along these lines include re-examination of the role of Nuclear Weapons Free Zones in the light of the recent actions of South Africa, Brazil, and Argentina and exploration of the proposal for Nuclear Safe Zones. These would encompass nuclear-armed or nuclear-capable states but would contribute to regional confidence and provide a starting point for eventual nuclear reductions in regions where they are adopted.⁸⁴

The chief implication of government learning, generational change, and the reverse demonstration effect in the present context, however, may be that the downturn in nuclear diffusion and proliferation possibilities described at the outset involves more than adopting a different perspective in evaluating and classifying the spread of nuclear weapons. As intimated earlier, the very way in which proliferation has been viewed in the past is in need of updating, both to take account of new factors that may be at play and also to prevent the dead hand of an outdated mindset from causing new non-proliferation opportunities or techniques to be missed. This would entail adopting a more

differentiated perspective on possible proliferators to facilitate policies more tailored to the various stages of, and motivations for, nuclear weapons acquisition.

As in all cases where incentives are sought to encourage behavior that is acceptable to a community, it is also important not to examine just the actual or possible defectors from the regime but also those that have joined it. This means concentrating more on the experience and security calculus of NPT adherents for lessons that may be applicable to the candidate nuclear states. While actual and potential proliferators will be especially resistant to tutelary tactics and cultural imperialism, it is nevertheless important to find ways to stress the security and other disincentives to possession of nuclear forces.

Overall, therefore, the most important contributions to constraining proliferation in the future may have to do, not with improvements in concrete measures, but in improved ways of thinking about the proliferation problem. We need to encourage a revision in thought amongst those who see nuclear forces as solving more problems, with fewer consequences, than they can.

ENDNOTES

- ¹ Arthur Schlesinger, Jr., A Thousand Days: John F. Kennedy in the White House (New York: Houghton Mifflin, 1965), p. 897.
- ² Christopher Drew, "U.S. Seeks New Start with Ukraine on Nuclear Arms," Chicago Tribune, May 12, 1993, p. 8.
- ³ See the overview by Sen. John Glenn, "This Country Encouraged the Spread of Nuclear Weapons," Washington Post, June 24, 1992. For a summary of how concern about a Soviet drive to the Persian Gulf--made possible or abetted by Iranian fundamentalism and instability--animated U.S. regional policy in the 1980s, see the author's "On the Brink in the Gulf, Part 1: Onset of the 'Classic' 1990 Crisis," Security Studies, 2:2, Winter 1992, pp. 178-180.
- ⁴ George Questor, "Conceptions of Nuclear Threshold Status," in Regina Cowen Karp, ed., Security With Nuclear Weapons: Different Perspectives on National Security (Oxford: Oxford University Press, 1991), p. 226, similarly notes how the media recycle old 'news' about proliferation in sensational terms. Shahram Chubin--in an essay in Mitchell Reiss and Robert S. Litwak, eds., Nuclear Proliferation after the Cold War (Washington: Woodrow Wilson Center Press, 1994), p. 34--also notes that both bureaucrats and academics have incentives for hyping proliferation after the Cold War; bureaucrats and academics, of course, are the principal sources of reporters covering foreign affairs.
- ⁵ A notable example is Mitchell Reiss, Bridled Ambition: Why Countries Constrain Their Nuclear Capabilities (Washington: Wilson Center Press, 1995). Reiss analyzes nine cases of apparent nuclear self-denial. He does not assert, however, that this constitutes a trend.
- ⁶ On the process of innovation-imitation that produces general technological similarity or homogeneity, see William H. McNeill, The Pursuit of Power: Technology, Armed Forces, and Society Since A.D. 1000 (Chicago: University of Chicago Press, 1982), p. 54.
- ⁷ In his conclusion to Nuclear Proliferation after the Cold War, Reiss identifies these factors, pp. 336-337, as "Incentives during the Cold War," along with "technological determinism."
- ⁸ A further ramification might be that proponents of versions of neo-realist or structuralist theory that disallow any influence from the unit or internal level on state behavior, emphasize exclusively the role of the system in determining state action, and regard nuclear diffusion--albeit, somehow, 'selective'--as beneficial for stability would face still another challenge to the explanatory power of these variants of the theory. The contention of the pope of neo-realism, Kenneth Waltz, that system dynamics will cause Japan and Germany to go nuclear would be much harder to sustain, for example, if it were shown that domestic restraint on entry overcame or supplant systemic conditions favoring the nuclear option. For Waltz's predictions regarding Japan and

Germany, see his "The Emerging Structure of International Relations," International Security, 18:2, Fall 1993, p. 54. Critical of this view is Glenn Chafetz's "The End of the Cold War and the Future of Nuclear Proliferation: An Alternative to the Neo-realist Perspective," Security Studies, 2:3/4, Spring/Summer 1993.

⁹ Definition in George W. Rathjens, The Future of the Strategic Arms Race: Options for the 1970s (New York: Carnegie Endowment for International Peace, 1969), p. 51.

¹⁰ The more cynical may argue that Kennedy's estimate was merely self-serving, since he was striving for a Limited Test Ban Treaty with Britain and the Soviet Union at the time. His assessment, however, was consistent with those of specialists. As Alastair Buchan, then director of the (International) Institute for Strategic Studies, noted in his introduction to A World of Nuclear Powers?--published after China detonated its first atomic device--"the biggest gap in the chain reaction of proliferation may be from the fifth to the sixth. From the sixth to the sixteenth the progression might be rapid" (Englewood Cliffs NJ: Prentice-Hall, Inc., 1966), p. 9. Related to fears of a sudden expansion in nuclear powers, another prime proliferation concern of the time was expressed by Stanley Hoffmann in the same volume (p. 121): the complex problem of "too many fingers on a trigger" or an unstable, many-sided nuclear face-off or competition.

¹¹ Aron is quoted by Hoffmann, A World of Nuclear Powers?, p. 99.

¹² India is among those styled a '*de facto* Nuclear Weapon State,' reflecting the present semantic and conceptual problems of past thinking on proliferation and non-proliferation, which conflates a test and a nuclear arsenal. Even states that have not detectably tested are informally counted in the '*de facto* NWS' camp.

¹³ On Pakistan's announcement, see R. Jeffrey Smith, "Pakistan Can Build One Nuclear Device, Foreign Official Says," Washington Post, February 7, 1992. For the timing of Pakistan's acquisition of nuclear capability, see Reiss, Bridled Ambition, pp. 187 and 215. On the recent state of nuclear programs and policy in India, Israel, Pakistan, and South Africa, see the chapters by, respectively, Brahma Chellaney, Shai Feldman, Ali T. Sheikh, and David Fischer in Reiss and Litwak, *op. cit.*

¹⁴ For a brief overview, see R. Jeffrey Smith, "South Africa's 16-Year Secret: The Nuclear Bomb," Washington Post, May 12, 1993. A more exhaustive account is in Reiss, Bridled Ambition [Note 5].

¹⁵ Author's estimate based on Seymour M. Hersh, The Sampson Option: Israel's Nuclear Arsenal and American Foreign Policy (New York: Random House, 1991), p. 177 (which addresses production).

¹⁶ For the numerous and varied obstacles to the use of the Soviet weapons by the three ex-republics, see the author's study of the leading case, "Nuclear Weapons in Ukraine: Hollow Threat, Wasting Asset," Arms Control Today, 23-6, July/August 1993, pp. 13-18. In the meantime, all three have taken appropriate steps to carry out their obligations under the 1992 Lisbon Protocol, ratify the START I treaty, and adhere to the NPT.

¹⁷ While Western, and presumably other, intelligence agencies had known of Israel's weapons for nearly 20 years, significant public confirmation came only in 1986 when The Sunday Times (London) Insight Team gained information from Mordechai Vanunu, an employee at Israel's Dimona nuclear research complex. For the revelations and Vanunu's fortunes, see: "Revealed: The Secrets of Israel's Nuclear Arsenal" and "How the Experts Were Convinced," Sunday Times, October 5, 1986; "France Admits it Gave Israel Bomb" and "Kidnap Fears for Israeli Who Gave Nuclear Secrets," Sunday Times, October 12, 1986; United Press International, "Priest Says Israelis Hold Missing A-Plant Worker," Washington Post, October 27, 1986; and Glenn Frankel, "Israeli Who Told of A-Bomb Vanishes," Washington Post, October 29, 1986.

¹⁸ Reiss and Litwak, *op. cit.*, Introduction, p. 6.

¹⁹ Pakistan's fissile (explosive) matter is highly enriched uranium (HEU). Plutonium also provides fissile material, which comes from isotopes capable of nuclear fission (i.e., fissionable). See the sources in Note 10, especially Ali T. Sheikh, in Reiss and Litwak, p. 196.

²⁰ Regarding nuclear weapon development without testing, see William J. Quirk, "How Necessary is Nuclear Testing for Proliferant Nations? The Future Role of U.S. Nuclear Weapons" (Livermore CA: Lawrence Livermore National Laboratory, 1993) cited in Ryukichi Imai, "Post-Cold War Nuclear Non-proliferation and Japan," in The United States, Japan, and the Future of Nuclear Weapons: Report of the U.S.-Japan Study Group on Arms Control and Non-proliferation After the Cold War (Washington: Carnegie Endowment for International Peace, 1995), p. 134. Quirk indicates that high-yield, compact thermonuclear devices require testing but devices using simple gun- or implosion-type designs do not.

²¹ Israel, for example, deployed its nuclear-capable Jericho I missile in the early 1970s, the Jericho II in the early 1980s, and an extended range version of the Jericho II in 1987, well ahead of the deployment of similar weapons by would-be proliferators; see Leonard S. Spector, The Undeclared Bomb: The Spread of Nuclear Weapons, 1987-1988 (Cambridge MA: Ballinger, 1988), pp. 27 & 188.

²² Sweden explored the prospects but did not undertake a weapons development program *per se*; see Lars Wallin, "Sweden," in Regina Karp, ed., Security With Nuclear Weapons? (Note 4), p. 366.

²³ A nuclear arsenal consisting of a very small number of weapons would, to be sure, have a certain value for threat-making but also runs grave risks of inviting a pre-emptive disarming first strike, as the Soviet leadership realized after Stalin's death. These risks motivate nuclear weapons states to develop stockpiles of at least 100 weapons or so as an insurance policy. Such considerations might not influence a terrorist organization possessing a bomb, but, as yet, there has been no sign of the much-feared terrorist atomic bomb; other weapons seem adequate to terrorist acts.

²⁴ The Foreword to the Report of the U.S.-Japan Study Group cited in Note 22 describes "...a background of continued high levels of nuclear armament, persistent threats of nuclear proliferation, and the burgeoning growth of conventional military forces" The proliferation threat does, indeed, persist. The issue to address now is

whether it persists at the level of intensity of an earlier era. While linear extrapolation from a few data points, as reflected in Figures 1 and 2, is a risky basis for projecting trends, it does raise important questions about the degree or probability of the proliferation threat. Methodologically, it provides a more accurate picture of proliferation than do similar linear extrapolations made by treating these cases as identical.

²⁵ India and Pakistan have been dubbed "opaque proliferators" by Benjamin Frankel, signifying that their "nuclear weapon capabilities...are 'suggested,' rather than openly acknowledged," according to Devin T. Hagerty, "The Power of Suggestion: Opaque Proliferation, Existential Deterrence, and the South Asian Nuclear Arms Competition," in Security Studies, 2:3/4, Spring/Summer 1993, p. 257 and Note 130. This seems a rather misleading classification, since no matter how much their nuclear programs lack transparency, they do not constitute deployed or viable nuclear forces.

²⁶ On denuclearization progress in Ukraine, Belarus, and Kazakhstan, see Beyond the Nuclear Peril: The Year in Review and the Years Ahead, Report No. 15 (Washington: Henry L. Stimson Center, January 1995), pp. 13-17.

²⁷ John Arquilla and Paul K. Davis, in "Modeling Decision-making of Potential Proliferators as Part of Developing Counterproliferation Strategies" (Santa Monica, CA: RAND Corp., 1994) focus on North Korea, Iran, and Iraq, implicitly acknowledging the reduced threat of Libyan proliferation *per se*. Their study addresses types of decision-making among possible proliferators and thus the "demand" rather than the "supply" or supplier side of proliferation.

²⁸ In a seminal article in this period, for example, Richard K. Betts listed a dozen possible proliferators: Argentina, Brazil, Egypt, Iran, Israel, Libya, North Korea, Pakistan, South Africa, South Korea, Taiwan, and Yugoslavia ("Paranooids, Pygmies, Pariahs and Non-proliferation Revisited," Foreign Policy No. 26, Spring 1977, reprinted with updating in Security Studies, 2:3/4, Spring/ Summer 1993). Other notable works in this period were Albert Wohlstetter et al., Moving Towards Life in a Nuclear Armed Crowd? (Los Angeles: Pan Heuristics, 1976) and Thomas C. Schelling, "Who Will Have the Bomb?" International Security, 1:1, Summer 1976. Stimulating concern was the recognition that fissile material would soon be available to many states in the spent fuel rods from their civilian nuclear power plants. This led to the U.S.-sponsored International Nuclear Fuel Cycle Evaluation (INFCE). On INFCE, see the essays by Theodor Winkler and Gloria Duffy in William H. Kincade and Christoph Bertram, Nuclear Proliferation in the 1980s: Perspectives and Proposals (New York: St. Martin's Press, 1982).

²⁹ On Iraq's treatment and the warning it may send to others, see the essays by Gary Samore and Shahram Chubin in Reiss and Litwak, *op. cit.*, as well as Reiss's concluding chapter. Samore notes (p. 31) that "Saddam Hussein provided an invaluable service to the international community. By serving as a warning of what might have been, he has given the international community greater reason and resources to deal with the threat." A useful overview of the Iraqi program is R. Jeffrey Smith and Glenn Frankel, "Saddam's Nuclear-Weapons Dream: A Lingering Nightmare," Washington Post, October 13, 1991. Possible secret proliferators will be

subject to closer scrutiny in future; this will push up the high existing cost of developing a nuclear weapon capability in secret.

³⁰ On Qadafi's reputation and Libya's efforts, see Shahram Chubin, "The Middle East," in Reiss and Litwak, pp. 53-54. See also Leonard S. Spector, The Undeclared Bomb, pp. 196-204. The Economist, "Nuclear Non-proliferation," March 25, 1995, p. 23, notes that Algeria, Libya, and Syria have had nuclear ambitions but have been "too strapped for cash to get far." On their nuclear efforts, Shai Feldman, "Israel," in Reiss and Litwak, p. 78.

³¹ See two 1994 Washington Post articles by Jessica Mathews defending the accord against its detractors: "A Sound Beginning With North Korea," October 21, and "A Good Deal with North Korea," October 30. Critics objected to negotiating with Pyongyang at all; see Albert Wohlstetter, "Too Many Flip-Flops," Washington Post, June 26, 1994. The October 21, 1994 "Agreed Framework" appears in Disarmament (New York: United Nations) XVII:2, 1994, pp. 136-140, and Arms Control Today, 24:10, December 1994, p. 19. A summary of its provisions is in Beyond the Nuclear Peril, p. 33.

³² An Iranian device is not seen as an immediate danger, as Chubin makes clear in his analysis cited in Note 32. The task facing the Islamic Republic of Iran is one of reviving the earlier, broad nuclear program of the deposed Shah Mohammed Reza Pahlevi, one designed to lead to a "nuclear option," while confronting strong U.S. counter-action. See Jon B. Wolfsthal, "Iran, Russia Sign Nuclear Deal, Raising Proliferation Concerns," Arms Control Today, 25:1, January/February 1995, quoting Defense Secretary William Perry and outgoing CIA Director James Woolsey on obstacles to any near-term Iranian nuclear weapons capability.

³³ Mitchell Reiss, in the final chapter of Nuclear Proliferation after the Cold War, p. 347, reaches a similar conclusion, noting that "Disincentives [to diffusion] have generally been strengthened and reinforced, whereas incentives have generally weakened." His focus is mainly on technical and external factors and less on military or political reasons that may account for decreased interest in nuclear capability.

³⁴ "Neo-Non-proliferation," Survival, 37:1, Spring 1995, p. 69.

³⁵ See Note 5.

³⁶ Rosalind G. Reynolds, "The Proliferation of Nuclear Weapons Programs; Non-Weaponized Tools for Diplomacy," paper presented at the 36th Annual Convention of the International Studies Association, Chicago IL, February 22, 1995.

³⁷ "The Political Economy of Nuclear Restraint," International Security, 19:2, Fall 1994.

³⁸ See, for example, the exchange in Survival, 37:2, Summer 1995, pp. 174ff., between Leonard Spector and two Department of Defense officials, Ashton B. Carter and Mitchel B. Wallerstein.

³⁹ See Benjamin Frankel, "An Anxious Decade; Nuclear Proliferation in the 1990s," Journal of Strategic Studies, vol. 13, September 1990, and similar, but not necessarily pessimistic, articles cited by Spector in "Neo-Non-proliferation," p. 83, Note 11.

⁴⁰ Chubin makes a similar point in Reiss and Litwak, *op. cit.*, p. 59, but also notes "...it is getting harder and costlier to proliferate: more and better resources are available through better detection, better equipment, better coordination, and more diplomatic muscle." Largely a product of the 1991 discoveries about Iraq's weapon program, these improvements make hiding a program more problematic but do not alter the weakening of scientific and technological obstacles once considered the main barriers.

⁴¹ On the attempt to corner uranium sources, see McGeorge Bundy, Danger and Survival: Choices About the Bomb in the First Fifty Years (New York: Random House, 1988), pp. 134 & 469.

⁴² Prepared beforehand by Princeton University physicist Henry DeWolf Smyth and published immediately after the Hiroshima attack, its subtitle is: "The Official Report on the Development of the Atomic Bomb under the Auspices of the United States Government, 1940-1945." For background, see Bundy, *op. cit.*, Chapter IV. The report disclosed information already widely known to the international community of physicists; see L. Badash, E. Hodes, and A. Tiddens, Nuclear Fission: Reaction to the Discovery in 1939 (LaJolla CA: Institute on Global Conflict and Cooperation, University of California, San Diego, 1986).

⁴³ Bundy, *op. cit.*, pp. 467-470. By his account, the Congress was largely ignorant of the British contribution, without which an atomic bomb could not have been developed by 1945.

⁴⁴ Bundy, *op. cit.*, pp. 474-494.

⁴⁵ Leonard S. Spector, with Jacqueline R. Smith, Nuclear Ambitions: The Spread of Nuclear Weapons, 1989-90 (Boulder CO: Westview Press, 1990), p. 9. The Pressler Amendment to the 1985 Foreign Assistance Act bars foreign aid to countries which the president cannot certify as not in possession of a nuclear device. Dr. K. Subrahmanyam, foreign affairs consulting editor for India's Economic Times, in a paper at the National Defense University's symposium on "Counterproliferation: Security Dimensions of WMD (weapons of mass destruction) Proliferation," Washington, November 16-17, 1994, p. 17, cites estimates of a Pakistani stock-pile "ranging from two to seven or eight weapons," following the common practices of (1) using the estimates of Western anti-proliferators and (2) conflating amounts of fissile material with real weapons. In his paper at the same conference, former chair of the Pakistan Atomic Energy Commission Dr. Munir Ahmad Khan employs similar practices to estimate the strength of India's nuclear capability as to potential weapons and delivery systems. [Hereinafter, papers from this conference are identified as 1994 NDU WMD Symposium materials.]

⁴⁶ The Atoms for Peace program, combined with the NPT, is deemed to mark the U.S. shift from a strict policy of denial to a mix of "constructive engagement" and selective denial; see National Academy of Sciences, Nuclear Arms Control: Background and Issues (Washington: National Academy Press, 1985), p. 237. In Bridled Ambition, p.

326, Mitchell Reiss notes that the acceleration of proliferation by Atoms for Peace is reflected in India's 1974 nuclear test.

⁴⁷ On superpower cooperation in the formation of the IAEA, see David Holloway, Stalin and the Bomb (New Haven: Yale University Press, 1994), pp. 348-354.

⁴⁸ Data from The Military Balance 1992-1993 (London: International Institute for Strategic Studies, 1992), p. 132; Chellaney in Reiss and Litwak, *op. cit.*, pp. 180 & 184; and "The Global Proliferation of Theater Ballistic Missiles," Arms Control Today, 24:3, April 1994, pp. 29-30. India's shorter-range Prithvi has the larger payload.

⁴⁹ Jon Wolfstahl, "U.S. Bid to 'Cap' Indian-Pakistani Programs Faces Opposition," Arms Control Today, 24:4, May 1994, p. 18 and Jon Wolfstahl, "South Asia's Arms Race Continues to Cause Serious Concern," Arms Control Today, 24:8, October 1994, p. 19.

⁵⁰ In 1994, CIA Director R. James Woolsey confirmed work on two missiles with ranges in excess of 1,000 and 2,000 miles. R. Jeffrey Smith, "CIA Confirms North Korea's New Missiles," Washington Post, March 18, 1994. See also David Wright and Timur Kadyshev, "The North Korean Missile Program: How Advanced Is It?" Arms Control Today, 23:3, April 1994, pp. 9-12, and the summary, pp. 29-30, "The Global Proliferation of Theater Ballistic Missiles."

⁵¹ Other country studies indicating the influence of domestic and other restraining factors are to be found in Reiss and Litwak, *op. cit.*, especially those on India, Pakistan, South Africa, and Brazil and Argentina. See also the studies of Canada and Sweden by John Barrett and Lars Wallin, respectively, in Karp, ed., Security With Nuclear Weapons? More speculative or theoretical analyses suggesting a possibly significant influence of internal variables on nuclear restraint are the essays by George Questor and Harald Muller in the same volume and Questor's essay in the companion volume edited by Regina Cowen Karp: Security Without Nuclear Weapons? Different Perspectives on Non-Nuclear Security (Oxford: Oxford University Press, 1992). Yet the tendency to emphasize the determining role of external incentives for proliferation and non-proliferation remains strong.

⁵² Canada, which was to obtain nuclear weapons from the U.S., and Sweden, where a nuclear weapons program contemplated in the 1960s was hotly debated, are, of course, exceptions. See the essays by Barrett and Wallin cited in the preceding Note. The progression of American decisions from research and development to use is detailed in the author's "The United States: Nuclear Decision Making 1939-1989" in Karp's Security With Nuclear Weapons? and reflects the interlocking nature of decisions.

⁵³ For its use of American breakthroughs at the onset of the nuclear age, see Holloway, *op. cit.*

⁵⁴ Rodney W. Jones and Steven A. Hildreth, Modern Weapons and Third World Powers, CSIS Significant Issues Series, Vol. VI, No. 4 (Boulder CO: Westview Press, 1984), pp. 77-80.

- ⁵⁵ Peter D. Zimmerman, "Technical Barriers to Nuclear Proliferation," Security Studies, Vol. 2, No. 3/4, Spring/Summer 1993, p. 354.
- ⁵⁶ See R. Jeffrey Smith, "South Africa's 16-Year Secret: The Nuclear Bomb," and Reiss, Bridled Ambition, pp. 15-16, for slightly varying accounts.
- ⁵⁷ Essentially the same diagram appears in the author's "The United States: Nuclear Decision Making, 1939-1989," in Karp, Security With Nuclear Weapons?, p. 22.
- ⁵⁸ On the perils of pre-emption or preventive attack for a small nuclear force, see Scott D. Sagan, "The Perils of Proliferation: Organization Theory, Deterrence Theory, and the Spread of Nuclear Weapons," International Security, 18:4, Spring 1994, pp. 74-85. Sagan challenges the contention of neo-realist promoters of 'stabilizing' nuclear proliferation that any new nuclear power would, of necessity, act with extreme caution, citing evidence of incaution by the existing nuclear powers. Israel's 1981 bombing of Iraq's Osirak nuclear reactor offers an ambiguous lesson regarding a preventive conventional attack. It may encourage a determined proliferator, like Saddam Hussein, to adopt elaborate measures to prevent identification of bomb-making facilities. Yet, these measures will likely raise significantly the cost and time for developing a nuclear capability.
- ⁵⁹ On the impact of cost increases experienced by proliferators from export controls, see Litwak and Reiss, *op. cit.*, p. 342.
- ⁶⁰ Cost Growth in Major Weapons Systems (Washington: General Accounting Office, May 1973).
- ⁶¹ Ali T. Sheikh cites economic transition as a factor affecting Indian and Pakistani opinion on security issues in Reiss and Litwak, *op. cit.*, p. 192. In their papers at the 1994 NDU WMD Symposium, Khan of Pakistan and Subrahmanyam of India cite economic factors and declining defense spending, respectively, as influences on decision-making.
- ⁶² On South American, see Monica Serrano, "Brazil and Argentina" in Reiss and Litwak, *op. cit.*; Itty Abraham, "Pakistan-India and Argentina-Brazil: Stepping Back from the Nuclear Threshold?" Occasional Paper No. 15 (Washington: Henry L. Stimson Center, October 1993) and Tom Collina and Fernando Barros, "Transplanting Brazil and Argentina's Success," ISIS Report February 1995 (Washington: Institute for Science and International Security).
- ⁶³ On the South African program and its termination, see Spector, The Undeclared Bomb, pp. 286-300, and, Reiss and Litwak, *op. cit.*, Chapter 9 by David Fischer.
- ⁶⁴ Using a schema applied by Timothy Colton to the former Soviet republics, India would be a proto-democracy, Pakistan a pre-democracy, and Iraq and North Korea anti-democracies. See Colton and Robert Legvold, eds., After the Soviet Union: From Empire to Nations (New York: W. W. Norton, 1992), pp. 22-23.
- ⁶⁵ Chubin, in the Reiss and Litwak volume, p. 36, also makes an explicit link between authoritarian rule and proliferation.

⁶⁶ Mitchell Reiss is among those identifying the importance of bureaucratic momentum in Reiss and Litwak, *op. cit.*, pp. 336-337.

⁶⁷ On the Admirals' Revolt, see David Alan Rosenberg, "American Atomic Strategy and the Hydrogen Bomb Decision," Journal of American History, 66;1, June 1979, and "The Origins of Overkill: Nuclear Weapons and American Strategy, 1945-1960," International Security, 7:4, Spring 1983; Edmund Beard, Developing the ICBM: A Study in Bureaucratic Politics (New York; Columbia University Press, 1976); and Walter Millis, Arms and Men: A Study in American Military History (New Brunswick NJ: Rutgers University Press, 1981), p. 325.

⁶⁸ Brahma Chellaney calls "controlling domestic unrest" the top security priority of India, Pakistan, and other Asian states in Reiss and Litwak, *op. cit.*, p. 166. In his paper for the 1994 NDU WMD Symposium, p. 3, Munir Ahmad Khan notes that the South Asian states are "faced with serious economic, social, ethnic and political problems."

⁶⁹ Chubin, in Mitchell and Reiss, *op. cit.*, p. 54.

⁷⁰ For example, a split within North Korea's government on nuclear issues has been detected; see Don Oberdorfer, "The Silence of a Strange Land," Washington Post Outlook, January 29, 1995.

⁷¹ For an application of the learning model to security policy change, and a fine summary of concepts and review of seminal literature, see Robert Legvold, "War, Weapons, and Soviet Foreign Policy," in Seweryn Bialer and Michael Mandelbaum, eds., Gorbachev's Russia and American Foreign Policy (Boulder CO: Westview Press, 1988).

⁷² Macmillan is quoted in Muchkund Dubey, "The Only Alternative is the Elimination of Nuclear Weapons," Disarmament, XVII:2, 1994. George Questor addresses the possibility of reduced prestige from nuclear mastery in "Nuclear Pakistan and Nuclear India: Stable Deterrent or Proliferation Challenge" (Carlisle Barracks PA: U.S. Army War College, Strategic Studies Institute, November 1992), p. 7. For the problems posed by nuclear sites, see Gary Lee, "Nuclear Plant Cleanup Assailed," Washington Post, March 15, 1995.

⁷³ Among many examples of 'new thinking' about the Cold War, see George Perkovich, "Counting the Costs of the Arms Race," Foreign Policy No. 85, Winter 1991-92. At the 1994 NDU WMD Symposium, Georgi E. Mamedov, formerly a Soviet specialist on U.S. arms control policy and now Deputy Minister for Foreign Affairs of the Russian Federation, delivered remarks on "Counteracting the Proliferation of WMD" noting that "the end of the Cold War and the tough East-West confrontation" caused "improvement of the general strategic situation."

⁷⁴ Paul M. Cole, Sweden Without the Bomb: The Conduct of a Nuclear-Capable Nation Without Nuclear Weapons, RAND Report MR-460 (Santa Monica CA: RAND, 1994), p. xiii.

- ⁷⁵ Lars Wallin, "Sweden," in Karp, Security With Nuclear Weapons?, p. 380.
- ⁷⁶ See the papers by Khan and Subrahmanyam in the 1994 NDU WMD Symposium materials (Note 47) and Questor's "Nuclear Pakistan and Nuclear India" for such evidence.
- ⁷⁷ Questor, *op. cit.*, observes that each country has hostages in members of the other's dominant ethno-religious groups and that nuclear reactors in each nation represent a form of 'bomb' that the other side can detonate.
- ⁷⁸ Stalin's reaction to Hiroshima was to direct his subordinates that, under no circumstances, would the USSR yield to nuclear pressure, even though the U.S. had a monopoly on the technology. See Holloway, *op. cit.*, p. 133 and pp. 154-161.
- ⁷⁹ Representative Les Aspin speculated in a similar vein on hypothetical Iraqi possession of nuclear weapons before the 1990 Gulf Crisis, noting how different U.S. coalition-building would have been and that future nuclear states might be "undeterrable" ("From Deterrence to Denuking: Dealing with Proliferation in the 1990s," Washington: February 18, 1992, photocopy).
- ⁸⁰ The speculation by Aspin on the limitations of deterrence, cited in the previous note, has in recent years expressed itself in particular as a problem of American self-deterrence regarding the use of virtually any kind of force. See Dagobert L. Brito and Michael D. Intrilligator, "The Economic and Political Incentives to Acquire Nuclear Weapons," Security Studies, 2:3/4, Spring/Summer 1993, pp. 291-292; A. J. Bacevic, "The Use of Force in Our Time," Wilson Quarterly, XIX:1, Winter 1995; Jerome H. Kahan, "Nuclear Threats from Small States" (Carlisle PA: Strategic Studies Institute, U.S. Army War College, June 1994); and Stanley R. Sloan, "The United States and the Use of Force in the Post-Cold War World: Toward Self-Deterrence?" (Washington: Library of Congress, Congressional Research Service, July 1994).
- ⁸¹ On these developments, see the author's article cited in Note 16 and his "Eurasia Letter: Unneighborly Neighbors," co-authored by Natalie Melnyczuk, Foreign Policy, No. 94, Spring 1994.
- ⁸² Robert Carlin's essay, "North Korea," in Reiss and Litwak, *op. cit.*, p. 134 and elsewhere makes a very strong case that North Korea's self-image will not allow it to act under perceived pressure or threats. Reynolds, in her paper on non-weaponized tools for diplomacy, notes, p. 14, that North Korea honors the value of "*juche*," or self-reliance and independence."
- ⁸³ For a persuasive analysis of the failure of U.S. threats to achieve more than temporary and tactical compliance by Saddam Hussein, see Mustafa Javed Ali, "United States Post-Gulf War Policy Towards Iraq Under the Lens of Cognitive Psychology and Deterrence Theory," The American University, December 1994, photocopy.
- ⁸⁴ On nuclear safe zones, see Ali T. Sheik, in Reiss and Litwak, *op. cit.*, p. 201.