

Going Nuclear

Nuclear Proliferation and International Security in the 21st Century

AN *International
Security* READER

EDITED BY

Michael E. Brown

Owen R. Coté Jr.

Sean M. Lynn-Jones

and Steven E. Miller

THE MIT PRESS

CAMBRIDGE, MASSACHUSETTS

LONDON, ENGLAND

The contents of this book were first published in *International Security* (ISSN 0162-2889), a publication of the MIT Press under the sponsorship of the Belfer Center for Science and International Affairs at Harvard University. Copyright in each of the following articles is owned jointly by the President and Fellows of Harvard College and of the Massachusetts Institute of Technology.

Scott D. Sagan, "Why Do States Build Nuclear Weapons? Three Models in Search of a Bomb," 21:3 (Winter 1996/97); Etel Solingen, "The Political Economy of Nuclear Restraint," 19:2 (Fall 1994); William C. Potter and Gaukhar Mukhatzhanova, "Divining Nuclear Intentions: A Review Essay," 33:1 (Summer 2008); Matthew Fuhrmann, "Spreading Temptation: Proliferation and Peaceful Nuclear Cooperation Agreements," 34:1 (Summer 2009); Sumit Ganguly, "India's Pathway to Pokhran II: The Prospects and Sources of New Delhi's Nuclear Weapons Program," 23:4 (Spring 1999); Samina Ahmed, "Pakistan's Nuclear Weapons Program: Turning Points and Nuclear Choices," 23:4 (Spring 1999); Sumit Ganguly, "Nuclear Stability in South Asia," 33:2 (Fall 2008); S. Paul Kapur, "Ten Years of Instability in a Nuclear South Asia," 33:2 (Fall 2008); Peter Liberman, "The Rise and Fall of the South African Bomb," 26:2 (Fall 2001); Ariel E. Levite, "Never Say Never Again: Nuclear Reversal Revisited," 27:3 (Winter 2002/03); Chaim Braun and Christopher F. Chyba, "Proliferation Rings: New Challenges to the Nuclear Nonproliferation Regime," 29:2 (Fall 2004); Alexander H. Montgomery, "Ring in Proliferation: How to Dismantle an Atomic Bomb Network," 30:2 (Fall 2005); Whitney Raas and Austin Long, "Osirak Redux? Assessing Israeli Capabilities to Destroy Iranian Nuclear Facilities," 31:4 (Spring 2007).

Selection, preface, and Matthew Bunn, "Nuclear Terrorism: A Strategy for Prevention," copyright © 2010 by the President and Fellows of Harvard College and of the Massachusetts Institute of Technology.

All rights reserved. No part of this book may be reproduced in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without permission in writing from the MIT Press. For information, please visit <http://mitpress.mit.edu>, or please contact the MIT Press, Journals Department, 238 Main Street, Suite 500, Cambridge, MA 02142.

Library of Congress Cataloging-in-Publication Data

Going nuclear : nuclear proliferation and international security in the 21st century / edited by Michael E. Brown...[et al.].

p. cm. — (International security readers)

Includes bibliographical references.

ISBN 978-0-262-52466-7 (pbk. : alk. paper)

1. Nuclear nonproliferation. 2. Security, International. 3. International relations. I. Brown, Michael E.

JZ5675.N8386 2010

327.1'747—dc22

2009034753

10 9 8 7 6 5 4 3 2 1

Preface

Sean M. Lynn-Jones

The spread of nuclear weapons is an important issue in the theory and practice of international relations. The most fundamental reason why scholars and analysts study nuclear proliferation is that the spread of nuclear weapons may increase the likelihood of nuclear war. Although there has been a vigorous debate between nuclear optimists and nuclear pessimists over whether nuclear proliferation increases the risk of war,¹ most analysts and policymakers have worried that war—including nuclear war—will become more likely as more states go nuclear.

There are many reasons to think that the spread of nuclear weapons will make it more likely that such weapons will be used. If more states have nuclear weapons, the probability that one leader will decide to use them may increase. Even if rational decisionmakers are likely to be deterred by the threat of nuclear retaliation, the possibility of inadvertent or accidental use remains.

The spread of nuclear weapons also increases the probability of theft of nuclear materials. Even if nuclear weapons have a stabilizing effect on relations between states, terrorist groups may be able to steal nuclear materials or nuclear bombs and then detonate a nuclear weapon in a major city, killing hundreds of thousands. Such concerns existed before the terrorist attacks of September 11, 2001, but have become more acute since. As more states acquire nuclear weapons, there will probably be more opportunities for theft by terrorists.

A state's quest for nuclear weapons can be a source of conflict even when such efforts are terminated, unsuccessful, or incomplete. A state that fears that an adversary is developing nuclear weapons may launch preventive attacks against its adversary's nuclear facilities. Israel bombed the nuclear reactor at Osirak, Iraq, in 1981 and attacked an apparent nuclear facility in Syria in 2007. The United States made plans to strike North Korean nuclear facilities in 1994. Many analysts believe that Israel or the United States might attack sites related to Iran's nuclear program.² In extreme cases, a state may respond to concern over the nuclear program of a hostile state by launching a full-scale war. The 2003 U.S. invasion of Iraq was at least partially motivated by U.S. fears that Iraq was developing nuclear weapons.

Concern over nuclear proliferation is likely to increase in the coming years. Many observers believe that the spread of nuclear weapons to one or two more

1. The classic contribution to the optimism-pessimism debate remains Scott D. Sagan and Kenneth N. Waltz, *The Spread of Nuclear Weapons: A Debate Renewed* (New York: W.W. Norton, 2002).

2. See Whitney Raas and Austin Long, "Osirak Redux? Assessing Israeli Capabilities to Destroy Iranian Nuclear Facilities," in this volume.

states will trigger a wave of new nuclear states. More states may turn to nuclear power to meet their energy needs as other sources of energy become more costly or undesirable because they emit carbon that contributes to global climate change. As more nuclear reactors are built, the world's stock of nuclear expertise and fissionable materials is likely to grow.

Because most analysts and policymakers have feared the consequences of nuclear proliferation, states have attempted to limit the spread of nuclear weapons. The centerpiece of international efforts to limit nuclear proliferation is the Nuclear Nonproliferation Treaty (NPT), which was signed in 1968 and extended indefinitely in 1995. The NPT requires that states without nuclear weapons not seek them and that states with nuclear weapons not transfer them. It recognizes that states without nuclear weapons have a right to the peaceful use of nuclear energy, provided that they accept safeguards overseen by the International Atomic Energy Agency (IAEA). The NPT's Article 6 also requires nuclear weapon states to attempt to reduce or even eliminate their nuclear arsenals.

In addition to the NPT, many states—particularly the United States—have pursued additional policies to prevent the spread of nuclear weapons. These policies have included diplomatic and economic pressure on potential proliferants, as well as restrictions on the transfer of technologies required for the production and delivery of nuclear weapons.

The essays in this book focus on two questions. First, why do states want nuclear weapons? Second, what can be done to prevent or slow the spread of nuclear weapons? Although several essays also consider the effects of nuclear proliferation—particularly in South Asia—this volume is primarily about understanding and preventing the spread of nuclear weapons.

The essays in the volume—and the broader literature on nuclear proliferation—include several explanations for states' nuclear decisions. What motivates them to devote resources to acquiring nuclear materials, technologies, and knowledge and combining them to build bombs?

First, many analysts and scholars argue that states seek nuclear weapons because such weapons can enable them to counter threats to their security. For a state that faces conventional military threats, nuclear weapons can be used to deter attacks. Nuclear weapons also may be the best means of deterring attacks with nuclear weapons. This explanation of nuclear proliferation suggests that states will be less likely to go nuclear—and may even dismantle their nuclear weapons—if they are relatively secure or become more secure.

Second, other analysts and scholars focus on domestic instead of interna-

tional explanations for nuclear proliferation. They argue that external security threats often matter less than internal organizational dynamics. For example, the nuclear scientists and engineers in a country often will have a vested interest in maximizing the resources devoted to their programs. They may be able to lobby for increased funding for expanded programs that at least create the capability to build nuclear weapons. In other cases, nuclear decisions may be driven by public opinion. An unpopular leader may try to enhance his or her standing with the public by, for example, testing a nuclear weapon.

Third, international norms may constrain or encourage nuclear proliferation. If nuclear weapons are seen as legitimate weapons that confer status and prestige on states that possess them, states may be more likely to seek them. On the other hand, if nuclear weapons are regarded as illegitimate and there is a strong norm against acquiring them, fewer states are likely to pursue the nuclear option. Many observers believe that the NPT has encouraged the development of a strong international norm against acquisition of nuclear weapons.

Fourth, external incentives, including norms, may interact with domestic factors. States that seek nuclear weapons may face economic sanctions or a cutoff of foreign aid. Whether a state is sensitive to these external incentives and disincentives may depend on its internal political economy, its integration into world markets, and its domestic structure.

Finally, some analysts argue that states with access to sophisticated nuclear technology—including the knowledge and facilities vital to a civilian nuclear power program—are more likely to acquire nuclear weapons. Although this argument is not “technological determinism,” because it does not hold that all states with nuclear technology inevitably develop nuclear weapons, it suggests that proliferation policies should pay attention to the “supply side” of nonproliferation and do more to restrict the spread of nuclear technologies and knowledge.

The essays in this volume assess the importance of each of these factors in shaping the nuclear decisions of France, India, Israel, North Korea, Pakistan, South Africa, Sweden, and many other states that have (or have not) become nuclear weapons states.

The second major question examined in this book is how to prevent nuclear proliferation. In many cases, the policies chosen to limit proliferation reflect an understanding of proliferation’s causes. If states seek nuclear weapons because they want to enhance their security, the logical nonproliferation policies include pledges by major powers to defend vulnerable states, and commitments not to use nuclear weapons against nonnuclear weapons states. If a particular

domestic interest group is driving a country's quest for nuclear weapons, external support for other groups may be the best way to prevent proliferation. Strengthening the norm against nuclear weapons and nuclear proliferation (e.g., by reaffirming the NPT and reducing the nuclear arsenals of nuclear weapons states) may affect the political calculations of many states that might otherwise consider acquiring nuclear weapons. The NPT and other aspects of the existing nuclear nonproliferation regime include many elements of these policies.

Understanding and preventing nuclear proliferation must begin with an examination of why states acquire nuclear weapons. The first section of this volume thus features essays that attempt to explain why states build the bomb. The four essays in this section present and assess alternative theories.

Scott Sagan, in "Why Do States Build Nuclear Weapons? Three Models in Search of a Bomb," challenges the conventional wisdom that countries seek nuclear weapons when facing a security threat that they cannot meet with nonnuclear forces. He examines three alternative theoretical frameworks for explaining why states develop nuclear weapons. The first is the "security model," which embraces the conventional wisdom that states seek nuclear weapons to provide security against foreign threats. The second, the "domestic politics model," holds that nuclear weapons programs are often used to advance domestic political and bureaucratic interests. The third is the "norms model," which argues that a state's policies toward nuclear weapons often symbolize its modernity and identity.

Sagan finds that each theory can explain some cases. The security model's central premise is that states acquire nuclear weapons because they are threatened by the nuclear arsenals of other states. Nuclear proliferation is therefore "a strategic chain reaction." The Soviet Union developed nuclear weapons because it feared the U.S. nuclear monopoly after the nuclear attacks on Hiroshima and Nagasaki. Britain and France responded to the Soviet threat by acquiring nuclear forces. China was initially threatened by the United States and later by the Soviet Union, giving it a double impetus to build its own bomb. India responded to China's nuclear weapons with its own nuclear program, which in turn provoked Pakistan to seek the bomb.

The security model explains nuclear restraint as a response to the reduction of threats. By this logic, South Africa, for example, could dismantle its small nuclear arsenal in 1991, because it was no longer threatened by the Soviet Union and it had negotiated settlements of regional issues in Angola and

Namibia. Similarly, Argentina and Brazil ended their nascent nuclear programs when they realized that they did not pose a threat to each other. The security model also argues that the former Soviet republics Belarus, Kazakhstan, and Ukraine could relinquish the nuclear weapons on their territory because they did not see Russia as a military threat.

Sagan notes that the security model has several policy implications. First, the United States should continue to guarantee the security of its allies, which otherwise might be tempted to seek nuclear weapons. Second, the United States should support the NPT, because that treaty reduces incentives to develop nuclear weapons by reassuring countries that their neighbors will not develop them. Sagan points out, however, that the realist logic that underpins the security model also implies that nuclear proliferation can be slowed, but not prevented. The inherent insecurity of international politics and chain-reaction dynamics make it inevitable that more states will want nuclear weapons.

Is the security model valid? Although it seems plausible, Sagan argues that decisionmakers often have a vested interest in claiming that they opted to develop nuclear weapons in response to threats. Such policies appear to be rational attempts to pursue the national interest. Moreover, it is almost always possible to identify some threat that existed before a state decided to seek nuclear weapons. Looking inside the “black box of decision-making” may reveal other motives for building the bomb.

The domestic politics model recognizes that acquiring nuclear weapons often serves the interests of various domestic groups: a state’s nuclear energy establishment; units within the armed forces; and politicians in states where the public supports nuclear weapons. Sagan recognizes that there are no good general theories of domestic politics and foreign policy; he argues that bureaucrats and weapons scientists with an interest in starting or expanding a nuclear weapons program often can manipulate information and threat perceptions. Whereas the security model emphasizes the importance of threats as causes of nuclear programs, the domestic politics model regards threats as “windows of opportunity through which parochial interests can jump.”

Sagan examines how the domestic politics model explains the nuclear decisions of India and South Africa. India did not respond to China’s 1964 nuclear test by initiating a nuclear weapons program. Instead, a prolonged bureaucratic battle ensued, in which some groups argued for nuclear weapons and others favored global nuclear disarmament. India eventually conducted a “peaceful” nuclear test in 1974. It is unclear whether security concerns or domestic-political considerations drove India to develop nuclear weapons, but

the nuclear test immediately boosted the political standing of an unpopular government.³

South Africa's decision to start and then terminate a nuclear weapons program also can be explained by looking at domestic political factors. South Africa initiated its nuclear program in 1971, long before Cuban forces intervened in the Angolan civil war. The program may have been intended to produce peaceful nuclear explosions for use in South African mining operations. The first nuclear devices were produced by South Africa's nuclear establishment without consulting the South African military. South Africa decided to dismantle its nuclear weapons before the Cold War ended and the external threat to South Africa diminished. The decision apparently reflected concern that the weapons would be controlled by a black successor government.⁴

Domestic political factors also may have played a role in the decisions of Argentina and Brazil not to develop nuclear weapons in the 1980s. Neither country saw a reduction in external security threats. On the contrary, Argentina may have had more incentives to develop nuclear weapons after its 1982 military defeat by Great Britain, a nuclear power. Yet Argentina and Brazil apparently decided to eschew nuclear weapons because they were ruled by liberalizing coalitions that did not want to jeopardize access to international markets.⁵

The domestic politics model suggests that the United States needs a diverse array of policy instruments to limit nuclear proliferation. Foreign aid should be made conditional on reductions in military budgets. The United States could provide accurate estimates of the costs of nuclear weapons programs. Encouraging strict civilian control of the military might prevent secret nuclear programs. The United States also could provide alternative sources of employment for nuclear scientists and others who might participate in nuclear programs. The NPT should be viewed as an instrument to empower domestic actors who oppose nuclear weapons programs. The United States and other nuclear powers should attempt to limit and reduce their nuclear arsenals so that advocates of nuclear weapons in other countries cannot justify nuclear programs by accusing the nuclear powers of failing to live up to their NPT obligations.

3. See Sumit Ganguly, "India's Pathway to Pokhran II: The Prospects and Sources of New Delhi's Nuclear Weapons Program," in this volume for a different interpretation of India's nuclear decisions.

4. See also Peter Liberman, "The Rise and Fall of the South African Bomb," in this volume.

5. For a more complete discussion of Argentina and Brazil and the role of liberalizing coalitions, see Etel Solingen, "The Political Economy of Nuclear Restraint," in this volume.

The norms model holds that states make decisions about nuclear weapons on the basis of norms and beliefs about legitimate international behavior. Nuclear weapons are symbols of a state's identity, not instruments of national security. Whether a state seeks or shuns nuclear weapons may depend on prevailing international norms. International regimes and the positions of the leading powers influence beliefs about what behavior is legitimate and responsible. Nuclear norms have changed over time. The NPT itself contributed to the emergence of norms against nuclear weapons. The cases of France and Ukraine reflect the changes in nuclear norms since the 1950s.

According to the norms theory, France pursued nuclear weapons because it believed that having the bomb would symbolize France's status as a great power. Nuclear weapons would endow France with grandeur even after it had lost its colonial empire and slipped from the ranks of the leading conventional military powers. France began to pursue nuclear weapons even before its confrontation with the nuclear Soviet Union in the 1956 Suez crisis. For French President Charles de Gaulle, the atomic bomb was primarily a symbol of French prestige and independence, not a strategic deterrent.

In contrast to France, Ukraine decided to relinquish the nuclear arsenal it inherited from the Soviet Union after the Soviet Union collapsed in 1991. This decision is at odds with the security model's emphasis on how states rely on nuclear weapons to respond to threats. Ukraine's renunciation of nuclear weapons was initially linked to its quest for independence. Ukraine sought international support for its secession from the Soviet Union by proclaiming that it would be a nonnuclear neutral state. It did not want to be regarded as a "rogue" state that violated the norm of nonproliferation. U.S. policies that made economic support for Ukraine conditional on denuclearization also played a role.

The norms model generates policy prescriptions that sometimes contradict policies derived from other models and that may be difficult for the United States to implement. For example, U.S. threats to use nuclear weapons to defend nonnuclear allies that might otherwise seek their own nuclear arsenals are in conflict with NPT norms against possessing or using nuclear weapons. In other cases, however, the United States could follow the norms model by offering alternative sources of prestige to potential nuclear powers. For example, countries could be offered permanent UN Security Council membership only if they renounced nuclear weapons. More generally, the norms model suggests that the United States should reaffirm its commitment to global nuclear disarmament and reduce its nuclear forces in accordance with Article 6 of the NPT.

Sagan concludes that further research is necessary to determine when each of the three models applies. He also observes that the United States eventually will have to face the contradictions among the policies implied by each of the three models. If the United States hopes to prevent nuclear proliferation by enhancing the norms against nuclear possession and use, it will have to abandon its nuclear first-use doctrine and wean its allies away from nuclear guarantees.⁶

One way for states to exercise nuclear restraint and not develop nuclear weapons is to participate in a regional regime. Why do some states join regional nuclear regimes? Etel Solingen, in “The Political Economy of Nuclear Restraint,” argues that “ruling coalitions pursuing economic liberalization” are more likely to embrace regional regimes that limit nuclear proliferation.⁷

Solingen argues that neorealist theories that explain nuclear choices as a response to security concerns are inadequate, because such theories do not explain the wide range of behavior across countries and across time. Variations in the level of vulnerability do not correlate with variations in nuclear policies. Israel, South Africa, South Korea, and Taiwan are vulnerable to conventional attacks, yet all but Israel have renounced nuclear weapons. When one regional state acquires or seeks nuclear weapons, the others do not necessarily follow. The certainty—or uncertainty—of security guarantees often does not influence nuclear decisions. Such guarantees played no role in the decisions of Argentina, Brazil, Egypt, and South Africa to abandon their quests for nuclear weapons.

Propositions derived from hypotheses about the “democratic peace” offer an alternative to the neorealist approach to explaining nuclearization and denuclearization.⁸ The logic of the democratic peace suggests that democracies will not rely on nuclear weapons for their security against other democracies, but they may resort to nuclear deterrence against threats from nondemocracies.

6. Sagan now advocates a U.S. no-first-use policy. See Scott D. Sagan, “The Case for No First Use,” *Survival*, Vol. 51, No. 3 (June–July 2009), pp. 163–182.

7. For additional discussion of Solingen’s arguments, see William C. Potter and Gaukhar Mukhatzhanova, “Divining Nuclear Intentions: A Review Essay,” in this volume.

8. The “democratic peace” argument holds that democracies rarely, if ever, go to war with one another. There is a huge body of literature on this topic. For representative works that offer different perspectives, see Bruce Russett, *Grasping the Democratic Peace: Principles for a Post–Cold War World* (Princeton, N.J.: Princeton University Press, 1993); Michael E. Brown, Sean M. Lynn-Jones, and Steven E. Miller, *Debating the Democratic Peace* (Cambridge, Mass.: MIT Press, 1996); and Sebastian Rosato, “The Flawed Logic of Democratic Peace Theory,” *American Political Science Review*, Vol. 97, No. 4 (November 2003), pp. 585–602.

Democratic political systems are also supposed to have more credibility, transparency, and predictability than their authoritarian counterparts. These characteristics may make democracies more likely to join nuclear regimes.

Solingen argues that the factors that account for the apparent peace among democracies may not explain whether or not democracies join nuclear regimes. In most cases, including the NPT and the Treaty of Tlatelolco in Latin America, international regimes consist of democracies and nondemocracies. Solingen writes, "Political freedom thus seems neither necessary nor sufficient for the emergence of a nuclear regime." She also suggests that the democratic peace primarily has been a peace among advanced industrial democracies. Lessons from the experience of such countries may not apply to less stable emerging democracies.

Solingen contends that states with ruling coalitions that are pursuing economic liberalization are more likely to join regional nuclear regimes than states governed by inward-looking nationalists. In her view, "economic liberalization implies a reduction of state control over markets and of barriers to trade, and expansion of private economic transactions and foreign investment, and the privatization of public sector enterprises." Liberalizing coalitions recognize that maintaining ambiguous nuclear intentions or cheating on NPT commitments can jeopardize access to foreign technology, capital, and markets. Such coalitions also may want to limit the power of domestic nuclear industrial complexes and other bureaucracies that oppose economic liberalization and openness.

Liberalizing coalitions generally include large banks and industrial complexes, smaller firms that produce exports, and highly skilled workers. The members of these coalitions rely heavily on the global economy and seek good relations with the major powers that control international economic regimes and institutions. They therefore prefer nuclear restraint, which makes good relations with leading international states and regimes more likely. Domestically, liberalizing coalitions also oppose the expansion of state power and unproductive investments. Denuclearization can help such coalitions to limit the power of secret or semi-secret state bureaucracies engaged in nuclear weapons programs.

On the other hand, inward-looking nationalist coalitions include state enterprises and their employees, unskilled workers, small businesses, firms that produce goods that compete with imports, and politicians who control state enterprises and rely on them as a source of patronage. These coalitions derive limited benefits from participating in the international economy and may re-

sent international economic regimes that, for example, demand unwelcome adjustment policies. In the Middle East and South Asia, these coalitions often include religious extremists who also resent foreign investment and the policies of the International Monetary Fund (IMF).

In many cases, states are governed by mixed coalitions that pursue industrialization strategies that combine liberalizing and inward-looking policies. Solingen notes that the domestic political determinants of which coalition comes to power are important, but they are beyond the scope of this essay. She points out that both types of coalitions may or may not be democratically elected.

Solingen assesses how domestic coalitions have influenced policies toward nuclear weapons and regional nuclear regimes in four cases: the Korean Peninsula; India-Pakistan; the Middle East; and Argentina and Brazil.

The two Koreas provide clear support for Solingen's argument. South Korea's liberalization coalition pursued economic development by increasing its integration into the world economy. In the 1970s it recognized that seeking nuclear weapons would undermine this strategy and thus ratified the NPT in 1975. North Korea, in contrast, is essentially an ideal-type of a state ruled by an inward-looking nationalist coalition. For Pyongyang, the pursuit of nuclear weapons is a symbol of national independence. North Korea's nuclear policies have strong support from its military establishment.⁹

The nuclear policies of India and Pakistan reflect the presence or absence of liberalizing coalitions in the governing circles of each country. After independence, India adopted an inward-looking economic policy and sought to distance itself from international economic regimes. It rejected nonproliferation and exploded a nuclear device in 1974. In Pakistan President Zulfikar Ali Bhutto adopted a similar inward-looking strategy and also pursued the bomb. In the 1970s, 1980s, and early 1990s, tentative steps toward liberalization in both countries coincided with limited efforts at nuclear cooperation. In each country, however, inward-looking nationalist coalitions reasserted themselves, rejected or limited economic liberalization, and continued or expanded nuclear programs.

In the Middle East, liberalizing coalitions that have sought greater engagement in the international economy have supported the NPT and called for a

9. Solingen wrote her essay before North Korea's nuclear ambitions were clear, but events since 1994 appear to confirm her argument about the domestic support for North Korea's nuclear program.

Nuclear-Weapon-Free Zone (NWFZ) in the region. Egypt—especially under President Anwar al-Sadat—is a prime example. Radical Islamic political blocs have pursued the opposite approach, rejecting ties to the international economy and pursuing nuclear programs, as exemplified by Iran. Under Saddam Hussein, Iraq was a clear example of an inward-looking, nationalist, militarized state. It rejected economic liberalization and sought nuclear weapons. Israel is a more ambiguous case. Although Israel’s liberalizing Labor-led coalitions sometimes endorsed an NWFZ in the Middle East, the continued threat from Arab states that refused to recognize Israel made it impossible for them to renounce nuclear weapons. Likud-led coalitions tended to embrace economic nationalism, but they did not take a position on the NWFZ issue.

The nuclear policies of Argentina and Brazil reflect the complex evolution of their domestic coalitions and attitudes toward economic liberalization. In the late 1940s and early 1950s, both countries embraced national populism and opposed free trade and international economic institutions. Each began a nuclear program during this period. In subsequent decades, liberalizing coalitions sometimes gained strength under military and civilian governments, but liberalizing forces were never strong enough to end each country’s quest for nuclear weapons. At the end of the 1980s, both countries responded to economic crises by adopting economic liberalization. In 1990 Argentina and Brazil began a process of nuclear cooperation that included mutual renunciation of nuclear weapons, mutual verification and inspection procedures, and support for an updated version of the Tlatelolco treaty.

Solingen concludes that the character of domestic coalitions can explain policies toward nuclear weapons in many different regions and security environments. Only liberalizing coalitions have embraced denuclearization and regional nuclear regimes. International institutions can and should encourage and support liberalizing coalitions. The IMF and other institutions should avoid imposing harsh structural adjustment programs that could weaken liberalizing coalitions. Such institutions also should consult more effectively with liberalizing coalitions in developing countries and be more sensitive to the domestic political needs of those coalitions. The nuclear members of the NPT should bolster support for the nonproliferation regime by reducing their nuclear arsenals, as required by Article 6 of the treaty.

Since the beginning of the nuclear age, many analysts have predicted that nuclear weapons will spread quickly. In “Divining Nuclear Intentions: A Review Essay,” William Potter and Gaukhar Mukhatzhanova explore why nuclear proliferation has been less rapid than expected and question the

prevailing view that many states will seek nuclear weapons. They assess two important recent books that offer explanations for why states do or do not decide to acquire nuclear weapons: Jacques Hymans's *The Psychology of Nuclear Proliferation: Identity, Emotions, and Foreign Policy* and Etel Solingen's *Nuclear Logics: Alternative Paths in East Asia and the Middle East*. Hymans and Solingen both reject the conventional wisdom that security fears drive states to go nuclear.

Hymans argues that few national leaders desire nuclear weapons. Most are reluctant to take the risky and revolutionary decision to build and deploy nuclear weapons. Those who want to acquire a nuclear arsenal are likely to be "oppositional nationalists" who regard the external world as extremely hostile and believe their own countries are superior to others. Fortunately, such leaders are rare.

Solingen argues that regimes that seek economic growth through outward-looking policies and integration into the world economy are less likely to seek nuclear weapons than those that rely on inward-looking policies.¹⁰ Thus changes in the external security environment may have little impact on nuclear decisions. Changes in domestic political coalitions matter much more. Solingen's explanation sheds new light on Japan's decision to renounce nuclear weapons, which others have attributed to the legacy of Hiroshima and Nagasaki or to Japan's reliance on the U.S. nuclear umbrella.

Potter and Mukhatzhanova praise the books by Hymans and Solingen as models of "theoretical sophistication, methodological rigor, focused comparative analysis involving original field research, and attention to hypothesis testing." They note that Hymans focuses on individual decisionmakers, whereas Solingen emphasizes the role of broad political coalitions. More important, Hymans emphasizes the role of emotions such as pride and fear. Solingen, on the other hand, sees nuclear decisions as rational calculations that take into account internal and external costs and benefits. Hymans suggests that nuclear decisions are hard to reverse. Solingen recognizes that states may alter their nuclear policies if domestic or regional circumstances change.

Potter and Mukhatzhanova commend Hymans for providing new insights into cases in which countries have sought nuclear weapons, including Argentina, France, and India. They admire the quality of Solingen's case studies, but question whether her theory of liberalizing coalitions can explain

10. For an elaboration of this argument, see Solingen, "The Political Economy of Nuclear Restraint," in this volume.

Israel's quest for the bomb, which seems to reflect security-related neorealist logic.

Hymans and Solingen find that three prominent theories of international relations that have been applied to nuclear proliferation—neorealism, neoliberal institutionalism, and constructivism—explain little about states' nuclear decisions.

Potter and Mukhatzhanova recall that scholarly and governmental analyses have been predicting rapid nuclear proliferation for decades. In the 1950s and 1960s, Canada, Italy, Japan, Sweden, Switzerland, and West Germany were all identified as states on the verge of going nuclear. Many analysts expected that India's 1974 "peaceful nuclear explosion" would trigger a cascade of nuclear proliferation.

The books by Hymans and Solingen provide a useful corrective to this tradition of alarmism. Hymans indicates that leadership intentions may matter more than whether a potential proliferator is a "rogue" state. He also questions the "domino theory" of proliferation on the grounds that states' decisions to go nuclear "are not highly contingent on what other states decide." In general, he doubts that states seek the bomb as a deterrent or as a source of status. He also questions claims that the interests of domestic groups drive states to pursue nuclear weapons, as well as the argument that the international nonproliferation regime prevents proliferation. Although Potter and Mukhatzhanova contend that some of Hymans's arguments need to be qualified, they acknowledge that Hymans casts much doubt on the conventional pessimism about the spread of nuclear weapons.

Solingen is also mildly optimistic that the world is not on the verge of a wave of nuclear proliferation. She, like Hymans, sees little evidence of proliferation chain reactions. States make decisions based on their own domestic and international interests, and those interests vary from state to state. Solingen, however, is concerned that regional or global dynamics—such as a global economic downturn—could undermine liberalizing coalitions and accelerate proliferation.

Potter and Mukhatzhanova conclude by enumerating four policy implications of the books by Hymans and Solingen. First, Hymans's book points to the need to pay attention to public leadership statements, which may offer a better guide to nuclear intentions than restricted human and signals intelligence. Second, Hymans and Solingen reveal the importance of developing counterintuitive explanations for nuclear decisions and subjecting all explanations to rigorous empirical tests. For example, both authors find that security guaran-

tees do little to curtail states' nuclear ambitions. They provide evidence for this claim, which deserves further serious examination. Third, Hymans and Solingen demonstrate that assertions that nuclear capacity leads to nuclear weapons acquisition are greatly exaggerated. Although they offer different explanations, they agree that there is no technological imperative to develop nuclear weapons. Hymans calls attention to the need to focus on the national identity conceptions of leaders, not just their latent technical capabilities to develop nuclear weapons. Solingen suggests that analysts consider regional perspectives on liberalization, as well as the global political and economic rewards for states that exercise nuclear restraint. Finally, the books by Hymans and Solingen are an important reminder that classified forecasts of nuclear proliferation are not necessarily better than analyses by scholars using open sources.

The next essay in this volume assesses one hypothesis about the sources of nuclear proliferation: the argument that countries that receive civilian nuclear assistance are more likely to develop nuclear weapons. In "Spreading Temptation: Proliferation and Peaceful Nuclear Cooperation Agreements," Matthew Fuhrmann finds that "all types of civilian assistance raise the risks of proliferation." He notes that this finding contradicts the conventional wisdom that states go nuclear when they believe that they need the bomb, not when they have the technical capacity to start a nuclear weapons program.¹¹

Fuhrmann calls for shifting focus from demand-side to supply-side explanations of proliferation. Unlike other recent studies of the supply side of proliferation, he argues that all forms of atomic assistance—not just sensitive assistance such as providing weapons-grade fissile material—make nuclear proliferation more likely. He points out that weapons-related nuclear technologies have dual uses and thus can be employed for civilian purposes. Uranium enrichment facilities can produce fuel for nuclear reactors or fissile material for nuclear bombs. Similarly, civilian nuclear cooperation spreads knowledge that can be used to develop nuclear weapons. For example, familiarity with handling radioactive materials can be developed in a civilian program and used in a weapons program.

Fuhrmann develops and tests four hypotheses about the connection between peaceful nuclear cooperation and the spread of nuclear weapons. First, states that receive civilian nuclear assistance become more likely to begin nu-

11. The other essays in this volume, for example, consider explanations for proliferation such as perceived security needs, a desire for international status and prestige, and pressure from domestic interest groups.

clear weapons programs, because such assistance reduces the costs of such programs and makes their leaders more confident about developing a bomb. Second, states that receive civilian nuclear assistance and find themselves in a deteriorating security environment are more likely to develop nuclear weapons. Third, peaceful nuclear cooperation makes it more likely that a country will successfully build nuclear weapons, because civilian nuclear assistance helps states to produce fissile material and establishes a technical knowledge base. Fourth, countries that receive civilian nuclear assistance and experience a worsening security environment are especially likely to succeed in developing nuclear weapons.

Fuhrmann briefly examines three cases that show how civilian nuclear assistance influenced nuclear decisionmaking. In South Africa, U.S. peaceful nuclear assistance contributed to the start of that country's nuclear weapons program. The United States constructed a reactor, provided highly enriched uranium, and trained scientists. South Africa's atomic energy complex made technological progress and its scientists acquired political influence, enabling them to lobby successfully for a nuclear weapons program. Israel was able to assemble a nuclear weapon much faster because France assisted in reprocessing and Norway, the United Kingdom, and the United States supplied heavy water. North Korea received technical assistance and a research reactor from the Soviet Union in the 1950s and 1960s. It subsequently used the knowledge it acquired to develop and test a nuclear device.

Fuhrmann devotes more attention to the important cases of India and Pakistan. India built its first research reactor in 1955 with designs supplied by Britain. In 1956 Canada agreed to supply a research reactor. The United States provided heavy water and trained Indian nuclear scientists. In the 1960s, further U.S. and Canadian assistance included another reactor, uranium, and a reprocessing plant that could extract plutonium from spent nuclear fuel. This assistance gave India the capability to pursue a nuclear weapons program, a fact recognized and emphasized during the 1950s and 1960s by Homi Bhabha, chairman of the Indian Atomic Energy Commission. Even though India faced economic hardships, Bhabha was able to argue that the country had the technical base to produce nuclear weapons at relatively low cost. India thus began a nuclear program in 1964. Security threats from China played a role in this decision, but so did foreign nuclear assistance.

Pakistan acquired a research reactor in the 1950s. The United States and Canada supplied uranium and heavy water. European countries provided additional assistance in the 1960s and 1970s. The United States and European

countries also trained Pakistani personnel. Pakistan initiated its nuclear weapons program after its defeat by India in 1971. India's 1974 test of a nuclear device gave further impetus to the program. The Pakistan Atomic Energy Commission was confident that it had the nuclear knowledge to produce a bomb. While working in the Netherlands, a Pakistani metallurgist, Abdul Qadeer (A.Q.) Khan, stole blueprints for centrifuges that could be used to enrich uranium. Pakistan constructed enrichment facilities and was able to assemble at least one nuclear bomb by 1987. The training and assistance that Pakistan's scientists received enabled them to use the technology and material acquired from abroad.

Fuhrmann tests his four hypotheses quantitatively using a data set that includes all nuclear cooperation agreements signed from 1945 to 2000. His statistical analysis also finds that other factors, including industrial capacity and membership in the NPT, affect proliferation, but civilian nuclear assistance is "consistently salient" in explaining why states start nuclear weapons programs and ultimately build a bomb. States that receive nuclear assistance are 360 percent more likely to acquire nuclear weapons. States that receive assistance and are involved in frequent militarized disputes are 750 percent more likely to build the bomb. Fuhrmann notes that 80 percent of the countries that initiated a nuclear weapons program had received civilian nuclear assistance and that from 1955 to 2000 every country that started a nuclear program had first received civilian assistance. The effect of civilian nuclear assistance is significant even when confounding variables are taken into account.

One potential criticism of Fuhrmann's argument is that states seek civilian nuclear assistance after they have already decided to pursue nuclear weapons. If this is the general pattern, civilian assistance would not be a cause of states' decisions to go nuclear. Fuhrmann attempts to address this endogeneity issue with a two-stage probit least squares model, and the results are consistent with his general findings.

The main implication of Fuhrmann's findings is that nuclear states and the international community need to reconsider policies that encourage civilian nuclear assistance. Such policies have been in place since U.S. President Dwight Eisenhower proclaimed the goal of "atoms for peace" in 1953. The International Atomic Energy Agency (IAEA) and the NPT regime are designed to facilitate peaceful nuclear cooperation while inhibiting the spread of nuclear weapons. Fuhrmann does not dispute that illicit nuclear transfers can contribute to nuclear proliferation, but he emphasizes that legal commerce also poses

significant risks.¹² Fuhrmann recommends that countries provide more resources to the IAEA so that it can monitor nuclear facilities and implement safeguards agreements more effectively. Nuclear suppliers also need to limit nuclear exports, especially to countries that face security threats. He calls for further research on why nuclear suppliers provide civilian nuclear assistance.

The first section of this volume considers the causes of nuclear proliferation. The next section of essays focuses on the causes and the effects of nuclear proliferation in South Asia, where India and Pakistan have acquired nuclear weapons. Why did these two countries eventually decide to build the bomb? How has their acquisition of nuclear capabilities influenced their relationship? Does the experience of nuclear South Asia confirm or refute existing theories, beliefs, and predictions about nuclear proliferation?

In “India’s Pathway to Pokhran II: The Prospects and Sources of New Delhi’s Nuclear Weapons Program,” Sumit Ganguly examines India’s decision to become a nuclear power. India had exploded a “peaceful” nuclear device in 1974, but then adopted an ambiguous policy toward nuclear weapons until 1998, when it tested five nuclear devices and became a nuclear weapons state.

Ganguly traces the evolution of India’s nuclear program through five phases. Phase one of the program began when Indian physicist Homi Bhabha persuaded Prime Minister Jawaharlal Nehru of the importance of atomic energy research. Nehru opposed nuclear weapons but allowed Bhabha to develop India’s nuclear infrastructure. China’s defeat of India in the 1962 Sino-Indian border war revealed the folly of India’s conciliatory policy toward China and probably stimulated India to consider developing a nuclear arsenal.

The second phase of India’s nuclear program began after China’s October 1964 nuclear test. China’s test prompted India to consider developing a nuclear deterrent. Bhabha and Indian strategists articulated the advantages of nuclear deterrence, but Nehru remained opposed to nuclear weapons. In the mid-1960s Indian political leaders continued to debate whether to seek nuclear weapons. Many senior figures in the Congress Party rejected going nuclear on moral grounds. At the same time, India tried unsuccessfully to obtain nuclear guarantees from the Soviet Union, the United Kingdom, and the United States.

12. For discussions of illicit nuclear rings, see Chaim Braun and Christopher F. Chyba, “Proliferation Rings: New Challenges to the Nuclear Nonproliferation Regime”; and Alexander H. Montgomery, “Ringling in Proliferation: How to Dismantle an Atomic Bomb Network,” both in this volume.

India initially was active in drafting the NPT, but after the 1965 Indo-Pakistani war, it stopped supporting the NPT and did not sign the treaty.

Phase three of India's nuclear program was marked by its May 1974 test of a "peaceful" nuclear device. Prior to the test, India had failed to obtain security guarantees and had reoriented its foreign policy away from moral principles and nonalignment and toward traditional statecraft. After the 1971 war with Pakistan, Prime Minister Indira Gandhi tilted toward the Soviet Union and eventually authorized India's first nuclear test. Although external factors increased India's motivation to seek nuclear weapons, the test was timed to boost Prime Minister Gandhi's domestic popularity. After the test, the United States and other Western states restricted nuclear cooperation with India and adopted other measures to limit proliferation more generally.

In its fourth phase, which began in the late 1970s and lasted through the 1980s, India's nuclear program initially made relatively little progress. Cooperation with the Soviet Union reduced India's security fears. Indira Gandhi's Congress Party faced domestic opposition and was voted out of office from 1977 to 1980. After the United States increased its military and economic aid to Pakistan following the Soviet invasion of Afghanistan in 1979, India became increasingly concerned about the threat from Pakistan. India's concerns increased as Pakistan supported insurgents in Indian-controlled Kashmir. In the 1980s, India also became aware that Pakistan had the capability to develop nuclear weapons. India continued to expand its own capabilities—including ballistic missiles—for an effective nuclear deterrent.

The fifth phase of India's nuclear program began when the Indo-Soviet security relationship collapsed with the disintegration of the Soviet Union in 1991. India opposed the 1995 extension of the NPT and the 1996 Comprehensive Test Ban Treaty. When the United States resumed military assistance to Pakistan, India was on the verge of conducting a nuclear test. U.S. reconnaissance satellites detected the preparations, however, and the United States was able to persuade India to cancel the planned test. In 1998 elections, the nationalist Bharatiya Janata Party (BJP) emerged as India's largest parliamentary party and formed a governing coalition. The BJP favored making India a nuclear power, a stance that had widespread military, scientific, and public support. Pakistan's April 1998 missile tests were sufficient to trigger India's decision to conduct its May 1998 nuclear tests.

On the basis of the historical record, Ganguly argues that three factors explain India's decision to test nuclear weapons in 1998. First, over the years India had accumulated the capability to build nuclear weapons. Second,

Indian leaders made a series of political decisions that fitfully advanced the nuclear program even in the absence of a commitment to develop nuclear weapons. Third, perceived security threats from Pakistan and China and the absence of superpower security guarantees accelerated India's nuclear program.¹³

Ganguly rejects prominent alternative explanations, many of which pay too little attention to the security imperatives that contributed to India's decision to develop nuclear weapons. In particular, he criticizes claims that attribute India's nuclear choice entirely to the 1998 electoral success of the BJP. Although the BJP clearly supported nuclear weapons, it could pursue this option only because India's previous governments had developed an enormous nuclear infrastructure. Nor was the BJP alone in perceiving a growing threat from Pakistan and China.

Ganguly finds little evidence to support claims that the 1974 and 1998 Indian nuclear tests were intended to bolster the domestic standing of the ruling party. Even if the 1974 test temporarily bolstered Indira Gandhi's popularity, electoral and political motivations cannot explain India's long-term investments in nuclear capabilities.

Ganguly also questions claims that India's nuclear tests were intended to enhance India's international status and prestige, arguing that if India had been most concerned with its ebbing prestige, the tests would have come at the end of the Cold War, when India's place in the international order was particularly uncertain.

Finally, Ganguly rebuts the argument that India sought nuclear weapons because leading members of its nuclear scientific-bureaucratic establishment fostered the mythology that nuclear weapons would enhance India's security, even if they could not prove this proposition. Ganguly contends that the nuclear establishment was not unified in its fervor for nuclear weapons and that ultimate authority remained in the hands of India's political leaders.

Ganguly concludes by noting that India must now consider what sort of doctrine to adopt for its nuclear forces. He also recommends that India begin discussions with China and Pakistan about stabilizing the region and avoiding a regional arms race.

13. Other analysts dispute Ganguly's claims that India's security fears were key reasons why India acquired nuclear weapons. See the letter by Rodney Jones, as well as Ganguly's response, in "Correspondence: Debating New Delhi's Nuclear Decision," *International Security*, Vol. 24, No. 4 (Spring 2000), pp. 181–189. Jones attributes India's nuclear test to "an elite interest group's subjective drive for international esteem and for national assertion in great power politics." *Ibid.*, p. 186.

In “Pakistan’s Nuclear Weapons Program: Turning Points and Nuclear Choices,” Samina Ahmed traces the evolution of Pakistan’s quest to become a nuclear power and discusses the implications of the 1998 nuclear tests.

Ahmed puts Pakistan’s nuclear program in context by noting that since independence Pakistan has regarded India as the prime threat to its security. Pakistan’s military has controlled its security policy, which has been based on external alliances against India. During the 1950s the United States became Pakistan’s main ally. U.S. support enabled Pakistan’s military to strengthen its domestic position and to build up its conventional forces. Pakistan did not initially consider acquiring nuclear weapons, but in 1957 the Pakistan Atomic Energy Commission (PAEC) was established and the country began to develop a nuclear infrastructure.

Pakistan began to explore the nuclear option after it failed to expand its control over Kashmir in its 1965 war with India. The United States banned military assistance to both countries after the war, tipping the conventional balance in favor of India. Foreign Minister Zulfikar Ali Bhutto, who had previously been minister for atomic energy, argued that Pakistan should develop nuclear weapons. In 1966 he declared that “even if Pakistanis have to eat grass, we will make the bomb” if India went nuclear. Like India, Pakistan refused to sign the NPT.

After Pakistan’s defeat by India in the 1971 war with India, Bhutto became Pakistan’s leader and initiated a nuclear weapons program. India’s 1974 nuclear test gave added impetus to the program, which was headed by A.Q. Khan but also relied on the nuclear infrastructure and scientists of the PAEC. Bhutto sought to purchase from France a reprocessing plant that could enrich plutonium, claiming that Pakistan was pursuing a civilian nuclear power program. The United States became suspicious, urged Pakistan to abandon its quest for reprocessing technology, and then persuaded France to cancel the sale. The U.S. Congress also voted to cut off U.S. aid to countries that imported unsafeguarded enrichment or reprocessing technology. In 1977 Bhutto was deposed in a military coup led by Gen. Mohammed Zia-ul-Haq and then hanged in 1979. While in prison, Bhutto accused U.S. Secretary of State Henry Kissinger of threatening to have him eliminated if he did not give up Pakistan’s quest for nuclear weapons. This accusation resonated with the Pakistani public, who came to associate nuclear weapons with Pakistan’s national sovereignty and prestige.

The Zia military regime that had removed Bhutto invoked the Indian threat and Pakistan’s nuclear program in order to maintain domestic support. Zia

oversaw a clandestine and overt quest for uranium enrichment technology. China provided significant assistance, including weapons-grade uranium and help with uranium enrichment. In 1977 and 1979, the United States imposed sanctions on Pakistan to curb Pakistan's nuclear program.

After the 1979 Soviet invasion of Afghanistan, the United States needed Pakistan as an ally and waived sanctions in return for Pakistan's cooperation. Ronald Reagan's administration looked the other way as Pakistan continued to develop its nuclear infrastructure. The United States sold Pakistan F-16 aircraft, which could deliver nuclear weapons. In 1988, when Zia was killed in a midair explosion, Pakistan was on the threshold of becoming a nuclear state. Pakistan acknowledged that it had a nuclear weapons program and unofficially disclosed that it could build nuclear weapons.

After Zia's death, Pakistan's military continued to control nuclear policy, even though civilian rule returned to the country. The alternating civilian governments of Benazir Bhutto and Nawaz Sharif depended on the goodwill of the military and realized that they could not change Pakistan's nuclear policy. During this period, Pakistan also developed ballistic missiles that could deliver nuclear weapons. When the Cold War ended and the United States no longer needed Pakistan's support in fighting Soviet forces in Afghanistan, U.S. pressure on Pakistan to curtail its nuclear program increased. Nevertheless, the Pakistani military calculated that it could withstand U.S. sanctions and enhanced its nuclear production capabilities. Pakistan also resorted to implicit nuclear threats against India as Indo-Pakistani tension over Pakistan's support of insurgents in Kashmir grew. Bill Clinton's administration adopted a more flexible posture on U.S. sanctions against Pakistan, which convinced Pakistan's policymakers that the United States was willing to accept Pakistan's *de facto* nuclear status.

The April 1998 electoral victory of the BJP in India ended a tentative rapprochement between India and Pakistan and set the stage for both countries' May 1998 nuclear tests. Pakistan's military decided to test its Ghauri ballistic missile in April 1998. India responded by testing nuclear weapons, thereby carrying out the BJP's electoral promise. After an internal debate between proponents of overt weaponization and those who favored continued nuclear ambiguity, Pakistan decided to test nuclear weapons, which was the strong preference of the military. The absence of a strong international response to India's tests helped to convince Pakistani decisionmakers that Pakistan would not be punished heavily for its tests. After both countries had tested nuclear weapons, however, international concern about a nuclear arms race in South

Asia grew. The United States imposed sanctions that significantly damaged Pakistan's economy and exacerbated regional and ethnic schisms in Pakistan.

Ahmed, writing in early 1999, correctly predicted that the military would respond to Pakistan's economic turmoil by staging a coup to remove the civilian government of Prime Minister Sharif. (The coup took place in October 1999.) She recommended that the United States and other influential actors send clear signals of their resolve to roll back nuclear proliferation in South Asia. The strategic situation changed fundamentally after the terrorist attacks of September 11, 2001, however, and regional nuclearization continued.

In the next two essays, Sumit Ganguly and Paul Kapur assess the first decade of open nuclear rivalry in South Asia. They reach opposite conclusions about the impact of nuclear weapons on South Asian security.

In "Nuclear Stability in South Asia," Ganguly contends that "nuclear weapons have reduced the risk of full-scale war in the region and have therefore contributed to strategic stability." Nuclear deterrence in South Asia will remain robust unless India deploys viable defenses against ballistic missiles.

Ganguly starts by summarizing the pessimistic perspective on proliferation in general. He notes that organization theorists claim that organizational pathologies create risks in new nuclear states. Organization theory suggests that the rigid routines and parochial interests of professional militaries may cause deterrence failures. Firm civilian control over the military may limit this risk, but such control is not always present in new nuclear states. Other pessimists point to the "stability/instability paradox" and argue that nuclear deterrence may make South Asia safe for lower-level conventional wars, which could nonetheless escalate as a result of misjudgments and misperceptions. A variation of this argument holds that Pakistan will take greater risks and provoke India because it believes its nuclear arsenal deters large-scale Indian retaliation. A low-level conflict could escalate if India shows less restraint than Pakistan expects.

Ganguly next examines the history of repeated Indo-Pakistani conflicts since 1947–48. The two countries have gone to war in 1947–48, 1965, 1971, and 1999. With the exception of the 1971 conflict, all the wars were over Kashmir, which is central to the identity of both states. Pakistan claims Muslim-majority Kashmir because it sees itself a homeland for South Asia's Muslims. India wants to retain Kashmir because including it in India reaffirms India's secular ideology. In all these conflicts, India and Pakistan pursued limited aims and exercised military restraint.

India and Pakistan also have been involved in many crises. Three of the

most recent include the Brasstacks crisis of 1987, the 1990 crisis over Pakistan's support for insurgents in Kashmir, and the 1999 Kargil crisis, which qualifies as a war due to the extent of the fighting and number of battle deaths. In the Brasstacks crisis, India and Pakistan conducted military exercises at a time when Pakistan's support for insurgents in the border Indian state of Punjab had increased Indo-Pakistani tensions. Pakistan may have issued a veiled nuclear threat. The crisis was resolved with the aid of U.S. and Soviet diplomatic intervention. The 1990 crisis arose when Pakistan deployed military units near the Indian border after completing an exercise. At the same time, an uprising in Kashmir grew with the support of Pakistan, causing India to strengthen its forces in Kashmir. Concerned by bellicose rhetoric emanating from New Delhi and Islamabad and aware that India and Pakistan were pursuing nuclear weapons, the United States dispatched Deputy National Security Adviser Robert Gates on a diplomatic mission that contributed to a resolution of the crisis. The 1999 Kargil crisis/war was the first to take place after India and Pakistan became overt nuclear weapons states. For reasons that remain unclear, Pakistani forces crossed the Line of Control and occupied positions in the mountains near Kargil. After several months of difficult fighting and U.S. diplomacy, India recaptured most of the occupied territory and Pakistan withdrew its forces. Ganguly argues that the conflict did not escalate because Indian leaders were aware of the possibility of nuclear war and thus exercised restraint.

India and Pakistan experienced more crises in 2001–02, as insurgents supported by Pakistan staged terrorist attacks on the Jammu and Kashmir State Assembly building in October 2001 and on the Indian parliament building in December of that year. India demanded that Pakistan take action against terrorist groups operating from Pakistan and deployed large forces near the Pakistani border. In May 2002, tensions increased after insurgents attacked an Indian military base in Kashmir and killed many wives and children of Indian soldiers. War seemed imminent at the end of May, when India shifted more forces to its border with Pakistan. Under diplomatic pressure from the United States and other countries, Pakistan appeared to limit its support for the Kashmiri insurgency in June and war was averted. Ganguly argues that India again did not initiate a major attack against Pakistan in 2002 because nuclear deterrence worked.

Ganguly recognizes that possession of nuclear weapons may have emboldened Pakistan to take greater risks and to support insurgents in Kashmir more actively, but he notes that Pakistan may have acted in this manner even

without nuclear weapons. The end of the Cold War enabled Pakistan—and insurgents—to turn their attention from Afghanistan to Kashmir. The insurgency also expanded in response to India's poor administration of Kashmir, which was unrelated to Pakistan's pursuit of nuclear weapons.

In Ganguly's view, nuclear weapons imposed much greater restraint on India's military operations. Indian aircraft, for example, were ordered not to cross the Line of Control. India's behavior in 1999 and 2002 was much more restrained than in the 1965 war, in which India launched an attack into Pakistani Punjab.

Ganguly concludes that efforts to persuade India and Pakistan to abandon their nuclear arsenals are futile. The United States and other major powers should instead help Pakistan to protect its nuclear weapons from theft, sabotage, or unauthorized use; urge India to adhere to its plans to maintain a minimum deterrence capability; and promote a peace process in Kashmir.

In "Ten Years of Instability in a Nuclear South Asia," Paul Kapur offers a different perspective on Indo-Pakistani nuclear relations. He argues that nuclear weapons have destabilized the South Asian security environment in two ways. First, they have encouraged aggressive Pakistani behavior. Nuclear deterrence shields Pakistan from the risk of significant retaliation for its aggressive actions. At the same time, the prospect of nuclear war attracts international attention to Pakistan's dispute with India. Second, Indo-Pakistani crises since 1998 have driven India to adopt a more aggressive and dangerous conventional military posture that could increase the risk of future wars. Kapur supports these arguments with evidence from three phases of Indo-Pakistani relations since the 1998 nuclear tests.

In the first phase, from 1998 to 2002, Pakistan took advantage of its ability to deter Indian retaliation to initiate low-intensity conflicts that provoked confrontations with India. In the 1998–99 Kargil crisis, Pakistani forces infiltrated Indian-controlled Kashmir and occupied positions inside the Line of Control before eventually being dislodged by an Indian offensive. These conflicts were not resolved because of the presence of nuclear weapons. Instead, Kapur argues, diplomatic calculations and conventional military factors motivated each country to avoid war. India did not cross the Line of Control because it feared that it would lose the support of world public opinion if it did so. In any event, Indian forces were able to repel the Pakistani forces without crossing the Line of Control. On the basis of the historical record and interviews with Pakistani strategic analysts and political leaders, including Benazir Bhutto and President Musharraf, Kapur concludes that Pakistan's acquisition of nuclear weapons fa-

cilitated each crisis by enabling Pakistan to challenge India without fear of catastrophic Indian retaliation.

The second phase of Indo-Pakistani relations in a nuclear South Asia began in 2002 and ended in 2008. These years were marked by less tension and fewer crises than 1998–2002, but nuclear weapons were not responsible for this stability. Kapur argues that Pakistan has reduced its support for Islamic militants and insurgents in Kashmir because of U.S. pressure in the aftermath of the September 11, 2001, terrorist attacks. India has attempted to improve relations with Pakistan because it wants to focus on promoting domestic economic growth.

The third phase, which began in 2008, may feature increased instability in South Asia. Nuclear weapons may continue to encourage provocative behavior by Pakistan. India's emerging conventional military doctrine, formulated to respond to Pakistani provocations, may cause further destabilization. India has started to develop a "Cold Start" doctrine, which calls for Indian forces to mobilize quickly and then launch large-scale attacks into Pakistan.¹⁴ This new doctrine may intensify the regional security dilemma and make escalation more likely in any future Indo-Pakistani war.

Kapur concludes that the "nuclear proliferation optimists" have been wrong about South Asia. He further argues that the implications of Pakistan's experience with nuclear weapons include the possibility that Iran will also adopt risky policies that undermine regional stability if it acquires nuclear weapons.

Most analyses of nuclear proliferation focus on understanding and preventing the initial acquisition of nuclear weapons. In some cases, however, states that already have the bomb may decide to give it up and once again become nonnuclear states. Persuading nuclear weapons states to abandon their nuclear arsenals permanently is thus a potentially important nonproliferation policy. The essays in the third section explore the phenomenon of nuclear reversal.

Peter Liberman examines the most prominent case of nuclear reversal: South Africa. In "The Rise and Fall of the South African Bomb," he considers three explanations for why South Africa built and then dismantled nuclear weapons. The first explanation holds that changing external security threats motivated South Africa's nuclear decisions. The second attributes South African policies to domestic and bureaucratic politics, particularly the influence of the coun-

14. For a detailed analysis of this doctrine, see Walter C. Ladwig III, "A Cold Start for Hot Wars? The Indian Army's New Limited War Doctrine," *International Security*, Vol. 32, No. 3 (Winter 2007/08), pp. 158–190.

try's nuclear research complex and armaments agency. The final explanation includes international incentives other than security, including norms, rewards, and sanctions. Liberman recounts the history of South Africa's nuclear weapons program and concludes that no single factor explains South Africa's decisions.

South Africa's civilian nuclear research program evolved into a weapons program in the mid-1970s, at approximately the same time as South Africa's external threat environment deteriorated. The program ostensibly aimed to develop a capability for peaceful nuclear explosions that might be used for digging harbors and oil storage cavities. Although the precise date is uncertain, between 1974 and 1977 South Africa's political leaders decided to build nuclear weapons. Two nuclear devices were completed in 1978 and 1979. There were six and a half bombs in the arsenal by 1989. South Africa's nuclear strategy consisted of maintaining a covert nuclear capability that would be disclosed to Western nations if Soviet or Soviet-backed forces threatened to invade South Africa or Namibia. If the Western nations doubted the existence of South Africa's bomb, a weapon would be detonated over the ocean. The goal of the strategy was to induce Western countries to intervene on behalf of South Africa. South African strategists disagreed over whether nuclear weapons actually should be used in war, because nuclear use might invite Soviet retaliation that would destroy South Africa.

Liberman argues that South Africa's decision to pursue nuclear weapons appears to have been motivated by external security threats. In the mid-1970s, a Marxist regime came to power in Angola after the Portuguese withdrew from what had been their colony. Cuban troops intervened to support that regime against its opponents in the Angolan civil war. World pressure against South Africa on the issues of apartheid and South Africa's occupation of Namibia grew. Although South Africa did not face local adversaries with nuclear weapons, its leaders feared Soviet-backed aggression, even if chances of a Soviet or Cuban invasion were remote. Security factors also seem to explain subsequent South African nuclear decisions. For example, when Cuban troops advanced into southern Angola and clashed with South African forces in 1987–88, South Africa reopened its Kalahari nuclear test site. Nevertheless, South Africa did not develop a coherent nuclear strategy, which suggests that security concerns were not the only factors shaping South Africa's nuclear decisions.

Liberman argues that the organizational interests and influence of South Africa's Atomic Energy Board (AEB) contributed to the growth of South Africa's nuclear program. The AEB's nuclear scientists had considerable expertise and

prestige. They were able to persuade key decisionmakers to support the program, which was shrouded in secrecy and therefore difficult to criticize. The South African military was not enthusiastic about nuclear weapons, but Liberman suggests that military descriptions of the external threat to South Africa helped to build support for a South African nuclear arsenal.

External pressure had relatively little impact on South Africa's nuclear program. Although many international embargoes and boycotts were imposed on South Africa during the 1970s, the country was able to continue its nuclear program. Threats of even more serious sanctions or a rupture in diplomatic relations dissuaded South Africa from actually testing a nuclear device and becoming an overt nuclear power. Liberman argues that the South African government had many of the characteristics of a nationalist inward-looking coalition and thus would be expected to pay little heed to international pressures.

In 1991 South Africa became the only nuclear state to dismantle its entire arsenal.¹⁵ South Africa's policy changed after F.W. de Klerk became president in 1989. De Klerk believed that having nuclear weapons would make it harder for South Africa to gain international acceptance.

Liberman points out that South Africa's decision to give up the bomb followed a reduction in external threats to South Africa. In 1988 and 1989, the Soviet Union moderated its foreign policy and reduced aid to Angola, Mozambique, and the African National Congress. Negotiations led to the withdrawal of Cuban and South African forces from Angola and independence for Namibia. Liberman argues, however, that these changes in the security environment may not have caused South Africa to dismantle its nuclear weapons. Such weapons may no longer have been deemed essential to meet extreme threats to South Africa's security, but they did not make South Africa less secure.

In Liberman's view, South Africa's decision to relinquish the bomb undermines organizational theories, because such theories predict that organizations will not give up their autonomy and missions, let alone dissolve themselves. The decision reflected de Klerk's policy preferences, not the influence of advisers or the heads of powerful bureaucracies. Liberman regards the South Africa case as a triumph of presidential leadership over organizational politics.

15. The former Soviet republics of Belarus, Kazakhstan, and Ukraine had nuclear weapons on their territory when they became independent in 1991, but they did not build these weapons and had limited control over them before they were removed to Russian territory.

Liberman argues that South Africa's increased sensitivity to international pressure was a key factor in bringing about the end of South Africa's nuclear weapons program. De Klerk wanted to end apartheid, gain international acceptance, and remove sanctions. He thought that destroying South Africa's nuclear weapons and joining the NPT would win Western political and economic support for his efforts to transform South Africa's domestic political system. Liberman observes that South Africa's nuclear disarmament is consistent with Solingen's theory about liberalization and nuclear restraint.

Liberman concludes that the organizational politics theory best explains the growth of South Africa's latent nuclear capability, but it does not account for the decisions to build and then dismantle nuclear weapons. Changes in South Africa's security environment appear to provide partial explanations for South African nuclear decisions, but they were not sufficient to provide strong explanations. International pressure and liberalization within South Africa also account for some changes in policy.¹⁶ Liberman notes that alternative U.S. policies might have discouraged South Africa's acquisition of nuclear weapons. The United States could have provided security guarantees, found ways to employ South Africa's nuclear scientists in civilian research, or imposed harsher sanctions. The U.S. policy of negotiating the withdrawal of Cuban troops from Angola was successful in helping to create the conditions for South African denuclearization.

In "Never Say Never Again: Nuclear Reversal Revisited," Ariel Levite examines all the cases of nuclear reversal, which he defines as "the phenomenon in which states embark on a path leading to nuclear weapons acquisition but subsequently reverse course, though not necessarily abandoning altogether their nuclear ambitions." He identifies about twenty states that fall into this category.

Levite acknowledges that it is very difficult to analyze nuclear reversal, because nuclear programs and decisions often remain secret. Countries that want to keep open the option of resuming a terminated nuclear program are particularly likely to maintain such secrecy. Other countries may refuse to disclose the details of abandoned programs because they fear the domestic or international

16. For different perspectives on the factors that influenced South Africa's nuclear decisions, see the letter by Helen E. Purkitt and Stephen F. Burgess, and the reply by Peter Liberman, in "Correspondence: South Africa's Nuclear Decisions," *International Security*, Vol. 27, No. 1 (Summer 2002), pp. 186–194. Purkitt and Burgess suggest that Liberman overlooks psychological factors, such as the Afrikaner nationalist mentality of South Africa's leaders, as well as the role of U.S. pressure on South Africa.

political repercussions of revealing that they once pursued a nuclear option. There are other motives for secrecy, as well. In some cases, states may want to create the impression that they are on the threshold of having a nuclear capability. In others, states may use the belief that they might seek nuclear weapons to gain bargaining leverage as they attempt to extract security commitments from other states.

Levite notes that previous studies have identified several factors that cause nuclear reversal: changes in a state's external security situation; changes in the state's domestic regime; and changes in systemic incentives, such as the emergence of new norms.¹⁷ He argues that no single explanation accounts for nuclear reversal.

Levite introduces the concept of "nuclear hedging," which he defines as "a national strategy of maintaining, or at least appearing to maintain, a viable option for the relatively rapid acquisition of nuclear weapons." He argues that some cases of nuclear reversal should be classified as examples of nuclear hedging, because states that sign the NPT and appear to renounce nuclear weapons may do so only because they can retain a latent nuclear capability. Levite cites Japan's nuclear policy as a prominent example of nuclear hedging.¹⁸

Like other contributors to this volume, Levite argues that external security threats play an important role in state's nuclear choices. He recognizes, however, that other factors, including domestic regime change and external incentives, play a particularly important role in the process of nuclear reversal. These factors often must be combined with changes in the security environment to bring about nuclear reversal.

Levite finds that the process of nuclear reversal often involves one or more of the following characteristics. First, nuclear programs tend to "fizzle out" instead of being shut down abruptly and completely. (South Africa is a key exception, as discussed by Peter Liberman in his contribution to this volume.) Second, states do not have a clear objective when they begin to contemplate nuclear reversal. Third, states do not assume that reversal is permanent.

Levite argues that the United States has played a critical role in persuading countries to abandon their nuclear programs or to at least adopt a posture of

17. The factors are similar to those identified as causes of proliferation in many of the essays in this volume.

18. For further discussion of Japan's nuclear program, see Llewelyn Hughes, "Why Japan Will Not Go Nuclear (Yet): International and Domestic Constraints on the Nuclearization of Japan," *International Security*, Vol. 31, No. 4 (Spring 2007), pp. 67–96.

nuclear hedging. The United States has provided security guarantees, threatened to cut off or provide aid, revealed details about states' nuclear programs, encouraged regime change, and attempted to influence domestic debates over nuclear weapons. In many cases, including Argentina, Australia, Brazil, Egypt, Japan, NATO members, South Africa, South Korea, and Taiwan, these U.S. policies have been at least somewhat successful. In others, such as India, North Korea, and Pakistan, the United States has been much less successful.

Levite concludes that three factors help to persuade nuclear aspirants to switch to a posture of nuclear reversal or hedging: (1) a change in domestic perceptions of the utility of having nuclear weapons; (2) U.S. efforts to address a country's security concerns and requirements; and (3) U.S.-led attempts to prevent a country from acquiring nuclear weapons. The United States and other countries will not always succeed, as the case of Pakistan shows, but a sustained effort to address security concerns and to influence the domestic debate between proponents and opponents of nuclear weapons often can create the conditions for nuclear reversal or at least nuclear hedging.

Most of the preceding essays in this volume have analyzed the causes and, to some extent, the consequences of decisions to go nuclear. The essays in the final section focus on nuclear proliferation issues that have become prominent since the 1990s. Each assesses an important contemporary proliferation problem and makes policy recommendations.

Even before the September 11, 2001, terrorist attacks, many analysts regarded nuclear terrorism as a major threat.¹⁹ Matthew Bunn, in "Nuclear Terrorism: A Strategy for Prevention," assesses the risk that terrorists will acquire and use a nuclear bomb, examines existing programs to reduce that risk, and recommends a comprehensive strategy "to ensure that every nuclear weapon and every stock of potential bomb material worldwide is secured against the kinds of threats terrorists and criminals have demonstrated they can pose."

Bunn identifies many factors that increase the risk of nuclear terrorism. Although most terrorists do not want nuclear weapons, al-Qaida has made no secret of its desire to acquire nuclear weapons for use against the United States. A sophisticated terrorist group could build a nuclear bomb if it had the nuclear

19. See, for example, Graham T. Allison, Owen R. Coté Jr., Richard A. Falkenrath, and Steven E. Miller, *Avoiding Nuclear Anarchy: Containing the Threat of Loose Russian Nuclear Weapons and Fissile Material* (Cambridge, Mass.: MIT Press, 1996); and Richard A. Falkenrath, Robert D. Newman, and Bradley A. Thayer, *America's Achilles' Heel: Nuclear, Biological, and Chemical Terrorism and Covert Attack* (Cambridge, Mass.: MIT Press, 1998).

material, which could be stolen from any one of multiple facilities in many countries. Nuclear materials—and nuclear weapons—are particularly vulnerable to theft in Pakistan and Russia. Terrorists also could steal highly enriched uranium from many research reactors around the world. Some thefts have been detected already. Once they have stolen or built a nuclear bomb, terrorists probably would be able to smuggle it into the United States, where even a small blast in a U.S. city would have catastrophic consequences.

The good news is that there is no clear evidence that terrorists have yet acquired a nuclear bomb or the material required to make one. Terrorist groups would face many daunting technical challenges as they attempted to build a bomb. Even former al-Qaida members and other Islamist writers question the morality of detonating a nuclear weapon. Nuclear security at sites in Russia and elsewhere is improving, which makes it less likely that terrorists will be able to steal nuclear materials.

Existing programs have improved nuclear security and have made it harder for terrorists to steal nuclear weapons or nuclear materials. Bunn approvingly notes that security upgrades have been completed for most nuclear warhead sites and nuclear materials buildings in Russia and the other former Soviet republics, although it is not clear whether these measures will be adequate or permanent. Much less has been done to secure research reactors in other countries. Efforts to improve nuclear security in China, India, and Pakistan remain secret or minimal. The Global Threat Reduction Initiative (GTRI) has made progress in removing material from vulnerable sites and converting reactors to use low-enriched uranium that cannot be used for nuclear weapons, but much more needs to be done. There are also no global standards for what should be done to make nuclear materials secure.

Bunn outlines a comprehensive strategy for preventing nuclear terrorism. The four key elements of his approach are (1) securing and reducing nuclear stockpiles; (2) countering terrorist nuclear plots; (3) preventing and deterring state transfers of nuclear weapons or materials to terrorists; and (4) interdicting nuclear smuggling. Complacency, secrecy, political disputes, and bureaucratic obstacles all threaten to prevent successful implementation of this strategy. The United States will need to forge global cooperation and build a sense of urgency to prevent nuclear terrorism. It also should fulfill its own arms reduction obligations, organize and fund its organizations devoted to preventing nuclear terrorism, and improve its nuclear security. Finally, the United States must prepare for the worst and develop plans for responding to a nuclear terrorist attack on American soil.

The next two essays examine a relatively new issue: the growth of illicit networks of states and nonstate actors that exchange information and materials that could be used in nuclear weapons programs.²⁰ Such networks appear to be an important new threat to the nonproliferation regime, but the magnitude of the threat and the best way to respond are open to debate.

In “Proliferation Rings: New Challenges to the Nuclear Nonproliferation Regime,” Chaim Braun and Christopher Chyba examine how potential nuclear states trade or sell nuclear technologies, nuclear information, and delivery systems such as ballistic missiles. They argue that proliferation rings of third world nations threaten to undermine the nuclear nonproliferation regime, and recommend policies to address this important problem.

Braun and Chyba find ample evidence of significant interactions among the nuclear and ballistic missile programs of North Korea, Iran, Pakistan, and Libya. Pakistan has provided North Korea centrifuges and blueprints for uranium enrichment in return for plans for ballistic missiles. Pakistani nuclear scientist A.Q. Khan appears to have been involved in this arrangement, as well as a much larger illicit network that procured and sold nuclear technologies and information to Iran, Libya, and other countries. Iran appears to be developing a nuclear weapons program and has received assistance from China, North Korea, and Russia. It may have helped North Korea’s uranium enrichment efforts in return for engines for its ballistic missiles. These illicit networks could provide the technology and designs that would enable states to reduce the time required to obtain nuclear weapons and the necessary delivery systems. They also could enable terrorists to gain access to nuclear technologies.

Braun and Chyba believe that many of these transfers are intended to serve strategic requirements. Pakistan, for example, needed a less vulnerable delivery system that could strike targets in India. It therefore was interested in bartering for North Korean missiles.

The existing nonproliferation regime could be improved to address the threat posed by illicit proliferation networks. Braun and Chyba recommend taking steps to prevent or at least detect theft or smuggling of fissile material that could be used to build nuclear bombs,²¹ providing inducements for ratification of the IAEA’s Additional Protocol, and strengthening export con-

20. For a discussion of North Korea’s role in these illicit networks, see Sheena Chestnut, “Illicit Activity and Proliferation: North Korean Smuggling Networks,” *International Security*, Vol. 32, No. 1 (Summer 2007), pp. 80–111.

21. For a comprehensive discussion of this issue, see Matthew Bunn, “Nuclear Terrorism: A Strategy for Prevention,” in this volume.

trol regimes. These steps are only incremental improvements to the existing nonproliferation regime, however, and they will not address all the challenges posed by proliferation rings.

In 2003–04, the George W. Bush administration and Director General Mohammed ElBaradei offered proposals to prevent the spread of nuclear technologies and materials. President Bush initiated the Proliferation Security Initiative (PSI) in 2003. The PSI consists of countries that have pledged to interdict shipments of missiles, chemical and biological agents, and nuclear components through their territories. This approach depends on having good intelligence about suspect shipments. The initiative may not allow for the detection or interdiction of small shipments.

Director General ElBaradei's October 2003 proposals include establishing multilateral control over facilities that produce separated plutonium or highly enriched uranium; converting existing highly enriched uranium facilities to low-enriched uranium; considering multinational approaches to spent fuel and radioactive waste disposal; pursuing a Fissile Material Cutoff Treaty; increasing adherence to the Additional Protocol; prohibiting withdrawal from the NPT; and universalizing the export control system. These steps could make it more difficult for a country to construct an illicit nuclear program and also might limit proliferation rings involved in exporting nuclear weapons-related material. Braun and Chyba note, however, that nonnuclear states might not be eager to accept the limitations on their sovereignty that ElBaradei's proposals would impose.

President Bush offered many additional proposals in February 2004. Most of them did not call for new treaties to limit exports of sensitive nuclear materials, but instead relied on the cooperation of coalitions of the willing. The United States did, however, take the lead in proposing what became UN Security Council Resolution 1540 in April 2004. This resolution requires states to "prohibit any non-State actor to manufacture, acquire, possess, develop, transport, transfer, or use nuclear, chemical, or biological weapons and their means of delivery." The resolution also requires all states to control supplies of nuclear material and to take steps to prevent illicit trafficking.

Braun and Chyba recommend several new initiatives that would build on Security Council Resolution 1540 and the Bush and ElBaradei proposals. For example, nuclear exports would be permitted only to countries that have concluded Additional Protocol agreements with the IAEA and are honoring those commitments. They also argue that supply-side restrictions will be insufficient to control nuclear proliferation. Globalization will ensure that nuclear

weapons-relevant technologies—some of which have civilian applications—and knowledge will spread. Demand-side measures, such as security guarantees and the threat of economic sanctions, will continue to be necessary.

Braun and Chyba also recommend new initiatives that would ensure that the nonproliferation regime was regarded as equitable by nonnuclear states. They call for an Energy Security Initiative that would offer energy-related benefits to states that accept the burdens of the Additional Protocol and other export controls. Such countries could, for example, lease subsidized fuel for their nuclear reactors or even receive assistance with their nonnuclear energy programs. They also recommend that nuclear weapons states, including those that have not ratified the NPT, support a Fissile Material Cutoff Treaty (FMCT). Such a treaty would demonstrate that nuclear weapons states were willing to accept limits on their activities and contribute to nonproliferation by placing a cap on the production of nuclear weapons material. Finally, the United States should revise its nuclear posture to make clear that its policies do not emphasize attacks on states without nuclear weapons or preventive attacks on states suspected of seeking nuclear weapons.

In “*Ring in Proliferation: How to Dismantle an Atomic Bomb Network*,” Alexander Montgomery offers a different perspective on proliferation networks. He argues that the danger posed by such networks has been exaggerated. He coins the term “proliferation determinism” to describe some of the alarmist reactions to the combination of illicit networks and “rogue” states, and disputes claims that illicit networks have accelerated the pace of proliferation, that rogue states are determined to build the bomb, and that proliferation rings are so decentralized that they can be controlled only with universal measures, if at all. He suggests that proliferation determinists—many of whom were in the George W. Bush administration—should abandon their harsh rhetoric and determination to overthrow the regimes of potential proliferators such as Iran and North Korea. Montgomery recommends using the full range of potential incentives and disincentives to prevent states from going nuclear, identifying and targeting the hubs of proliferation rings, and negotiating directly with “rogue” states.

Montgomery argues that proliferation networks have not enabled potential nuclear proliferants to make rapid technological progress toward acquiring a bomb. Despite the apparent assistance of illicit networks, Iran, Libya, and North Korea all made slow progress in their quest to produce large quantities of fissionable material.

Montgomery also argues that there is no relationship between regime type

and the propensity to proliferate. He notes that France, India, Israel, the United Kingdom, and the United States are all democracies and all acquired (or are thought to have acquired) nuclear weapons. Many states that have abandoned their quest for nuclear weapons did so without experiencing regime change: Libya is the most obvious recent example.²²

According to Montgomery, existing ballistic missile and nuclear proliferation networks tend to have a hub-and-spokes structure, which makes them easier to shut down than decentralized networks. North Korea and Pakistan are the principal hubs in the networks. Montgomery contends that the networks have this type of structure because building nuclear weapons requires much “tacit knowledge,” and this sort of knowledge “must be learned through trial and error, potentially under the direct tutelage of someone who has already learned it.” Only the central hubs in the networks can provide the expertise “to train new proliferants in constructing and operating equipment.”

Montgomery calls for the United States to end its policy of attempting to overthrow the regimes of potential nuclear weapons states such as Iran and North Korea. Attempting to isolate or contain potential proliferants is also likely to fail or backfire. A U.S. strategy of “proliferation pragmatism” would balance threats of force with offers of diplomatic incentives and economic benefits. Montgomery advocates applying tailored incentives and disincentives to Iran, North Korea, and Pakistan to roll back the proliferation networks those states have created “before they form a network of ties so dense that it will be impossible to pull apart.”

Iran’s apparent interest in acquiring nuclear weapons provoked much concern and diplomatic activity in the first decade of the twenty-first century. In “Osirak Redux? Assessing Israeli Capabilities to Destroy Iranian Nuclear Facilities,” Whitney Raas and Austin Long examine whether Israel could successfully attack and destroy Iran’s nuclear facilities, much as it did when it bombed the Iraqi nuclear reactor at Osirak in 1981.²³ Their essay offers an important analysis of the problems and prospects of using military force to stop nuclear proliferation, as well as an overview of Iran’s nuclear program and Israel’s capabilities to launch an airstrike against it.

22. For an analysis of why Libya ended its nuclear program and ceased to be a “rogue” state, see Bruce W. Jentleson and Christopher A. Whytock, “Who ‘Won’ Libya? The Force-Diplomacy Debate and Its Implications for Theory and Policy,” *International Security*, Vol. 30, No. 3 (Winter 2005/06), pp. 47–86.

23. Israel also attacked and destroyed a site that may have contained a nuclear reactor in Syria on September 6, 2007.

Raas and Long point out that Iran's nuclear complex includes multiple sites throughout the country. Iran has argued that its nuclear facilities are elements of a civilian nuclear power program that will generate energy to meet Iran's future needs. Iran is developing uranium enrichment capabilities that could produce weapons-grade uranium, as well as a plutonium reactor and facilities to reprocess spent fuel and extract plutonium. Iran's nuclear facilities include the reactor at Bushehr, uranium mines, uranium conversion and enrichment plants, a fuel fabrication plant, and a heavy-water production facility. Iran is building heavy water reactors. There are probably additional clandestine facilities, but Raas and Long doubt that Iran has an entire covert parallel nuclear program.²⁴

If Israel wanted to delay Iran's ability to build nuclear weapons, it would probably target three critical facilities: (1) the uranium conversion facility in Isfahan; (2) the uranium enrichment facility at Natanz; and (3) a heavy water plant and plutonium reactors being built at Arak. The uranium conversion and enrichment facilities are the most important for producing highly enriched uranium for nuclear weapons. Raas and Long do not think Israel would launch airstrikes against the Bushehr reactor, because it is not vital to Iran's quest for nuclear weapons. If Israel decided to attack the reactor, it could do so with sea-launched cruise missiles.

Since the 1981 Osirak raid, the Israeli Air Force has acquired precision-guided penetrating munitions that enable it to destroy hardened targets such as Iran's underground facilities at Natanz. Israel's bombs would have less difficulty destroying the facility at Isfahan and the reactor at Arak. Raas and Long estimate that no more than twenty-four 5,000-pound bombs and twenty-four 2,000-pound bombs would be necessary.

Israel would probably use F-15 and F-16 aircraft with external fuel tanks to attack targets in Iran. Although Iran has some surface-to-air missiles and fighter aircraft, many of its weapons systems are old and may lack spare parts. Israel has some of the same missiles in its arsenal and would have developed effective countermeasures. Iran also lacks an integrated air defense system.

Raas and Long suggest that Israeli aircraft could use three possible routes on their way to targets in Iran: (1) north over the Mediterranean Sea and then across Turkey to Iran; (2) southeast and then along the Jordan-Saudi Arabia border and then across Iraq; (3) southeast and then along the Saudi-Iraq border and then north over the Persian Gulf. All three routes pose operational and

24. In September 2009 it was revealed that Iran had an additional uranium enrichment plant.

diplomatic challenges, but all are feasible. Israel would have to decide, for example, whether it preferred to risk facing hostile fire over Jordan or Saudi Arabia or to create a diplomatic crisis with Turkey.

Regardless of the route chosen to fly to Iran, if the Israeli force consisted of fifty strike aircraft, a sufficient number almost certainly would arrive at each target and drop their bombs. Iranian air defenses would have to shoot down approximately 40 percent of the Israeli planes to prevent the attackers from delivering enough ordnance. It is highly unlikely that Iran would be able to achieve attrition rates even close to that level. On the first day of the 1973 Yom Kippur War, the heavy attrition suffered by Israeli aircraft did not exceed 8 percent. The attrition rate for the 1986 U.S. raid on Libya—a mission similar to a potential Israeli attack on Iran—was only 4 percent. Even if Iran shot down more Israeli planes than expected and others malfunctioned, the remaining aircraft would be able to inflict significant damage on Iran’s nuclear facilities.

Raas and Long conclude that Israel has the capability “to destroy even well-hardened targets in Iraq with some degree of confidence.” More generally, their analysis suggests that precision-guided weapons can be an important counterproliferation tool, provided that intelligence on the location of nuclear facilities is available. They note, however, that any military attack on Iran may involve a “day after” problem: Iran would probably strike back at Israel or the United States. Counterproliferation policy should not rely on military actions alone.

The essays in this volume do not address every topic related to nuclear nonproliferation. Many important issues, such as international efforts to prevent North Korea from becoming a nuclear weapons state, continue to emerge and evolve. Other countries will almost certainly consider acquiring nuclear weapons. We hope that the essays collected here offer enduring insights into why states seek nuclear weapons and how the international community can strengthen the existing nonproliferation regime.