

MORE WILL BE WORSE

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Why should we worry about the spread of nuclear weapons? The answer is by no means obvious. After all, we have lived with nuclear deterrence for over half a century now. The two superpowers maintained a long peace throughout the cold war, despite deep political hostilities, numerous crises, and a prolonged arms race. Why should we expect that the experience of future nuclear powers will be any different?

A prominent group of scholars has pointed to the apparent contradiction between a peaceful nuclear past and a fearful nuclear future and argue that the further spread of nuclear weapons may well be a stabilizing factor in international relations. In Chapter 1, Kenneth Waltz presents the strongest and most sustained set of arguments in support of this thesis.¹ It is important to note from the start, however, that Waltz is by no means alone in holding this position, as a number of other political scientists have jumped onto the pro-proliferation bandwagon. For example, Bruce Bueno de Mesquita and William Riker advocate the "selective" spread of nuclear weapons into areas where nonnuclear states face nuclear-armed adversaries since "the chance of bilateral conflict becoming nuclear . . . decreases to zero when all nations are

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nuclear armed."² John Mearsheimer also believes that "nuclear weapons are a superb deterrent" and argues that the world would be a safer place if Germany, Ukraine, and Japan became nuclear powers in the modern era.³ Other scholars reach similar conclusions for different countries: Stephen Van Evera has advocated that Germany acquire a nuclear arsenal to deter Russia; Peter Lavoy predicted that nuclear weapons will prevent future wars between India and Pakistan; and both Martin van Creveld and Shai Feldman maintain that nuclear proliferation in the Middle East will stabilize the Arab-Israeli conflict.⁴ This "proliferation optimist" position flows easily from the logic of rational deterrence theory: the possession of nuclear weapons by two powers can reduce the likelihood of war precisely because it makes the costs of war so great.

Such optimistic views of the effects of nuclear proliferation have not escaped criticism, of course, and a number of scholars have argued that nuclear deterrence may not be stable in specific regional settings.⁵ What is missing in the debate so far, however, is an alternative theory of the consequences of nuclear proliferation; an alternative that is a broader conception of the effects of nuclear weapons proliferation on the likelihood of war. In this chapter, I present such an alternative, rooted in organization theory, which leads to a far more pessimistic assessment of the future prospects for peace.

There are two central arguments. First, I argue that professional military organizations—because of common biases, inflexible routines, and parochial interests—display organizational behaviors that are likely to lead to deterrence failures and deliberate or accidental war. Unlike the widespread psychological critique of rational deterrence theory—which maintains that some political leaders may lack the intelligence or emotional stability to make deterrence work⁶—this organizational critique argues that military organizations, unless professionally managed through a checks-and-balances system of strong civilian control, are unlikely to fulfill the operational requirements for stable nuclear deterrence.

Second, I argue that there are strong reasons to believe that future nuclear-armed states will lack the positive mechanisms of civilian control. Many current and emerging proliferators have either military-run governments or weak civilian-led governments in which the professional military has a strong and direct influence on policymaking. In such states, the biases, routines, and parochial interests of powerful military organizations, not the "objective" interests of the state, can determine state behavior. In addition, military organizations in many proliferators are "inward-looking," focusing primarily on issues of domestic stability and internal politics, rather than on external threats to national security. When such militaries are in power, senior officers' energies and interests necessarily shift away from professional concerns for the protection of national security; when civilians are in power, but are extremely fearful of military coups, defense policy is designed to protect their regime, not the nation's security, and officers are promoted according to their personal loyalty to current leaders, not their professional competence. In either case, such extensive military involvement in domestic politics, whether active or latent, means that the military's professional competence as a fighting force, and also as a manager of a deterrent force, will suffer.

What are the likely effects of the spread of nuclear weapons? My argument proceeds in three steps. First, I contrast the assumptions and logic of proliferation optimists to the assumptions and logic of a more pessimistic organizational-level approach to nuclear proliferation. Next, I compare the two theories' predictions about three major operational requirements of deterrence and, in each case, I present the existing empirical evidence concerning each requirement. Finally, at the end of the chapter, I present some lessons for international relations theory and United States nonproliferation policy.

RATIONAL DETERRENCE THEORY AND ORGANIZATION THEORY COMPARED

Rational Deterrence Theory

The influential writings of Kenneth Waltz are the most clear and confident expressions of faith in rational nuclear deterrence. "Nuclear weapons have been given a bad name," Waltz maintains. "Because catastrophic outcomes of nuclear exchanges are easy to imagine, leaders of states will shrink in horror from initiating them. With nuclear weapons, stability and peace rest on easy calculations of what one country can do to another. Anyone—political leader or man in the street—can see that catastrophe lurks if events spiral out of control and nuclear warheads begin to fly."⁷ Given that the costs of nuclear war are so high, even a small risk of war can produce strong deterrence. Because "a nation will be deterred from attacking even if it believes that there is only a possibility that its adversary will retaliate," Waltz maintains that "the probability of major war among states having nuclear weapons approaches zero."⁸ If this is true, then the spread of nuclear weapons should have very positive consequences: "The likelihood of war decreases as deterrent and defensive capabilities increase. Nuclear weapons make wars hard to start. These statements hold for small as for big nuclear powers. Because they do, the gradual spread of nuclear weapons is more to be welcomed than feared" (Ch. 1, p. 45).

Waltz writes with disdain about what he views as the ethnocentric views of psychological critics of deterrence: "Many Westerners write fearfully about a future in which Third World countries have nuclear weapons. They seem to view their people in the old imperial manner as 'lesser breeds without the law'" (Ch. 1, p. 41). For nuclear deterrence to work, he argues, one does not need to assume that decision-makers in new nuclear states make intricate rational calculations about every policy decision: it is sufficient that statesmen are highly "sensitive to costs" (Ch. 1, pp. 14), a

requirement, Waltz elsewhere acknowledges, "which for convenience can be called an assumption of rationality."⁹ When costs are so high, such sensitivity is easy and deterrence is therefore not difficult: "One need not become preoccupied with the characteristics of the state that is to be deterred or scrutinize its leaders," Waltz insists, since "in a nuclear world any state will be deterred by another state's second-strike forces."¹⁰

Within the rational deterrence framework, three major operational requirements for stable nuclear deterrence exist: (1) there must not be a preventive war during the transition period when one state has nuclear weapons and the other state is building, but has not yet achieved, a nuclear capability; (2) both states must develop, not just the ability to inflict some level of unacceptable damage to the other side, but also a sufficient degree of "second-strike" survivability so that its forces could retaliate if attacked first; and (3) the nuclear arsenals must not be prone to accidental or unauthorized use. Nuclear optimists believe that new nuclear powers will meet these requirements because it is in these states' obvious interests to do so. This is, as I will show, a very problematic belief.

An Organizational Perspective

The assumption that states behave in a basically rational manner is of course an assumption, not an empirically tested insight. Political scientists often assume high degrees of rationality, not because it is accurate, but because it is helpful: it provides a relatively simple way of making predictions, by linking perceived interests with expected behavior. The rational-actor view is clearly not the only one possible, however, and it is not the only set of assumptions that leads to useful predictions about nuclear proliferation.

An alternative set of assumptions views government leaders as intending to behave rationally, yet sees their beliefs, the options available to them, and the final implementation of their decisions as being influenced by powerful forces within

the country. If this is the case, organization theory should be useful for the study of the consequences of proliferation. This is important, since such an organizational perspective challenges the central assumption that states behave in a self-interested, rational manner.

Two themes in organization theory focus attention on major impediments to pure rationality in organizational behavior. First, large organizations function within a severely "bounded," or limited, form of rationality: they have inherent limits on calculation and coordination and use simplifying mechanisms to understand and respond to uncertainty in the outside world.¹¹ Organizations, by necessity, develop routines to coordinate action among different units: standard operating procedures and organizational rules, not individually reasoned decisions, therefore govern behavior. Organizations commonly "satisfice": rather than searching for the policy that maximizes their utility, they often accept the first option that is minimally satisfying. Organizations are often myopic: instead of surveying the entire environment for information, organizational members have biased searches, focusing only on specific areas stemming from their past experience, recent training, and current responsibility. Organizations suffer from "goal displacement": they often become fixated on narrow operational measurements of goals and lose focus on their overall objectives. Organizational filters continually shape the beliefs and actions of individuals. As James March and Herbert Simon put it, "the world tends to be perceived by the organization members in terms of the particular concepts that are reflected in the organization's vocabulary. The particular categories it employs are reified, and become, for members of the organization, attributes of the world rather than mere conventions."¹²

Second, complex organizations commonly have multiple, conflicting goals, and the process by which objectives are chosen and pursued is intensely political.¹³ From such a political perspective, actions that cut against the interests of the organization's leadership are often found to serve the narrow

interests of some units within the organization. Organizations are not simply tools in the hands of higher-level authorities but are groups of self-interested and competitive subunits and actors. "Theory should see conflict as an inevitable part of organizational life stemming from organizational characteristics rather than from the characteristics of individuals," Charles Perrow has argued. For example, organizational divisions and responsibilities help explain why "sales and production [are] in conflict in all firms . . . or faculty and administration in colleges, doctors and nurses and administrators in hospitals, the treatment and custodial staffs in prisons."¹⁴ This is also true in military organizations: weapon system operators often have different interests than their commanders, units in the field have different interests than the command headquarters, a particular service has different interests than the General Staff or the Joint Chiefs. And even when a professional military service or command acts in relatively rational ways to maximize its interests—protecting its power, size, autonomy or organizational essence—such actions do not necessarily reflect the organizational interests of the military as a whole, much less the national interests of the state. To the degree that such narrow organizational interests determine state behavior, a theory of "rational" state action is seriously weakened.

Although organization theory has been highly useful in a number of substantive areas of international relations—illuminating crisis behavior, alliance politics, weapons procurement, military doctrine and operations, and nuclear weapons safety¹⁵—it has not been used extensively to study the consequences of proliferation. This is unfortunate, since each of the three operational requirements for rational deterrence appear in a different light when viewed from an organizational perspective. What are professional military views about preventive war; could such views influence the probability of a nuclear attack during the transition period of an early arms race? What is the likelihood that professional militaries will develop and deploy survivable nuclear forces to maintain sta-

ble deterrence? What is the likely influence of the structures and biases of military organizations on the prevention of accidental and unauthorized uses of nuclear weapons in new proliferating states?

The next section presents predictions and empirical evidence concerning the three operational requirements for stable nuclear deterrence. In each section, I contrast the predictions made by nuclear optimists to the predictions deduced from an organizational approach and then present two kinds of evidence. The evidence from the United States case will be given first, both because there is more evidence available on American nuclear weapons operations and because the United States should be considered a tough test of my organizational approach since it is widely considered to have a highly professionalized military under a strong and institutionalized system of civilian control. If these problems are found to exist in the United States, therefore, they are likely to be even more pronounced in other nations. The currently available evidence about other nuclear states is then presented. Both kinds of evidence provide strong support for my pessimistic conclusion about the consequences of the spread of nuclear weapons.

PREVENTIVE WAR IN THE TRANSITION PERIOD

The first operational requirement of mutual nuclear deterrence between two powers concerns the transition period between a conventional world and a nuclear world: the first state to acquire weapons must not attack its rival, in a *preventive war*, in order to avoid the risk of a worse war later, after the second state has acquired a large nuclear arsenal.¹⁶ There are two periods in a nuclear arms race, according to Waltz, during which a state might consider a preventive strike: when its rival is developing nuclear capability but has clearly not yet constructed a bomb, and when the rival is in a more advanced state of nuclear development and therefore might

have a small number of weapons. Waltz maintains that a preventive strike might seem to make sense "during the first stage of nuclear development [since] a state could strike without fearing that the country it attacked would return a nuclear blow." Yet, he insists that such attacks are unlikely, because it would not be in a state's longer-term interests: "But would one country strike so hard as to destroy another country's potential for future nuclear development? If it did not, the country struck could resume its nuclear career. If the blow struck is less than devastating, one must be prepared either to repeat it or to occupy and control the country. To do either would be forbiddingly difficult" (Ch. 1, p. 19).

Later, once an adversary has developed "even a rudimentary nuclear capability," all rational incentives for preventive war are off, since "one's own severe punishment becomes possible" (Ch. 1, p. 19). A little uncertainty goes a long way in Waltz's world. If there is even a remote chance of nuclear retaliation, a rational decision maker will not launch a preventive war.

An organizational perspective, however, leads to a more pessimistic assessment of the likelihood of preventive nuclear wars, because it draws attention to military biases that could encourage such attacks. Waltz has dismissed this argument since he believes that military leaders are not more likely than civilians to recommend the use of military force during crises.¹⁷ Although this may be true with respect to cases of military intervention in general, there are five strong reasons to expect that military officers are predisposed to view preventive war in particular in a much more favorable light than are civilian authorities.

First, military officers, because of self-selection into the profession and socialization afterwards, are more inclined than the rest of the population to see war as likely in the near term and inevitable in the long run.¹⁸ The professional focus of attention on warfare makes military officers skeptical of nonmilitary alternatives to war, while civilian leaders often place stronger hopes on diplomatic and economic methods of

long-term conflict resolution. Such beliefs make military officers particularly susceptible to "better now than later" logic. Second, officers are trained to focus on pure military logic, and are given strict operational goals to meet, when addressing security problems. "Victory" means defeating the enemy in a narrow military sense, but does not necessarily mean achieving broader political goals in war, which would include reducing the costs of war to acceptable levels. For military officers, diplomatic, moral, or domestic political costs of preventive war are also less likely to be influential than would be the case for civilian officials. Third, military officers display strong biases in favor of offensive doctrines and decisive operations.¹⁹ Offensive doctrines enable military organizations to take the initiative, utilizing their standard plans under conditions they control, while forcing adversaries to react to their favored strategies. Decisive operations utilize the principle of mass, may reduce casualties, and are more likely to lead to a military decision rather than a political stalemate. Preventive war would clearly have these desired characteristics. Fourth, the military, like most organizations, tends to plan incrementally, leading it to focus on immediate plans for war and not on the subsequent problems of managing the postwar world. Fifth, military officers, like most members of large organizations, focus on their narrow job. Managing the postwar world is the politicians' job, not part of military officers' operational responsibility, and officers are therefore likely to be short-sighted, not examining the long-term political and diplomatic consequences of preventive war. In theory, these five related factors should often make military officers strong advocates of preventive war.

Evidence on Preventive War from the U.S. Case

What differences existed between U.S. civilian and military advice on the use of nuclear weapons during the early cold war? During major crises, few disagreements emerged. For example, after the Chinese military intervention in the Korean

War in late November 1950, both Truman's senior military and civilian advisors recommended against the use of the atomic bomb on the Korean peninsula.²⁰ If one focuses specifically on the issue of *preventive war*, however, strong differences between civilian and military opinions can be seen. During both the Truman and Eisenhower administrations, senior U.S. military officers seriously advocated preventive-war options and, in both cases, continued favoring such ideas well after civilian leaders ruled against them.

Although U.S. military officers were not alone in recommending preventive war during the Truman administration—as diverse a set of individuals as philosopher Bertrand Russell, mathematician John Von Neumann, and Navy Secretary Francis Matthews called for such a policy—within the government, military leaders were clearly the predominant and most persistent advocates.²¹ The Joint Chiefs of Staff (JCS) were quite direct in their advocacy of preventive options, calling for the “readiness and determination to take prompt and effective military action abroad to *anticipate and prevent attack*,” in their September 1945 top-secret report on postwar U.S. military policy: “When it becomes evident that forces of aggression are being arrayed against us by a potential enemy, we cannot afford, through any misguided and perilous idea of avoiding an aggressive attitude to permit the first blow to be struck against us.”²² Truman appears to have rejected the whole concept of preventive war rather quickly, however, largely on moral and domestic political grounds. “We do not believe in aggression or preventive war,” he announced in a public broadcast in 1950. “Such a war is the weapon of dictators, not of free democratic countries like the United States.”²³

The issue was not thoroughly addressed at the highest levels, however, until April 1950, when NSC-68 (National Security Council Document 68) presented three key arguments against preventive nuclear war. First, intelligence estimates suggested that a U.S. atomic attack on the USSR “would not force or induce the Kremlin to capitulate and that

the Kremlin would still be able to use the forces under its control to dominate most or all of Eurasia.” Second, a preventive attack “would be repugnant to many Americans” and therefore difficult to justify at home. Third, U.S. allies, especially in Western Europe, would share such beliefs, hurting U.S. relations with them and making it “difficult after such a war to create satisfactory international order.” The conclusion was clear: “These considerations are no less weighty because they are imponderable, and they rule out an attack unless it is demonstrably in the nature of a counter-attack to a blow which is on its way or about to be delivered.”²⁴

Senior military leaders were very cautious about discussing preventive nuclear strikes in public after that, with the exception of Major General Orvil Anderson, the commandant of the Air War College, whom Truman fired in September 1950 for advocating preventive nuclear war to the press.²⁵ Yet, in private, military support for preventive options remained high. Generals George Kenney, Curtis LeMay, Thomas Power, Nathan Twining, Thomas White, and Hoyt Vandenberg all privately expressed sympathy for preventive nuclear war and official air force doctrine manuals continued to support preventive-war ideas.²⁶

More open discussions of preventive-war options reemerged at the highest levels of the U.S. government during the first two years of the Eisenhower administration. Throughout the new administration's reevaluation of U.S. security strategy, senior military officers again supported preventive options. The U.S. Air War College, for example, produced the extensive “Project Control” study in 1953 and 1954, which advocated preventive war if necessary.²⁷ This study called for taking direct control of Soviet airspace and threatening massive bombing unless the Kremlin agreed to an ultimatum to withdraw troops from Eastern Europe, dissolve the Cominform, and abandon the Sino-Soviet alliance. Project Control was greeted with enthusiasm when it was briefed to Chairman of the Joint Chiefs of Staff (JCS) Admiral Arthur Radford in July 1954, though State Department officials com-

plained that such schemes were "simply another version of preventive war."²⁸ In addition, Eisenhower himself was briefed on a JCS Advanced Study Group report in mid-1954, which, according to a contemporary memorandum on the report, "pointed unmistakably to an advocacy of the US deliberately precipitating war with the USSR in the near future—that is before the USSR could achieve a large enough thermo-nuclear capability to be a real menace to the Continental US."²⁹

The most extreme preventive-war arguments by a senior officer, however, can be found in General Twining's August 1953 memorandum to the JCS on "The Coming National Crisis," which would occur, he maintained, when the USSR developed sufficient nuclear forces so that "our military establishment would be unable to insure the survival of our nation":

Prior to entering the second period of time [when the Soviet Union could destroy the U.S.] if our objectives have not been achieved by means short of general war, it will be necessary to adopt other measures. We must recognize this time of decision, or, we will continue blindly down a suicidal path and arrive at a situation in which we will have entrusted our survival to the whims of a small group of proven barbarians. If we believe it unsafe, unwise, or immoral to gamble that the enemy will tolerate our existence under this circumstance, we must be militarily prepared to support such decisions as might involve general war.³⁰

The Joint Chiefs' final position was much more calm in tone, though it too displayed "better now than later" logic. While acknowledging that official U.S. policy prohibited preventive war, Admiral Radford told the National Security Council in November 1954 that "if we continue to pursue a policy of simply reacting to Communist initiatives, instead of a policy of forestalling Communist action, we cannot hope for anything but a showdown with Soviet Communists by 1959 or 1960,"

adding ominously that the JCS could "guarantee" a successful outcome in a nuclear war only if it occurred "prior to Soviet achievement of atomic plenty."³¹

Why did Eisenhower reject this line of thinking? Eisenhower clearly did not object to preventive war on moral grounds.³² Eisenhower did question, however, whether war with the Russians was inevitable, given U.S. nuclear deterrent capabilities and his hope that the U.S. strategy of containment would eventually lead to an overthrow of the Soviet system from within. Moreover, his eventual rejection of preventive war appears to have been strongly influenced by his increasing belief that a preventive nuclear attack on the USSR would be too costly politically, *even if it succeeded* in narrow military terms. The political and human costs of maintaining control over a decimated Soviet society were especially appalling to Eisenhower. As he told a group of officers in June 1954:

No matter how well prepared for war we may be, no matter how certain we are that within 24 hours we could destroy Kuibyshev and Moscow and Leningrad and Baku and all the other places that would allow the Soviets to carry on war, I want you to carry this question home with you: Gain such a victory, and what do you do with it? Here would be a great area from the Elbe to Vladivostok and down through Southeast Asia torn up and destroyed without government, without its communications, just an area of starvation and disaster. I ask you what would the civilized world do about it? I repeat there is no victory in any war except through our imaginations, through our dedication, and through our work to avoid it.³³

Preventive War and New Nuclear States

This evidence presented here does not demonstrate that the United States almost launched a preventive war on the USSR in the early cold war period. Nor do I mean to suggest that civilian leaders could never rationally choose to launch a pre-

ventive attack. This evidence does strongly suggest, however, that military officers have strong proclivities in favor of preventive war and that proliferation optimists are therefore wrong to assume that any leader of a state will automatically be deterred by an adversary's "rudimentary" arsenal, or even by a significantly larger one. Preventive nuclear attacks were clearly imagined, actively planned, and vigorously advocated by senior U.S. military leaders well beyond the initial development and deployment of nuclear weapons by the USSR.³⁴ Without Truman's and Eisenhower's broader mix of moral and political objections to preventive war, the narrow military logic in favor of such an option might have prevailed.³⁵

This basic pattern—senior military officers favoring preventive war against new proliferators with civilian leaders being more skeptical—was repeated in a number of other cases as well. In the early 1960s, the U. S. government contemplated taking preventive action to destroy the nuclear program of the People's Republic of China. Senior State Department officials held the position that Beijing would remain a weak and cautious power, even after it developed its first nuclear weapons, and that any U.S. unprovoked military action against China would damage America's reputation abroad.³⁶ In contrast, the Joint Chiefs of Staff argued that "the attainment of a nuclear capability by Communist China will have a marked impact on the security posture of the United States and the Free World."³⁷ The JCS maintained that a conventional weapons strike on Chinese nuclear sites would be feasible but nevertheless also recommended that nuclear weapons be considered for such an attack.³⁸ The military position was eventually rejected. U.S. civilian authorities were not morally opposed to an unprovoked, preventive attack on the Chinese nuclear facilities. Indeed, officials in both the Kennedy and Johnson administrations approached the Russians, in the hope that Moscow would participate in or at a minimum acquiesce to an American strike against the Chinese. But when Moscow refused to cooperate, the U.S. government officials feared that the Soviets might retaliate in

response to any attack on China, a key consideration in their decision not to use force to stop China from developing nuclear weapons.

A similar example occurred in the summer and fall of 1969, only this time the American and Soviet roles were reversed.³⁹ After Chinese forces along the disputed Ussuri River attacked Soviet troops in the summer of 1969, secret discussions were held in Moscow on whether to launch a preventive strike on Chinese nuclear forces. In this case as well, senior military leaders favored a preventive attack despite the existence of a small Chinese nuclear arsenal: Marshall Andrei Grechko recommended that Moscow initiate a major nuclear strike to "once and for all get rid of the Chinese threat."⁴⁰ The Soviet military prepared for a possible strike by starting air force alert operations and conducting military exercises, including mock bombing runs against targets designed to resemble Chinese nuclear facilities. The senior political authorities in the Politburo, however, did not approve the attack plan, at least in part because the United States government alerted its nuclear forces, raising the risks that it would strongly oppose such Soviet action.⁴¹

Whenever a new state is seen to be developing nuclear weapons, it is likely that its rivals will consider preventive war under this "better now than later" logic. My theory and the evidence both suggest, however, that preventive war is more likely to be chosen when military leaders, who minimize diplomatic considerations and believe war is inevitable in the long term, have a significant degree of influence over the final decision. While there have not been, obviously, any nuclear preventive wars among the new proliferants, the probability of such attacks will increase in the future since strict centralized civilian control over military organizations is problematic in some new and potential proliferant states.

Two proliferant states are especially problematic in this regard. First, military biases in favor of preventive war could be influential in Pakistan in the future if there is an emerging imbalance in nuclear weapons and defensive systems with

India, and the Pakistani military feels that war now is better than war later. This logic has prevailed in the past in Pakistan, where the military has been in direct control of the government for more than half of the state's history. In the fall of 1962, senior military authorities unsuccessfully urged President Mohammed Ayub Khan, the leader of the military-controlled government, to attack India while its army was tied down in the conflict with China.⁴² Three years later, in September 1965, the Ayub government did launch a preventive war on India in an effort to conquer Kashmir before the anticipated Indian military build-up was completed.⁴³ Can we be assured that similar military biases could not be influential in future crises over Kashmir?

A second case in point is Iran. The Iranian Islamic government reluctantly developed and then used chemical weapons in the 1980s in response to Iraq's use of chemical weapons against Iranian soldiers and revolutionary guards during the Iran-Iraq War.⁴⁴ Since that time, both the Iranian Army and the Islamic Revolutionary Guards have developed and practiced offensive doctrines for the use of chemical weapons, despite the more defensive or deterrent doctrine apparently espoused by the central government in Tehran. This pattern is disturbing for it suggests that if Iran is successful in its current quest to develop nuclear weapons, the leaders of the military or revolutionary guards in control of nuclear weapons may not be fully controlled by central authorities.⁴⁵ The risks of a preventive war, caused by biased assessments of such Iranian leaders, cannot therefore be ruled out if Iran's acquisition of nuclear weapons forces its rivals such as Iraq or Saudi Arabia to institute their own nuclear weapons programs.

Other states with unstable civil-military relations could get nuclear weapons in the future. I cannot predict the exact strength of such preventive-war pressures or the timing of serious threats of war between all future nuclear states. Nevertheless, because civilians will not be in firm control in all future nuclear states, there are good reasons to fear that

military biases in favor of preventive war will be more likely to prevail than was the case with the superpowers during the cold war.

INTERESTS, ROUTINES, AND SURVIVABLE FORCES

The second operational requirement of deterrence is that new nuclear powers must build invulnerable second-strike nuclear forces. The United States and the former Soviet Union developed a large and diverse arsenal—long-range bombers, intercontinental ballistic missiles, cruise missiles, and submarine-launched missiles—and a complex network of satellite and radar warning systems, to decrease the risks of a successful first strike against their arsenals. Will new nuclear powers also construct invulnerable arsenals? How quickly?

Waltz addresses this issue with two related arguments. First, only a very small number of nuclear weapons are necessary for successful deterrence: since each nuclear warhead contains so much destructive power, "not much is required to deter" (Ch. 1, p. 22). Second, no rational nuclear power would permit all of its forces to be vulnerable to an enemy first strike. According to Waltz, "Nuclear forces are seldom delicate because no state wants delicate forces, and nuclear forces can easily be made sturdy. Nuclear weapons can be fairly small and light, and they are easy to hide and to move" (Ch. 1, p. 19). In short, Waltz is confident that any state will create the minimum deterrent of an invulnerable second-strike nuclear arsenal. "Because so much explosive power comes in such small packages, the invulnerability of a sufficient number of warheads is easy to achieve and the delivery of fairly large numbers of warheads impossible to thwart, both now and as far into the future as anyone can see."⁴⁶

It is puzzling, however, for a theory that emphasizes the rationality of actors to note that both superpowers during the cold war believed that they needed much larger forces than the minimum deterrence requirement. Waltz insists, however,

that that belief was the result of "decades of fuzzy thinking" about nuclear deterrence: "The two principal powers in the system have long had second-strike forces, with neither able to launch a disarming strike against the other. That both nevertheless continue to pile weapon upon unneeded weapon is a puzzle whose solution can be found only within the United States and the Soviet Union."⁴⁷ Yet, if "fuzzy thinking" at the domestic level can cause a state to spend billions of dollars building more forces than are necessary for rational deterrence, couldn't similar "fuzzy thinking" at the organizational level of analysis also lead a state to build inadequate forces?

Why would professional militaries not develop invulnerable nuclear forces if left to their own devices? Five reasons emerge from the logic of organizational theory. First, military bureaucracies, like other organizations, are usually interested in having more resources: they want more weapons, more men in uniform, more of the budget pie. This could obviously lead to larger than necessary nuclear arsenals. Yet programs for making nuclear arsenals less vulnerable to attack (for example building concrete shelters or missile-carrying trains) are very expensive, and therefore *decrease* the resources available for the military hardware, the missiles or aircraft, that the organization values most highly. Military biases can therefore lead to more weapons but not necessarily more survivable weapons. Second, militaries, like other organizations, favor traditional ways of doing things and therefore maintain a strong sense of organizational "essence."⁴⁸ Since efforts to decrease the vulnerability of nuclear forces often require new missions and weapon systems—and, indeed, often new organizational units—one would expect that the existing organizations would be resistant. Third, if organizational plans for war and conceptions of deterrence do not require invulnerable forces, militaries will not have incentives to pursue building them. Thus, if military officers believe that they are likely to engage in preventive war, preemptive attacks, or even launch-on-warning options, then survivability measures may be perceived as simply unnecessary. Fourth, military organi-

zations inevitably develop routines to coordinate actions among numerous individuals and subunits, and such routines are commonly inflexible and slow to change. Even if the technical requirements for invulnerability are met, however, poorly designed standard operating procedures and military routines can undermine a survivable military force. In particular, organizational routines of military forces can produce "signatures" to enemy intelligence agencies; these signatures can inadvertently reveal secret information and the location of otherwise "hidden" military units. Fifth, organizational learning tends to occur only after failures. Military organizations, like other organizations, have few incentives to review and adjust operations when they believe they are successful. Thus, if the first four problems create an undesirable survivability problem with nuclear forces, military organizations are unlikely to fix the problem until after an attack has revealed how vulnerable their forces really were.

Evidence from the Cold War

The history of U.S. and Soviet nuclear weapons programs strongly supports these organizational arguments. The United States eventually developed invulnerable second-strike forces, but only after civilian authorities forced reluctant military organizations to deploy new weapons systems and change traditional operational practices. The influence of such factors can be seen in the history of three major weapons developments: the creation of a survivable basing system for strategic bombers in the United States; the development of the submarine-launched ballistic missile (SLBM); and the construction of the intercontinental-range ballistic missile (ICBM).

The first case in point is the development of a survivable basing system for Strategic Air Command (SAC) bombers in the mid-1950s. SAC war plans at the time—based on routines developed during World War II when the air force had not faced threats of air strikes against their long-range bomber

bases—called for sending the nuclear retaliatory force to bases on the periphery of the Soviet Union in crises.⁴⁹ These overseas bases, however, became highly vulnerable to a surprise Soviet first strike, and, making matters even worse, air force regulations required SAC to concentrate the facilities at individual bases to minimize the peacetime costs of utilities, pipelines, and roads. When civilian analysts at the RAND Corporation pointed out the ill-wisdom of such plans, narrow organizational interests produced significant resistance to change. SAC's autonomy was threatened: officers there feared that the RAND study would lead to broader interference in SAC operations. Moreover, as Bruce Smith put it, SAC officers feared that "the Air Force could also be embarrassed before Congress" and that "the study could undermine the confidence and morale of their units."⁵⁰ The basing study led to radical changes in SAC operational plans, including U.S. basing and in-flight refueling, only after independent civilian RAND analysts did a successful "end-run" around the system, bypassing layers of opposition in SAC and briefing senior air force leaders directly.⁵¹

The U.S. SLBM force has been the least vulnerable component of the strategic arsenal for over thirty years, yet it is important to note that this weapons system was developed against the wishes of the U.S. Navy leadership. The major impediment to development of the Polaris missile system was, as Harvey Sapolsky notes, "the Navy's indecisiveness about sponsoring a ballistic missile program."⁵² Senior naval officers were concerned in the early 1950s that, given the Eisenhower administration's budget cuts, spending on missile programs would come at the expense of more traditional navy programs, and insisted that the Strategic Air Command should pay for sea-based missiles. Even navy submariners were unenthusiastic since "in their view, submarines were meant to sink ships with torpedoes, not to blast land targets with missiles."⁵³ The program's supporters within the navy eventually were forced to go to a group of civilian outsiders, the Killian Committee, to get endorsement of the program.⁵⁴

It is not clear whether or when a large-scale SLBM force would have been constructed without continued high-level civilian intervention.

Similar organizational resistance to innovation can be observed in the early history of the ICBM force. Why did the U.S. Air Force take so long to develop strategic missiles, eventually producing the perceived missile gap crisis? In his compelling study of the missile program, Edmund Beard concludes that "the United States could have developed an ICBM considerably earlier than it did but that such development was hindered by organizational structures and belief patterns that did not permit it."⁵⁵ Devotion to manned aircraft, and especially the manned bomber, led to a prolonged period of neglect for ICBM research and development funds. As late as 1956, General Curtis LeMay placed the ICBM as the air force's sixth-highest priority weapon, with four new aircraft and a cruise-missile program above it; and even within the air force's guided missile branch, air-to-air and air-to-surface missiles (which were to be used to help bombers penetrate to their targets) were given higher priority than intercontinental-range surface-to-surface missiles.⁵⁶ Again, civilian intervention was critical: not until the Killian Committee report recommended that ICBMs also be made a national priority, and civilian Pentagon officials threatened to create a separate agency to oversee the program, did the air force put adequate funds into ICBM development.⁵⁷

Soviet nuclear history also contains three classic examples of how organizational routines and practices created serious vulnerabilities to what might otherwise have been their secure and survivable nuclear forces. First, the failure of the Soviet military to keep its 1962 missile deployment in Cuba secret, despite the strong desire for such secrecy by the Kremlin, was caused by construction crew routines that produced "signatures" leading American intelligence analysts to locate the "secret" missiles. The "Star of David" pattern of air defense missile battery placements and the easily recognized "slash marks" on missile pads, practices developed and seen

in the USSR, gave away the secret Cuban operation to American intelligence officers.⁵⁸ Second, American photo-interpreters were also able to locate the "secret" ICBM silos of the Soviet Strategic Rocket Forces during the cold war because the Soviet deployments had a discernable pattern. In each case, the Soviet military built triple security fences around the "secret" silo buildings and the distinctive wide radius curves in the entry roads, built to transport long missiles to the sites.⁵⁹ These routines made the missile deployments logistically easier and the nuclear warheads more secure from theft or sabotage; these routines also, however, made the Soviet missile silos more vulnerable to an American attack.

The third, and most dramatic, example of how a military organization's operational routines can produce serious strategic vulnerabilities concerns the U.S. secret penetration of the Soviet Navy's underwater communications system. Ballistic missile submarines (SSBNs) are widely considered to be the least vulnerable portion of a nuclear arsenal, providing a stabilizing, secure second-strike capability. In the early 1970s, however, the United States Navy initiated a secret intelligence operation against the Soviet SSBN fleet that enabled the U.S. to know the timing and locations of Soviet submarine patrols in the Pacific and to maintain a U.S. attack submarine trailing behind each Soviet SSBN. The organizational failures of the Russian military that led to this problem read more like the Keystone Cops than the KGB. The Soviets failed to encrypt many messages sent through an underwater communications cable in the Sea of Okhotsk to the missile submarine base at Petropavlovsk, figuring that such protected waters were safe from U.S. spying activities. To make matters worse, they gave away the location of the "secret" communications cable by posting a sign on the beach telling local fisherman "do not anchor, cable here." The crew of the *U.S.S. Halibut* thus easily located the line, tapped into the Soviet Navy's secret underwater communications, and received the operational plans and tactical patrol orders for the Russian SSBN fleet. It is

important to note that the Soviet General Staff continued use of this vulnerable communication system, believing that their forces were secure unless proved otherwise, until an American spy revealed the secret operation to Moscow.⁶⁰

Will New Nuclear Powers Build Survivable Forces?

This evidence demonstrates that there are strong organizational reasons to expect that professional militaries, if left on their own, may not construct invulnerable nuclear arsenals. Logic would therefore lead to a prediction that the development of a secure retaliatory force would be especially prolonged in time and imperfect in implementation in states in which civilian control over military organizations is problematic. Although these organizational impediments are likely to take somewhat different forms in different states, evidence does exist suggesting that parochial organizational interests and rigid routines have impeded the development of secure retaliatory forces in the developing world.

The influence of organizational biases on strategic weapons deployments can perhaps best be seen in the People's Republic of China. China tested its first nuclear weapon in 1964, yet it did not develop a confident and secure second-strike capability until the early 1980s, when initial deployments of ICBMs (1981), SLBMs (1982-83), and mobile and concealed intermediate-range ballistic missiles (IRBMs) were instituted (1980).⁶¹ Why did China, which developed the atomic and hydrogen bombs very quickly, take so long to develop invulnerable missile-basing modes? The absence of perceived strategic threats is not a plausible answer, since the clashes along the Sino-Soviet border and the subsequent nuclear threats from Moscow occurred in 1969. Indeed, in 1970, U.S. intelligence agencies predicted that China would deploy ICBMs by 1975; and the failure to do so has been described as "a major enigma in the PRC's strategic weapons effort."⁶²

While both technical problems and the political turmoil

of the Cultural Revolution clearly played roles in the delayed development of Chinese strategic missiles, professional military biases also had an apparent impact in two specific areas. First, it is important to note that the military officers of Second Artillery Division, who controlled the operational missile forces in the 1970s, consistently argued for larger arsenals, but did not independently pursue the survivability measures needed for the existing land-based missiles. Only in 1975, after Mao Zedong approved a weapons institute report recommending that advanced deception measures be used to make China's medium-range ballistic missiles less vulnerable to Soviet attacks, were successful camouflage and cave-basing deployment methods developed.⁶³ As was the case in the United States, high-level intervention by civilian authorities was necessary to encourage operational innovation. Second, the strong bureaucratic power of traditional People's Liberation Army interests in the party and weapons institutes appears to have slowed the development of the Chinese navy's SLBM force. The SLBM and ICBM programs were started at the same time, but land-based systems were consistently given higher priority: the reverse engineering of SLBM missiles supplied by the Soviets was abandoned in 1961, while similar land-based missile programs continued; and in the late 1960s, the DF [ICBM] program was considered a "crash effort," while "the JL-1 [SLBM] designers did not feel an immediate or compelling urgency."⁶⁴ Thus, while China eventually developed a diverse set of survivable forces, it was a very vulnerable nuclear power for a longer period of time than can be explained by the rationalist assumptions of proliferation optimists.

Even if apparently invulnerable forces are built, however, their ability to withstand a first strike will be highly problematic if inappropriate organizational practices and operational routines are maintained. I will provide two examples. A useful illustration of how poorly designed organizational procedures and routines can produce "unnecessary" force vulnerabilities can be seen in Egyptian air force opera-

tions in June 1967. Given the balance between the Egyptian and Israeli air forces at the time (Egypt had over a 2-to-1 advantage in bombers, fighter-bombers, and interceptors⁶⁵), Egyptian authorities had strong reasons to believe that their ability to retaliate against any Israeli air attack was secure. Indeed, President Nasser publicly emphasized that the Israeli "fear of the Egyptian air force and bombers" was a deterrent to war when he ordered that the Gulf of Aqaba be closed.⁶⁶ Two organizational routines of the Egyptian Air Force, however, created a severe vulnerability for what was "objectively" a sufficient retaliatory force. First, during the crisis, the air force lined up most of its aircraft wing-tip to wing-tip on the runways, making them easier to launch in a first strike, rather than dispersing them to reduce their vulnerability to an Israeli attack.⁶⁷ Second, the Egyptians always placed an interceptor force into defensive air patrol positions and held a "stand-to" alert at air bases at dawn, when they believed an Israeli strike was most likely. Both these operations routinely ended at 7:30 a.m., and, having observed these organizational practices, the Israelis attacked at 7:45 when the planes had landed for refueling and the pilots and crews were having breakfast.⁶⁸ What appeared to be an invulnerable force was thus virtually destroyed in the first hours of the war.

A second example concerns North Korea. If the North Korean government moves forward with its nuclear weapons program, in violation of international agreements, will it build a survivable deterrent force, successfully hiding the weapons from all potential adversaries? Possibly. But the fact that the North Korean government could not hide its secret nuclear weapons program from its adversaries does not bode well. Even in a highly secretive and centralized system, like the North Korean government, large organizations undertaking complex tasks will follow rules and develop routines that can create inadvertent vulnerabilities. How did the United States come to suspect that North Korea was developing nuclear weapons in violation of the nuclear Non-Proliferation Treaty? Although the full details are shrouded in secrecy, it appears that

inappropriate organizational routines were a critical factor. In the early 1990s, the North Korean leadership apparently sought to hide at the Yongbyon reactor facility nuclear-waste materials, evidence that could serve as a tip-off that they were in the process of developing nuclear weapons. The North Koreans, however, were trained by Soviet technical personnel and mimicked the designs of Soviet nuclear-waste storage facilities so closely that U.S. intelligence agencies could immediately identify the covert sites. According to David Albright, "these sites have a distinctive pattern of round and square holes in an above-ground concrete structure that holds liquid and solid waste."⁶⁹ This kind of organizational problem—building a covert site following a distinctive pattern developed while constructing earlier sites that were not hidden—is similar to the Soviet military mistakes in their missile deployment in Cuba. In the deadly cat-and-mouse game between nuclear forces and enemy intelligence agencies, such routinized behavior can inadvertently produce a high degree of military vulnerability.

From a purely rationalist perspective, the spread of nuclear weapons to very small powers might be worrisome since such states might not have the financial resources to procure hardened ICBMs or ballistic missile submarines nor sufficient territory to deploy mobile missiles. Awareness of organizational problems, however, leads to an even more pessimistic appraisal. Even if the economic resources and geographical conditions for survivable forces exist, a state may not develop a secure second-strike capability if organizational biases and inflexible routines of the professional military dominate its behavior.

ORGANIZATIONS, ACCIDENTS, AND PROLIFERATION

The final operational requirement for stable deterrence is that nuclear arsenals not be prone to accidental or unauthorized use. Waltz believes that any such dangers are temporary and can be easily fixed:

All nuclear countries live through a time when their forces are crudely designed. All countries have so far been able to control them. Relations between the United States and the Soviet Union, and later among the United States, the Soviet Union, and China, were at their bitterest just when their nuclear forces were in early stages of development and were unbalanced, crude, and presumably hard to control. Why should we expect new nuclear states to experience greater difficulties than the ones old nuclear states were able to cope with? (Ch. 1, pp. 21)

Waltz answers his own rhetorical question with a rationalist assumption. It is presumably in the interests of proliferating states to keep their forces under strict control; therefore, they will do so. As he puts it:

We do not have to wonder whether they will take good care of their weapons. They have every incentive to do so. They will not want to risk retaliation because one or more of their warheads accidentally struck another country. (Ch. 1, p. 21)

What does organization theory say about the likelihood of nuclear weapons accidents? If organizations are highly rational, then they might be able to achieve extremely high reliability in managing hazardous technologies, avoiding serious accidents by following three basic strategies: construct highly redundant systems with numerous back-up safety devices; use trial-and-error learning to fix organizational problems after they emerge; and develop a "culture of reliability" through strong socialization and discipline of the organization's members.⁷⁰ If organizations are only "boundedly" rational and that they contain political conflicts over goals and rewards, however, then a far more pessimistic appraisal is warranted. This approach raises doubts about whether any state can build a large nuclear arsenal that is completely "secure from accident," even if such strategies are followed.

Charles Perrow's *Normal Accidents* argues there are

inherent limits to the degree to which any large organization can understand the technical systems it creates to manage hazardous technologies, such as nuclear power plants, petrochemical industries, advanced biotechnology, and oil tankers.⁷¹ If organizations were omniscient, they could anticipate all potential failure modes in their systems and fix them ahead of time. Perrow argues, however, that boundedly rational organizations in the real world will inevitably have serious system accidents over time whenever they exhibit two structural characteristics: high *interactive complexity* (systems containing numerous interrelated, yet unplanned, interactions that are not readily comprehensible) and *tight coupling* (systems with highly time-dependent and invariant production sequences, with limited built-in slack).

My own book, *The Limits of Safety*, adds an explicitly political dimension to "normal accidents theory," combining with Perrow's structural arguments to produce even greater pessimism about the likelihood of organizational accidents. Conflicting objectives inevitably exist inside any large organization that manages hazardous technology: some top-level authorities may place a high priority on safety, but others may place a higher value on more parochial objectives, such as increasing production levels, enhancing the size of their subunit, or promoting their individual careers, which can lead to risky behaviors. Such a focus on the political manner in which conflicting goals are chosen and pursued is necessary to explain both why systems with such dangerous structural characteristics are constructed and why organizational learning about safety problems is often severely limited.⁷²

Normal accidents theory suggests that each of the three basic strategies used to improve organizational safety is highly problematic. In some conditions, adding redundant back-up systems can be very counterproductive: redundancy makes the system both more complex and more opaque and therefore can create hidden catastrophic common-mode errors. Large organizations nevertheless often continue to add layers of redundancy upon redundancy to complex systems.⁷³ Why?

Organizations often add redundancy not only when it is needed to improve reliability but also because they must appear to be doing something to solve problems after accidents occur. Unproductive redundancy is also sometimes constructed because such redundant systems serve the narrow interests of organizational subunits, when it enhances *their* size, resources, and autonomy. The politics of blame inside organizations also reduces trial-and-error learning from accidents because organizational leaders have great incentives to find operators at lower levels at fault: this absolves higher leaders from responsibility, and, moreover, it is usually cheaper to fire the operator than to change accident-prone procedures or structures. Knowing this, however, field-level operators have strong incentives not to report safety incidents whenever possible. Finally, from a normal accidents perspective, strong culture and socialization can have negative effects on organizational reliability since they encourage excessive concern about the organization's reputation, disdain for outsiders' and internal dissenters' opinions, and even organizational cover-ups.

The U.S. Nuclear Safety Experience

From the perspective of normal accidents theory, there are strong reasons to expect that the safety of modern nuclear arsenals is inherently limited: large-scale arsenals and command systems are highly complex, by necessity, and are tightly-coupled, by design, to ensure prompt retaliation under attack; the military organizations that manage them are inevitably politicized, with numerous conflicting interests existing between commands and the broader society and within the organizations themselves. How serious were the dangers of U.S. nuclear weapons accidents and even accidental war during the cold war? The available evidence now demonstrates that there were many more near-accidents than previously recognized. Moreover, the U.S. military's reaction to these safety problems shows how only limited degrees of organizational learning took place.

New information on dangerous military operations during the October 1962 Cuban missile crisis demonstrates these points. At the start of the crisis, the Strategic Air Command secretly deployed nuclear warheads on nine of the ten test ICBMs in place at Vandenberg Air Force Base in California and then launched the tenth missile, on a prescheduled ICBM test, over the Pacific. No one within the responsible organizations thought through the risks that Soviet intelligence might learn of the nuclear weapons deployment and the alert at Vandenberg and then, in the tension of the crisis, might misinterpret a missile launch from that base. A second safety problem occurred at Malmstrom Air Force Base in Montana at the height of the crisis, when officers jerry-rigged their Minuteman missiles to give themselves the independent ability to launch missiles immediately. This was a serious violation of the Minuteman safety rules, but when an investigation took place after the crisis, the evidence was altered to prevent higher authorities from learning that officers had given themselves the ability to launch unauthorized missile attacks. A third incident occurred on October 28, when the North American Air Defense Command (NORAD) was informed that a nuclear-armed missile had been launched from Cuba and was about to hit Tampa, Florida. Only after the expected detonation failed to occur was it discovered that a radar operator had inserted a test tape simulating an attack from Cuba into the system, confusing control room officers who thought the simulation was a real attack.

Learning from these incidents was minimal: the relevant military procedures and routines were *not* altered after each of these incidents. In each case, the existence of serious safety problems was not reported to or was not recognized by higher authorities. Each one of the accident-prone nuclear operations was therefore repeated by U.S. military commands in October 1973, in the brief U.S. nuclear alert during the Arab-Israeli war.

The history of SAC's B-52 monitor mission at Thule, Greenland provides a useful example of how adding redun-

dant safety devices to a complex system can inadvertently cause the accidents they are designed to prevent. The U.S. responded to the Soviet development of an ICBM force in the late 1950s by building the Ballistic Missile Early Warning System (BMEWS) radars and developing plans to launch the vulnerable strategic bomber force upon warning. SAC, however, faced a serious problem: if the radar links went dead, would it mean that communications had failed or that a Soviet nuclear attack had started? To make sure that such ambiguity was clarified, NORAD placed radio-equipped "bomb alarm" sensors at the Thule BMEWS base. Yet SAC wanted to be absolutely sure that it got accurate warning (and wanted to control the means of that warning itself), and therefore also placed a B-52 bomber in a continual orbit over the Thule base, where it could determine whether or not a Soviet attack had begun. The bombers on what became a routine monitor mission were, however, part of the airborne alert force and therefore had thermonuclear weapons on board. No one in the Pentagon or SAC headquarters imagined that the plane might crash and that an accidental detonation would occur, which would have produced false confirming evidence that a Soviet nuclear attack had occurred.⁷⁴ The risks of such an accident were not negligible, and even after a series of B-52 bomber crashes led civilians to cancel the airborne alert program in 1968, SAC continued to plan to fly nuclear-armed B-52s above the Thule BMEWS base in future crises.

Proliferation and Nuclear Weapons Safety

Waltz asked why we should expect new nuclear states to experience greater difficulties than did the old ones. The number of near-accidents with U.S. nuclear weapons during the cold war suggests that there would be reason enough to worry about nuclear accidents in new nuclear states even if their safety difficulties were "only" as great as those experienced by old nuclear powers. Unfortunately, there are also

five strong reasons to expect that new nuclear states will face even greater risks of nuclear accidents.

First, some emergent nuclear powers lack the organizational and financial resources to produce adequate mechanical safety devices and safe weapons design features. Although all countries may start with "crude nuclear arsenals," in Waltz's terms, the weapons of poorer states will likely be more crude, and will remain so for a longer period of time. Evidence supposing this prediction can be found in the case of the Iraqi nuclear weapons program, as United Nations' inspectors discovered soon after the 1991 Persian Gulf War:

The inspectors found out one other thing about the Iraqi bomb [design]—it is highly unstable. The design calls for cramming so much weapon-grade uranium into the core, they say, that the bomb would inevitably be on the verge of going off—even while sitting on the workbench. "It could go off if a rifle bullet hit it," one inspector says, adding: "I wouldn't want to be around if it fell off the edge of this desk." ⁷⁵

Second, the "opaque" (or covert) nature of nuclear proliferation in the contemporary world exacerbates nuclear weapons safety problems. Fearing the international diplomatic consequences of a public crossing of the nuclear threshold, most new proliferants have developed weapons capabilities in a secret manner. Israel, India (until 1998), South Africa, Pakistan, (until 1998) and possibly North Korea fit this pattern. There are, however, both organizational and technical reasons to believe that this opaque path to nuclear weapons status is inherently less safe. Organizationally, the secrecy and tight compartmentalization of such programs suggests that there will not be thorough monitoring of safety efforts, and the lack of public debate about nuclear issues in such states increases the likelihood that narrow bureaucratic and military interests will not be challenged. (For example, even in the case of India—a very democratic state—the nuclear weapons complex is not thoroughly monitored and supervised by political

leaders. ⁷⁶) Finally, an important technical constraint exacerbates the safety problem in such states: the inability to have full-scale nuclear weapons tests hinders the development of effective safety designs. For example, when the South African weapons engineers examined their first (untested) nuclear device, they considered it to be based on "an unqualified design that could not meet the rigid safety, security, and reliability specifications then under development."⁷⁷

The third reason why new nuclear states will be accident prone is that their tight-coupling problem will be significantly worse at the beginning of this experience with nuclear weapons, since they are in closer proximity to their expected adversaries than were the United States and the Soviet Union. At the start of the cold war, during the strategic bomber era, the superpowers had many hours to determine whether warnings were real or false; later, in the 1960s, they had approximately thirty minutes to react to reports of ICBM attacks; and only after many years of experience with nuclear arsenals did they have to face less than ten minutes of warning time, once missile submarines were deployed off the coasts in the 1970s. New and potential future nuclear rivals—Iran and Iraq, India and Pakistan, North and South Korea—will immediately have very small margins of error at the outset of nuclear rivalries, since they have contiguous borders with their adversaries. Moreover, the poorer of these states are likely to have less reliable warning systems trying to operate successfully in this more challenging environment.

Fourth, the risk of an accidental nuclear war will be particularly high if the leader of a government of a new nuclear power, fearing a "decapitation attack" (an attack against the central leadership) by an enemy, delegates the authority to use nuclear weapons to lower level commanders. Proliferation optimists argue that this will not happen because they assume that the leaders of new proliferators would never delegate authority for the use of nuclear weapons to subordinate officers due to fears of coups or insubordination. Although we lack detailed information about nuclear predel-

egation decisions within new nuclear states, the evidence concerning predelegation of biological and chemical weapons authority in Iraq during the Gulf War supports a more alarming view that predelegation is likely and that it can produce serious risks of accidental war due to responses to false warnings.

During the 1990-91 Gulf War, Saddam Hussein felt compelled by military necessity to predelegate authority to use twenty-five SCUD missiles (armed with warheads filled with botulinum toxin, anthrax, and aflatoxin) and fifty chemical warheads to senior commanders in Iraq's Special Security Organization (SSO). These officers were told to launch their chemical and biological weapons at Israel if they believed that Israel or the coalition forces had attacked Baghdad with nuclear weapons. The evidence that such an attack had occurred could have come through visual observation or because all communication links from Baghdad to the SSO missile unit were severed. Hussein underscored this strategy in a speech given to a group of U.S. senators in April 1990:

[We] might be in Baghdad holding a meeting with the command when the atomic bomb falls on us. So to make the military order clear to air and missile base commanders, we have told them that if they do not receive an order from higher authority and a city is struck with an atomic bomb, they will point toward Israel any weapons capable of reaching it.⁷⁵

Such a predelegation policy may be a reasonable response to the fear of a decapitation attack, but it inevitably raises the risks of accidental war. Two incidents from the 1991 Gulf War dramatically illustrate these dangers. First, on January 28, 1991, when the United States bombed a large ammunition bunker outside of Basra, the explosion was so large that both the Soviets (using their infrared satellite monitors) and the Israelis (who were receiving downlinks from the U.S. satellites) contacted Washington to ask if U.S. forces had

just detonated a nuclear weapon.⁷⁹ Second, on February 7, 1991, when U.S. forces used a "Daisy Cutter" BLU-82 bomb, a British commando behind the lines reportedly saw the large explosion and announced on an open (unclassified) radio, "Sir, the blokes have just nuked Kuwait."⁸⁰ Given these occurrences during the Gulf War, it should not take too much imagination to think through similar scenarios in which the special security officers in charge of nuclear weapons might incorrectly believe that the conditions under which they were predelegated authority to use their weapons had in fact come into effect.

The fifth reason to anticipate a significant increase in the risks of accidental and unauthorized weapons detonations is that serious political and social unrest is likely in the future in a number of these nuclear states. Waltz, in contrast, insists that domestic instability in new nuclear powers will not cause serious problems:

A nuclear state may be unstable or may become so. But what is hard to comprehend is why, in an internal struggle for power, the contenders would start using nuclear weapons. Who would they aim at? . . . One or another nuclear state will experience uncertainty of succession, fierce struggles for power, and instability of regime. Those who fear the worst have not shown how those events might lead to the use of nuclear weapons. (Ch. 1, p. 11)

This exclusive focus on *deliberate* uses of nuclear weapons is misleading, however, since severe domestic instability can produce *accidental* detonations under many plausible scenarios. If a civil war in a new nuclear state leads to a fire fight between rival military factions at a nuclear weapons base, the danger of an accidental detonation or spreading of plutonium increases. If domestic unrest leads to severe economic hardships at military bases, disgruntled operators are more likely to engage in acts of sabotage that could inadvertently or deliberately produce accidents. An example of the type of dangerous incident one should anticipate in future

nuclear states occurred in early 1992 at the Ignalina nuclear power plant in Lithuania, where a programmer reported that he had found a virus in the computer that ran the safety systems for the plant. Investigators later concluded, however, that he had placed the virus there himself in order to receive a pay bonus for improving safety.⁸¹ Finally, domestic political unrest can increase the risk of nuclear weapons accidents by encouraging unsafe transportation, exercise, or testing operations. If warheads are moved out of unstable regions in haste (as occurred in the USSR in 1991) or if weapons tests are rushed to prevent rebellious military units from gaining access to the weapons (as occurred in Algeria in 1961⁸²), safety is likely to be compromised. The most dramatic example of risky actions induced by domestic crises is Marshal Nie Rongzhen's October 1966 decision to launch a test missile eight hundred kilometers across China, with a live nuclear warhead onboard, in the middle of the Cultural Revolution. Nie was apparently fully aware of the risks involved in such an unprecedented test, but believed that the nuclear weapons program needed a dramatic and public sign of success as part of his "strategy of siding with the radicals to fend off radical penetration of the program."⁸³

In short, while there have been no catastrophic nuclear weapons accidents in the new nuclear states yet, there are good reasons to anticipate that the probabilities will be high over time. Any serious nuclear weapons accident will have tragic consequences for the local community; and if an accidental detonation, false warning, or unauthorized use of a weapon leads to "mistaken retaliation" and accidental war, the consequences would be even more catastrophic. As long as would-be nuclear states choose not to cross the final threshold of "weaponization" by actually deploying fully assembled nuclear weapons and launchers, these safety problems will largely remain dormant. Once these states begin to deploy arsenals, however, such organizational safety problems are likely to emerge rapidly. The current positive safety record is therefore likely to be only the lull before the storm.

CONCLUSIONS: BRINGING ORGANIZATIONS BACK IN

The nuclear optimists' view that the spread of nuclear weapons will produce stable deterrence is based on a rationalist assumption that the behavior of new nuclear states will reflect their interest in avoiding nuclear war. New nuclear powers will avoid preventive nuclear wars, develop survivable nuclear arsenals, and prevent nuclear weapons accidents because it is in their obvious national interests to do so. I have argued, in contrast, that the actual behavior of new proliferators will be strongly influenced by military organizations within those states and that the common biases, rigid routines, and parochial interests of these military organizations will lead to deterrence failures and accidental uses of nuclear weapons despite national interests to the contrary. The concepts behind this more pessimistic vision of proliferation are well-grounded in the rich theoretical and empirical literature on complex organizations. My theory makes less heroic assumptions about the rationality of states. It provides useful insights into U.S. nuclear history during the cold war, and it points to the checks-and-balances system of civilian control as a critical factor in creating the requirements of nuclear deterrence during the long peace. Although the jury of history is still out on the consequences of further nuclear proliferation, and will be for some time, the emerging evidence from the nuclear-proliferating world unfortunately supports this more pessimistic view.

Bringing Organizations Back into International Relations Theory

By assuming that all nuclear states will behave quite rationally and will therefore take all the necessary steps to fulfill the requirements of deterrence, Waltz and other nuclear proliferation optimists have confused prescriptions of what rational states *should* do with predictions of what real states *will* do. This is an error that the classical American realists rarely committed: Hans Morgenthau and George Kennan believed that

states should follow the logic of balance-of-power politics, but their whole enterprise was animated by a fear that the United States would fail to do so.⁸⁴ This is also an error that Waltz avoided in *Theory of International Politics*, where he noted that "the theory requires no assumptions of rationality . . . the theory says simply that if some do relatively well, others will emulate them or fall by the wayside."⁸⁵

Adding this element of natural selection to a theory of international relations puts less of a burden on the assumption of rationality. My approach is consistent with this vision. Many nuclear states may well behave sensibly, but some will not and will then "fall by the wayside." Falling by the wayside, however, means using their nuclear weapons in this case and thus has very serious implications for the whole international system.

"Realist theory by itself can handle some, but not all the problems that concern us," Waltz correctly noted in 1986. "Just as market theory at times requires a theory of the firm, so international-political theory at times needs a theory of the state."⁸⁶ Understanding the consequences of nuclear proliferation is precisely one case in point. To predict the nuclear future, we need to utilize ideas, building upon the theory of the firm, about how and when common organizational behaviors can constrain rational reactions to the nuclear revolution.

Bringing Organizations into Counter-Proliferation Policy

What are the policy implications of my organizational-level approach to nuclear proliferation? First, and most obviously, this approach suggests that the United States is quite correct to maintain an active nuclear nonproliferation policy. A world with more nuclear-armed states may be our fate; it should not be our goal. It is highly unfortunate, in this regard, that a growing number of defense analysts in new nuclear nations read the arguments of the U.S. nuclear optimists, most prominently the writings of Kenneth Waltz, and now cite that literature to legitimize the development of nuclear arsenals in

their nations.⁸⁷ It is fortunate, however, that U.S. government officials have not been convinced of the merits of the optimists' views, and there is little evidence that U.S. policy is going to move away from its strong opposition to the further spread of nuclear weapons.

Second, a more effective approach to nuclear proliferation would add a larger dose of intellectual persuasion to our current policy efforts, which are aimed primarily at restricting the supply of materials and providing security guarantees to potential nuclear states. There are ongoing debates—often in secret, sometimes in the open—about the wisdom of developing nuclear weapons in many of these countries. To influence such debates, nonproliferation advocates need to develop better understandings of the perceptions and interests of the domestic organizational actors involved. Decision makers in potential nuclear powers do not need to be told that proliferation is not in the *United States's* interests. They need to be convinced that it is not in *their* interest. Civilian leaders, military leaders, and wider publics alike in these states need to be reminded that the development of nuclear weapons will make their states targets for preventive attacks by their potential adversaries, will not easily lead to survivable arsenals, and will raise the specter of accidental or unauthorized uses of nuclear weapons. Just as importantly, they also need to be persuaded that nuclear proliferation may not be in their narrow self-interest as civilian leaders seeking for political power, as militaries seeking autonomy, and as citizens seeking safety.

Finally, an organizational approach offers a valuable, but pessimistic, perspective on efforts to manage proliferation if it occurs despite U.S. attempts to prevent it. At one level, an implication of an organizational perspective is that the United States should cooperate with new nuclear states—sharing knowledge of organizational "best practices," technology, and experience—to reduce the dangerous consequences of the spread of nuclear weapons. At a deeper level, however, the most disturbing lesson of this analysis is that, for organizational reasons, such cooperative efforts are not likely to succeed.

