

Chapter 2

Historical Case Study

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Case studies are useful in analyzing infrequent events because they can assess “close calls” in which such events could have occurred, as well as those instances in which they actually occurred. Nuclear weapons have been used twice, but there have been many more close calls. This chapter outlines an agenda for using case studies to assess the risks of nuclear weapons use. First, it identifies twelve cases in which leaders used, seriously contemplated using, or might have considered using nuclear weapons. Second, it notes thirteen cases of close calls of accidental or unauthorized detonation of a nuclear weapon. Third, it assesses three possible paths toward the use of nuclear weapons by non-state actors, none of which as yet has had any known close-call incidents. The chapter then briefly assesses how the historical risks of nuclear weapons use might change as the world evolves toward a larger number of nuclear weapons states. Finally, the chapter develops policy-relevant questions on the risks of nuclear weapons use that can be addressed through case studies, including the behavior of new nuclear weapons states, the likelihood of nuclear weapons use by field commanders versus that by national command authorities, the safety trade-offs of dispersed versus centralized nuclear weapons sites, and the differences between contemporaneous and historical evaluations of nuclear risks. These contributions are unlikely to lead to clear point estimates of nuclear risks, but they may help identify which paths toward possible nuclear weapons use deserve more attention and how risks on these paths can be reduced.

The challenges of assessing the risks of nuclear weapons use are unique in many ways, but they are similar in important respects to the difficulties of analyzing the likelihood of other rare but high-consequence events. Like nuclear weapons use, medical mistakes, airplane crashes, nuclear power plant accidents, space shuttle disasters, and wars are hard to study

because they are infrequent relative to their opposites (successful medical operations, uneventful flights, etc.). All are also difficult to predict because they can arise through many combinations of factors, some of which have unknown base rates and failure modes and some of which may not be identifiable even after the fact. A third commonality is that all involve “close calls” whose frequencies and seriousness are difficult to assess because the actors involved have incentives to underreport (or occasionally to exaggerate) near misses.

These shared features of relatively infrequent, high-consequence, and complex events make it both exceedingly difficult and unusually important for the organizations and scholarly communities concerned with preventing them to study not only instances in which they have happened but also close calls in which they could have happened. Such studies can help assess the overall risks of such events, identify the different pathways to their occurrence, and reduce the likelihood that they will take place.¹ In the areas of airline safety and medical anesthesia, where there are sufficiently frequent and identifiable outcomes and near misses to study, and where the risks of actors intentionally bringing about bad outcomes are either small or mostly preventable at acceptable cost, the study of “incidents and accidents” by professional associations, regulators, and businesses has led to considerable success in reducing the frequency of bad outcomes.²

Assessing less frequent and more intentional potential disasters is more difficult. Potential nuclear weapons use is perhaps the most difficult to study of all the possible disasters noted above because nuclear weapons embody the most challenging features of other potential disasters. Actors have very high incentives to hide nuclear close calls and everything related to them, such as how nuclear warning and launching procedures work. Drawing the right conclusions on the risks of nuclear weapons use is even more imperative than for most potential disasters because the use of even one nuclear weapon would be more costly than all the other disasters noted above save a large-scale conventional war. Finally, nuclear weapons use and nuclear close calls are, thankfully, as small in number as space shuttle flights and crashes, but this makes it exceedingly difficult to assess their likelihood.

Because of this “small *n*” nature of nuclear weapons use and risks, although scholars have usefully applied statistical methods to questions related to the likelihood of nuclear weapons use—such as nuclear

proliferation³ and how the acquisition of nuclear weapons affects the frequency of interstate crises and militarized disputes⁴—standard frequentist statistical techniques face sharp data limitations in assessing the risks of nuclear weapons use. Case studies are not a panacea for these inferential challenges, but they do have several advantages in the study of nuclear risks. Case studies do not require large numbers of cases to proceed, they draw on Bayesian rather than frequentist logic, and the number of actual and close-call uses of nuclear weapons is small enough that scholars have already intensively studied most of the known cases. Some, such as the Cuban missile crisis, are the subject of numerous studies.

A second advantage of case studies is that they can get closer to the mechanisms through which outcomes arise.⁵ Case studies can use process tracing to identify the paths through which nuclear weapons use has happened or nearly happened in the past, providing important clues to potential future risks even if some as-yet-nonexistent failure modes are not subject to historical study. Case studies of the 1962 Cuban missile crisis and the 1983 Able Archer exercise, for example, have clarified the paths through which nuclear weapons might be used as a result of accidents or misunderstandings, and have revealed these risks to have been much higher than top-level decision-makers understood them to be at the time.⁶

Third, study of cases that researchers judge to be analytically similar to current cases or emerging risks can provide insights into current policy dilemmas, so long as due attention is given to differences between the current case and the historical case to which analogies may be drawn.⁷

Fourth, case-study researchers can apply rigorous criteria to identify the relevant populations of “negative cases,”⁸ such as cases in which nuclear weapons might have been used but were not, and those in which leaders could have considered using nuclear weapons but did not seriously contemplate doing so. These cases can usefully be compared to those in which leaders came much closer to considering or using nuclear weapons, in order to develop insights on the factors that make the use of nuclear weapons likely. The population of close-call cases will remain biased and incomplete because of classified data, but it is possible to improve on extant lists of such cases, and a more complete population of close calls can help establish a lower bound on nuclear risks (the actual population of close calls is presumably higher than the population identifiable via public sources).

Fifth, case studies of efforts to reduce nuclear risks, such as the Washington–Moscow Direct Communications Link, or “hotline,” established after the Cuban missile crisis, may be relevant to ongoing risk-reduction efforts, such as recent or planned hotlines among Pakistan, India, and China.

Finally, although it is not possible to use case studies to arrive at precise estimates of past nuclear risks, careful analysis of both the events that happened and the counterfactual events that could have happened, such as assessment of contingency plans or standing orders that were in place, can give some sense of the magnitude of these risks.

This chapter outlines an agenda for using case studies to assess the risks of nuclear weapons use. It is not a history of all the instances in which nuclear weapons might have been used, nor does it aspire to offer the definitive bottom line from among contending views of this history; rather, it touches on existing nuclear histories to identify patterns and gaps for future research. First, it draws on existing case studies and data sets in a preliminary attempt to identify the full set of cases in which leaders seriously contemplated (as defined below) the possible use of nuclear weapons, as well as negative cases in which leaders might have contemplated nuclear weapons use but there is not (as yet) convincing evidence that they did so (the actual cases of nuclear weapons use, Hiroshima and Nagasaki, are of course well identified). Second, it categorizes these cases along three general paths toward possible nuclear weapons use—intentional use by state leaders, accidental or unauthorized use, and use by non-state actors or terrorists—and along more specific sub-paths within each of these three general categories. Third, it provides some preliminary observations on the frequency and seriousness of these close calls and potential close calls, and it identifies ongoing trends and potential future developments that will affect the ways in which future risks and path frequencies might differ from historical ones. Most obviously, for example, the frequencies of different potential paths to nuclear weapons use in a world of many nuclear powers with small nuclear arsenals might be quite different from what they have been in a world that until 1990 was characterized by two superpowers with large arsenals and a small number of other nuclear-armed states. Fourth, the chapter develops policy-relevant questions pertinent to the risks of nuclear weapons use that can be addressed through case studies, and it identifies the cases that might be studied to assess these questions as well

as the cases that deserve closer study because they most closely resemble current policy dilemmas or represent the potential paths to nuclear weapons use that might be more common in the future. These contributions are unlikely to lead to clear point estimates of nuclear risks, and may not lead to convincing confidence intervals on the different potential paths to nuclear weapons use, but they may help identify which paths deserve more attention and how risks on these paths can be reduced.

Defining the Population of Cases in Which Nuclear Weapons Were Used, Contemplated, or Could Have Been Contemplated

It is important at this stage of the research agenda to define close calls of potential use of nuclear weapons broadly, and to err on the side of including possible cases that might later prove irrelevant rather than risk leaving out relevant cases. I define cases of potential use of nuclear weapons along each of three general paths: intentional use by state leaders, accidental or unauthorized use by military organizations, and intentional use by terrorist organizations.

Cases of Actual or Potential Intentional Use by State Leaders

Cases of Actual Use of Nuclear Weapons

The cases of actual use of nuclear weapons, by the United States against Hiroshima and Nagasaki in 1945, have been intensively studied, and, for present purposes, only a few very general observations are in order.⁹ In particular, these uses of nuclear weapons were by a nuclear-armed state against a state lacking nuclear weapons, and in a context in which the state that used nuclear weapons saw them as an alternative to costly conventional conflict (although debate remains regarding whether Japan might have surrendered, and on what terms, even without the use of nuclear weapons¹⁰). The key point for present purposes is that this general situation—nuclear asymmetry in the midst of an ongoing or anticipated costly conventional conflict—has been one of the recurring contexts in which state leaders have contemplated most seriously the use of nuclear weapons.

Cases of Potential Intentional Use by State Leaders

I define cases of serious consideration of intentional nuclear weapons use by state leaders to include those in which any of the following took place: (1) a top leader (including high-level military officials as well as top political leaders) advocated the possible use of nuclear weapons in a high-level meeting in which the use of force was discussed; (2) a top political or military leader authorized study of the costs and benefits of nuclear weapons use, or of contingency plans for such use, in the context of an ongoing crisis or militarized confrontation (as opposed to general contingency planning in noncrisis contexts); (3) a top leader approached or authorized an approach to a third state to request assistance, cooperation, or approval with regard to the use of a nuclear weapon (this includes asking third states to use their nuclear weapons or seeking aid or approval in using one's own nuclear weapons); (4) a top leader authorized the specific use of a nuclear weapon, perhaps under defined contingent circumstances in a crisis context, even if this authorization is later reversed; or (5) a top leader ordered putting nuclear forces on heightened alert in the context of a crisis, even if this was viewed solely as a measure to make a preemptive strike by an adversary more difficult. A negative case of consideration of nuclear weapons use is one in which top leaders did none of these things in a situation that is closely analogous to those in which leaders have most frequently contemplated the use of nuclear weapons, such as a costly or losing conventional conflict against an adversary that lacks nuclear weapons or a nuclear-armed patron.

Cases in Which Leaders Contemplated the Possible Use of Nuclear Weapons

There are twelve well-documented contexts in which top leaders contemplated the use of nuclear weapons by the definition above:

1. **1948 Berlin crisis.** Defense Secretary Forrestal recommended a preventive strike on the Soviet Union.¹¹
2. **1951 Korean War.** General MacArthur repeatedly requested authorization to use nuclear weapons.¹²
3. **1953 Korean War.** President Eisenhower considered possible use of nuclear weapons to bring the war to an end.¹³

4. **1954 Vietnam.** French and US officials discussed the possible use of US nuclear weapons to relieve the siege of French forces at Dien Bien Phu.¹⁴
5. **1954–1955, 1958 Quemoy-Matsu crises.** Eisenhower and Secretary of State Dulles publicly threatened the use of nuclear weapons, and the United States deployed nuclear capable forces to the Taiwan Strait.¹⁵
6. **1961 Berlin crisis.** During the crisis, President Kennedy was briefed on a contingency plan for a nuclear first strike on Soviet forces, and Kennedy followed up with specific operational questions on a possible strike.¹⁶
7. **1962 Cuban missile crisis.** Kennedy and Khrushchev contemplated nuclear options.¹⁷
8. **1961–1964 United States–China.** The United States studied the possibility of preempting China’s nuclear capability, including possible use of a tactical nuclear weapon.¹⁸
9. **1968 Vietnam War, siege of Khe Sanh.** General Westmoreland convened a secret study of nuclear options.¹⁹
10. **1969 Korea:** The Nixon administration prepared a range of options, including an option for nuclear strikes, for possible retaliation against North Korea after it shot down a US reconnaissance plane.²⁰
11. **1969 Soviet–Chinese border clash.** A Soviet KGB official probed the possible US response if there were a Soviet attack on Chinese nuclear facilities.²¹
12. **1973 Middle East crisis.** The United States raised the DEFCON alert status of its nuclear forces, and Israeli prime minister Golda Meir rejected a request by Defense Minister Moshe Dayan to authorize preparations for a nuclear demonstration blast should one become necessary.²²

These twelve incidents, together with the two borderline cases of US conflict with Iraq in 1991 and 2003 discussed below,²³ can be divided into five potential paths toward the intentional use of nuclear weapons. Each path is useful in identifying analogous situations in which nuclear-armed states

might have considered the use of nuclear weapons, but for which there is no reliable public evidence that they did so. These might be “negative cases,” in which nuclear weapons never received serious consideration, or they could be cases in which nuclear weapons were actually given serious but secret consideration. I analyze each of these five paths or contexts in turn and provide a list of possible negative cases for each.

Path 1: A nuclear state faces a costly conventional conflict with a non-nuclear state or a conventional conflict in a theater in which it lacks conventional superiority over a nuclear or non-nuclear rival. This path covers the two actual uses of nuclear weapons (Hiroshima, Nagasaki) as well as several instances in which top leaders gave the most serious and detailed consideration to using nuclear weapons: the 1948 Berlin crisis, the Korean War, and the Vietnam War.

Other analogous cases in which a nuclear state may have considered using nuclear weapons by the definition above, but in which there is no credible public evidence that they did so, include Israel in 1967 (it is unclear whether Israel had by then achieved a usable nuclear weapon), Britain in the Falklands War in 1982, India during its crises with Pakistan in 1987 and 1990 (depending on when one thinks Pakistan attained a usable nuclear weapon), and Israel when it was under attack by Iraqi Scud missiles in 1991.

Path 2: A nuclear state contemplates or carries out a preemptive strike on a rival’s small or emerging nuclear weapons capability. A preemptive strike could use a nuclear weapon, or if it is against a state that has a small number of nuclear weapons, it could provoke a nuclear strike. This path includes the US consideration of an attack on China’s nuclear facilities in the early 1960s, and the Soviet contemplation of an attack on these facilities in 1969.

There have been many other cases in which nuclear-armed states considered or carried out attacks on other states’ nuclear weapons programs but in which there is no public evidence that they considered using nuclear weapons to carry out such attacks.²⁴ These may deserve study to try to classify them as either actual or negative cases of contemplated nuclear weapons use. These include the Israeli attack on Iraq’s Osirak nuclear reactor in 1981; US decision-making on North Korea’s nuclear program in 1994; Israeli consideration of attacks on Pakistan’s nuclear program in 1983–1987 (Israel sought help from India for possible conventional

attacks on Pakistan); Soviet contemplation of possible attacks on Israel's nuclear program in 1967; Soviet requests for US assistance in attacks on South Africa's nuclear program in 1976; US conventional strikes on Iraqi capabilities from 1990 to 2003; US consideration of preemptive strikes on Pakistan's nuclear capabilities in 1978–1979; Israeli consideration of (and request for US assistance with) strikes on Iran's nuclear program in 2008; and Israel's strike on a Syrian nuclear reactor in 2007. It is unlikely that nuclear states gave serious thought to using nuclear weapons in any of these instances, but these cases may still deserve study on whether states may have considered this, and why they did or did not do so.

Path 3: Crisis instability between two nuclear weapons states, especially if they lack large, secure second-strike forces, leads to consideration of preemptive nuclear strikes. This characterizes the 1961 Berlin crisis and the Cuban missile crisis to some degree, although it is unlikely that either side could have preemptively struck all the nuclear weapons of the other side. Crises between India and Pakistan in 1999 and 2002 fit into this category as well. Here again, it is unlikely that either side could have mounted a disarming first strike, not because their adversary's weapons were numerous or able to withstand a first strike but because the storage and potential launch points of their nuclear weapons (including those deliverable by aircraft) were secret.

Path 4: A non-nuclear state asks a nuclear ally to threaten or use nuclear weapons against an adversary. This path includes discussions between French and American officials about possible nuclear strikes against Vietnamese forces surrounding the French at Dien Bien Phu in 1954. Fidel Castro also urged the Soviet Union during the Cuban missile crisis to strike the United States if it invaded Cuba.²⁵ It is also possible, although less well documented, that Chinese leaders probed the Soviet Union's willingness to threaten to use or actually use nuclear weapons in defense of China in the in 1950s crises in the Taiwan Strait.

Path 5: A nuclear state considers the use of nuclear weapons to preempt or punish chemical and biological weapons use by a non-nuclear state. Two cases that came close to the criteria herein for leaders having contemplated the possible use of nuclear weapons are the 1990–1991 Gulf crisis and war and the 2003 US intervention in Iraq. In both cases, the

US president and top administration officials refused to rule out publicly the possibility of using nuclear weapons if Iraq used chemical weapons against American soldiers. In neither case, however, is there evidence that the president authorized contingency planning for such an eventuality or even seriously considered the possible use of nuclear weapons.²⁶ In addition, the Obama administration pledged that it would not use nuclear weapons against a non-nuclear state that is in compliance with the Nuclear Nonproliferation Treaty, even if that state attacks the United States with biological or chemical weapons.²⁷ Nonetheless, the active discussion of this issue by reporters and experts during the two Iraq crises suggests that it remains a possible path to the use of nuclear weapons by other countries or by the United States if it should reverse or fail to follow the Obama administration's policy pledge.

Cases of Potential Accidental or Unauthorized Nuclear Weapons Use

Depending on how one defines them, the list of cases of potential accidental or unauthorized use of nuclear weapons is much longer because presumably many low-level alerts and near accidents are not publicly known. Top leaders may not have been aware of near accidents as they arose or even later, and some close calls are presumably not known to the nuclear weapons operators who nearly caused them. I define these cases to include any of the following: (1) false alerts or warning indicators, whether by radars or intelligence operators, that were communicated to high-level military or political leaders; (2) false alerts that led to heightened alert status of nuclear forces, whether authorized by top political or military leaders or not; (3) change of control or loss of control of nuclear command authority in the context of a coup or attempted coup; (4) heightened alert status of nuclear forces or contemplated use of nuclear weapons by military units in a tactical military engagement in the absence of orders from high-level military or political leaders; or (5) use of dual-capable ships, aircraft, or artillery carrying nuclear weapons in tactical conventional combat, or deployment of dual-capable weapons systems to a crisis zone where they could be used. This last category, deployments of dual-capable weapons systems, embodies some elements of both potential intentional use of nuclear weapons and potential unintended escalation. It could arguably be placed under the intentional paths to nuclear weapons use, but for present purposes, this analytical choice makes little difference.

There are thirteen well-documented contexts of close calls of accidental or unauthorized use by this definition. There are more than thirteen incidents because some contexts involved several close calls. Indeed, the Cuban missile crisis alone included twelve incidents that could have led to unintended or unauthorized escalation to the use of nuclear weapons.²⁸ The overall list of contexts in which close calls of accidental or unauthorized use took place includes the following:

- **1956.** Suez crisis²⁹
- **1961.** US Ballistic Missile Early Warning System communication failure³⁰
- **1962.** Cuban missile crisis: multiple incidents³¹
- **1962.** The Penkovsky false warning³²
- **1965.** US power failure and faulty bomb alarms³³
- **1968.** B-52 crash near Thule, October 24–25³⁴
- **1969.** Nixon orders a nuclear alert to try to convince Soviet leaders he might take radical steps in the war in Vietnam³⁵
- **1973.** US false alarm during Middle East crisis³⁶
- **1979.** US computer exercise tape mistakenly inserted³⁷
- **1982.** Britain in the Falklands, ships carried nuclear weapons
- **1983.** Soviet alert over NATO Able Archer exercise³⁸
- **1991.** Transfer of nuclear codes to coup plotters in attempted coup against Gorbachev³⁹
- **1995.** Russian radar alarm of Norwegian scientific rocket launch⁴⁰
- **1995.** United States deploys a nuclear-armed aircraft carrier to the Taiwan Strait during a crisis⁴¹

A key point here is that most of the known close calls involve the United States not just because it has had nuclear weapons longer than any other state but because it has declassified more of the relevant documents than any other state. The second-most-frequent cases come from the Soviet Union and are known as a result of US intelligence efforts and Soviet participants' memoirs after the Soviet Union collapsed rather than because

of declassified Soviet or Russian documents. Presumably there are some unknown Soviet and Russian close calls. The least is known about close calls in other nuclear weapons states with more limited detection and alert systems, and in many instances shorter decision times before an adversary's weapons might strike, including France, Britain, China, North Korea, India, Pakistan, and Israel. The lack of evidence on potential accidental or unauthorized nuclear weapons use by these countries is one of the biggest data gaps in assessing the historical risks of nuclear weapons use.

The known close calls of accidental or unauthorized use embody five potential paths to nuclear weapons use:

Path 6: False alarms in the absence of an ongoing crisis or war. False alarms in noncrisis contexts are unlikely to lead to nuclear weapons use themselves, but they can indicate the kinds of failure modes that, were they to occur during crises, could be much more dangerous. The cases of such false alarms include the 1961 US Ballistic Missile Early Warning System communication failure,⁴² the 1965 US power failure in the Northeast that led to two faulty bomb alarms,⁴³ the mistaken insertion into US warning systems of a computer tape simulating an incoming nuclear missile attack in 1979,⁴⁴ and a 1995 Russian missile warning radar alarm set off by a Norwegian scientific rocket launch.⁴⁵ These incidents point to the importance of learning about and reducing the failure modes of the early warning systems of new nuclear weapons states that lack the redundant warning systems deployed by the United States.

Path 7: False alarms, misinterpretations, and dual-capable deployments in ongoing crises or wars. False alarms in crises are clearly more dangerous than those during peacetime. In crises, especially when alert levels are raised, warning and decision systems become more tightly coupled, redundancies and safeguards are lowered, decision times are shortened, and decision-makers' mindsets are more oriented toward interpreting any warning indicators as real signs of imminent threats rather than false alarms.⁴⁶ Four crisis incidents from the list above illustrate these dangers: the intersection of several incidents in the 1956 Suez crisis,⁴⁷ a false alarm at a US B-52 air base during the 1973 Middle East crisis, an elevation of the alert status of Soviet nuclear forces during the 1983 NATO Able Archer military exercises (a time of high tension⁴⁸), and, perhaps most dangerously,

a series of incidents that could have led to misinterpretations and nuclear weapons use in the Cuban missile crisis.⁴⁹

One incident during the Cuban missile crisis illustrates a potentially important sub-path toward nuclear weapons use in a crisis. During the Cuban crisis, the Soviet Union captured Oleg Penkovsky, a colonel in the Soviet Military Intelligence organization (the GRU) who had been acting as a spy for the United States. Penkovsky had been given a special code to transmit to warn of any impending Soviet nuclear attack on the United States, and after his capture this code was transmitted (whether by the intention of Penkovsky himself or unwittingly by his captors remains unclear). This incident draws attention to the more general possibility that a state or non-state actor intent on creating a nuclear crisis or even a nuclear war between two of its adversaries might try to create a false alert during a crisis.

Another sub-path involves the deployment of dual-capable weapons systems carrying nuclear weapons to an ongoing conflict or potential conflict zone. Britain's deployment of nuclear-armed ships to the Falklands in 1982 and the US deployment of a nuclear-armed aircraft carrier to the Taiwan Strait during a crisis in 1995 illustrate this sub-path. Such deployments might be seen by an adversary as advance preparation for actual nuclear weapons use, or they can lead to unintended escalation if the deployed forces are attacked or captured by an adversary's conventional forces.

Path 8: Close calls of potential use by local commanders without explicit national command authority orders. Because of concerns over possible communication disruptions in a crisis or war, US and Soviet leaders gave their submarine commanders the technical ability to use nuclear weapons without first having to receive an enabling code from national command authorities, so long as two sailors simultaneously turned launch keys (it is unclear whether this capability to initiate launch even without an authorization code continues). This creates the risk that commanders will use nuclear weapons should they come under direct attack and be unable to receive communications from national leaders indicating whether the attack they are experiencing is localized or part of a global or even nuclear conflict. In one of the most dangerous incidents in the nuclear age, this risk came close to being realized during the Cuban missile crisis. To enforce the naval quarantine of Cuba ordered by President Kennedy, American ship commanders began dropping small "practice" depth charges to force

Soviet submarines to the surface. The commander of one such submarine, Valentin Savitsky, believing his submarine was under attack and unsure whether a global war had started, ordered his crew to prepare a nuclear-armed torpedo for launch against the American ships. Fortunately, the second officer on the Soviet sub, Vasili Arkhipov, whose concurrence was needed for such a decision, convinced commander Savitsky to surface instead and seek orders from Moscow before taking further action.⁵⁰ Pry argues that Soviet and later Russian command and control procedures have allowed not only submarine commanders but also nuclear weapons operators at the level of colonel and above to have the technical capability of launching nuclear weapons without first having to receive an enabling code from national command authorities.⁵¹ More generally, delegation of independent launch authority to local military commanders can create great risks because these commanders may be acting under intense pressure, limited information, and immediate threats to their own lives and those of the soldiers in their units.

In addition, before US nuclear weapons were equipped with authorization codes or managed with dual-key arrangements, it was possible that US military commanders could have used nuclear weapons in crises or combat without explicit presidential authorization. For example, General Curtis LeMay, who headed the US Strategic Air Command, told a member of the Gaither Committee studying US security policy that his plan was to use nuclear weapons preemptively if he received intelligence indicating that Soviet forces were amassing for an attack. When told this contravened US policy, LeMay responded “It’s my policy. That’s what I’m going to do.”⁵²

Path 9: Disruption of national command authority chain of command in a civil war or coup. The most dangerous disruption of national command authority of a nuclear-armed state to date was the coup attempt against Soviet General Secretary Gorbachev on August 18–21, 1991. This incident amply demonstrates the dangers inherent in any such violent regime transition in a nuclear weapons state. One of the coup plotters’ first acts was to take the Soviet nuclear “football” from Gorbachev. This device may not be analogous to the American nuclear “football,” which is a device with the secret codes necessary to unlock the Permissive Action Links (PAL) or safety devices on all US nuclear weapons other than those on submarines. There are reports that the Soviet “football” does not contain codes for unlocking Soviet nuclear weapons and only has communications

equipment.⁵³ In any event, for two days, the coup plotters had some element of control over Soviet nuclear weapons, a worrisome prospect given that these individuals were operating under high stress and on little sleep. One indication of their unbalanced state of mind is that several committed suicide when the coup attempt failed.

A second close call along this path occurred in October 1993, with a split in the Russian government between President Yeltsin and vice president and former general Aleksandr Rutskoy. Forces backing Rutskoy managed to knock out Moscow's main television station, but they failed in their attempt to seize control of the Defense Ministry, and Rutskoy's coup attempt ultimately failed when military forces armed with tanks shelled and took over the parliamentary building in which he was holed up, capturing him and his key supporters.

Path 10: Accidental detonation of a nuclear weapon. US nuclear weapons involve redundant safety devices and procedures and are unlikely to detonate accidentally. Despite thirty-six accidents classified as "Broken Arrow" incidents, or accidents involving nuclear weapons, there have been no accidental nuclear detonations.⁵⁴ Most of these incidents involved airplane crashes, and several included detonation of the nuclear weapons' conventional explosives. Perhaps the most serious such incident, for present purposes, was the 1968 crash of a nuclear-armed B-52 near the Thule Air Base, which detonated the conventional explosives of the nuclear weapons on board. Had it led to a nuclear detonation so close to a US base, it could have triggered a false alarm of a nuclear attack.⁵⁵ More worrisome are the nuclear forces of emerging nuclear weapons states, which may lack safeguards as effective as those on US weapons.

Contexts of Close Calls by Non-State Actors

Nuclear weapons use by non-state actors such as terrorist groups would require three conditions to be jointly met: (1) existence of a terrorist group willing to carry out mass casualty attacks, (2) ability of this group to deliver a nuclear weapon to a target site, and (3) acquisition of a nuclear weapon by this group. As several groups, including not just al-Qaeda but also Lashkar-e-Taiba (a Pakistani group), have demonstrated a willingness to carry out mass-casualty attacks, and as the delivery of a nuclear weapon to a port city by boat is a much easier condition to achieve than acquisition of a nuclear

weapon, this section focuses on the third condition and examines paths through which a terrorist group might acquire a nuclear weapon.

There have been no known close calls of acquisition of a nuclear weapon by a terrorist group, but some of the steps toward such acquisition have been attempted, and the paths toward possible acquisition are easy to identify in their broad outlines. It may thus be useful to study the incipient attempts terrorists have made toward acquiring weapons of mass destruction⁵⁶ even if none have yet come close to fruition. Because it is far beyond the ability of terrorist groups to make the enriched uranium needed to produce a nuclear weapon, the present discussion focuses on the paths of buying or stealing an assembled weapon, buying or stealing enriched uranium and assembling a weapon, or acquiring a nuclear weapon from a state that backs the terrorist group.

Path 11: A terrorist group buys or steals an assembled weapon. States that have nuclear weapons typically keep them under sufficiently safe guard that it would be difficult for a terrorist group to steal an assembled weapon, and most nuclear-capable states have safety devices that would prevent their weapons from being used even if stolen. It cannot be ruled out, however, that insider assistance might enable a terrorist group to steal a weapon and circumvent its safeguards. This concern in part motivated the Nunn–Lugar program to increase the safeguards on Russian nuclear weapons, and nuclear scientists, after the Cold War.

Path 12: A terrorist group buys or steals enriched uranium and assembles a nuclear weapon. The huge Cold War nuclear arsenals of the United States and the Soviet Union generated large stockpiles of weapons-grade highly enriched uranium and plutonium. If terrorists were able to acquire highly enriched uranium, it might be within their technical capability to assemble a shotgun-style nuclear bomb.⁵⁷ From 1993 to 2012, the International Atomic Energy Agency confirmed sixteen cases of illegal possession of or attempts to move or trade highly enriched uranium or plutonium.⁵⁸ Also worrisome here is the possibility of nuclear scientists collaborating with terrorist groups. The network established by the Pakistani nuclear scientist A. Q. Khan, for example, provided nuclear assistance to other countries, and it is possible that a member of this network or one like it could cooperate with terrorist groups.

Path 13: A state sponsor of terrorism provides a nuclear weapon to a terrorist group. Several states have ties to well-organized terrorist groups: Pakistan and Lashkar-e-Taiba, Iran and Hezbollah.⁵⁹ Such a state might consider providing a nuclear weapon to a terrorist group. An important factor deterring such behavior is the fact that the radiological signature of any detonated weapon might allow identification of the country that was its source.

Preliminary Observations on Past Risks and Future Trends

Because of the relative infrequency of nuclear close calls along multiple different paths in the past, and the necessity of using counterfactual analysis to assess such “nonevents,” it is not possible to develop precise estimates of past nuclear risks. For example, when Captain Savitsky ordered his crew to prepare to launch a nuclear torpedo during the Cuban missile crisis, his second in command, Arkhipov, was reportedly initially the only one of the three top officers on the submarine who argued against this. Does this mean the odds of nuclear weapons use were one in three, or did Arkhipov usually succeed in such arguments? How close did the other Soviet submarine commanders come to considering the use of a nuclear torpedo? Had a nuclear torpedo been used, how would the United States (or local naval commanders) have responded? Some questions of this nature are inherently counterfactual, and others involve information that we are unlikely to ever have.

Nonetheless, some general judgments about past risks are possible. Most importantly, it is likely that top leaders have underestimated the risks of nuclear weapons use, particularly those arising from the interaction of complex warning and alert systems and the dynamics of crisis decision-making. Perhaps the most famous estimate of nuclear risks is President Kennedy’s statement that the odds of a nuclear war during the Cuban missile crisis were between one and three and even.⁶⁰ This seems to be in the ballpark of the risks evident in the Savitsky incident, but Kennedy could not have known of this incident, or of many of the other dozen or so close calls that arose during the crisis, at the time he made his observation. Perhaps Kennedy, having recently read Barbara Tuchman’s account of World War I, was factoring such potential close-call pathways into his estimate, but in a later example—the Soviet alert during the NATO Able

Archer exercise—Western leaders were evidently unaware of how seriously Soviet leaders believed that the exercise might be a cover for a planned surprise attack.⁶¹

Just as it is impossible to make precise estimates of past nuclear risks, these risks cannot be estimated with confidence for the future. What is possible, however, is to combine knowledge of past potential paths toward nuclear weapons use with expert opinions on future trends that will affect the likelihood of alternative paths. Expert elicitation is discussed in depth in chapter 3, and although it is a separate task from the present chapter's focus on a research agenda for improving knowledge of past risks, it is useful to briefly review here possible future trends and how they might reshape the risks evident in past close calls.

Most obviously, the proliferation of nuclear weapons and missiles capable of carrying them may change future risks of nuclear weapons use. Less obvious is how they will change those risks; some experts argue that more nuclear weapons might mean stronger deterrence (Waltz), while others emphasize the potential increased risks of temptations to preemptive strikes and misinterpretations and false alerts in crises (Sagan).⁶² Second, increased missile defenses might either deter first use or create incentives for preemption in either direction. Third, the generation of highly enriched uranium in a wider range of countries might create more opportunities for terrorists to buy or steal this material. Fourth, deep reductions in and de-alerting of US and Russian nuclear forces might reduce the risks related to these weapons along several different paths. Fifth, changes in enduring state rivalries among nuclear powers, or development of new ones, will affect the risks of both intentional and unintentional use. Sixth, increased dissemination of safety devices on nuclear weapons, or failure of new nuclear powers to use such devices, may affect nuclear risks. Seventh, the emergence or disappearance of terrorist groups willing to use weapons of mass destruction will affect nuclear risks. Eighth, the evolution of civil-military relations in new nuclear powers may affect which decision-makers have the authority or the ability to use nuclear weapons. Finally, cultural changes—most importantly, the strengthening or weakening of the “nuclear taboo” among existing and new nuclear weapons states—will affect nuclear risks.

Assessment of how past risks and future trends will intersect will require input from many experts, but for present purposes, this chapter builds

on the general intuition that the kinds of risks and pathways to potential nuclear weapons use evident in the cases listed above are indicative of potential future paths to nuclear weapons use, but the frequency and severity of future close calls or the likelihood of future nuclear weapons use is more likely to reflect the risks attendant on new and emerging nuclear powers with small, dispersed arsenals; politically powerful military officers; and limited warning and safety systems than it is to resemble the US–Soviet nuclear standoff that generated the majority of the historical close calls noted above. A priority for studying past cases is therefore to identify those most similar to the likeliest future risks.

Researchable Questions and Cases in Which They Might Be Studied

Both the literature on the historical close calls above and the wider literature on the risks of nuclear weapons use suggest a number of policy-relevant questions that might be researchable through case studies:

- Are new nuclear powers more aggressive vis-à-vis either nuclear or non-nuclear adversaries? Do nuclear dyads experience more or less frequent, more or less severe conflicts and crises with one another? How are new nuclear powers such as North Korea and potentially Iran likely to behave given long-standing security rivalries and unsettled domestic political orders?

The statistical literature on these questions is mixed. Horowitz argues that when states first acquire nuclear weapons, they are more likely to challenge adversaries and be challenged by them, but he argues that as time goes on from the date of acquisition, challenges in both directions become less likely.⁶³ Beardley and Asal conclude that opponents of nuclear weapons states demonstrate restraint in using violence but that the overall incidence of crises is not affected.⁶⁴ Rauchhaus argues that there is evidence for the “stability-instability paradox,” or that major war between nuclear powers is less likely than for mixed or non-nuclear dyads, but that militarized interstate disputes are more likely in nuclear dyads.⁶⁵ Case studies of new nuclear weapons states, such as North Korea and Pakistan, and their adversaries might shed light on this question and might be relevant to the

case of Iran's nuclear program. Civil–military relations in the 1991 Soviet coup attempt and the 1993 Russian civil conflict might also be relevant to North Korea and Iran, where military organizations play a large political role.

- Are field commanders more likely than national leaders to favor nuclear weapons use?

Several of the historical cases noted above, including the 1948 Berlin crisis, the Korean War, the Cuban missile crisis, and the Vietnam War, suggest that military leaders have been more willing to use nuclear weapons than top civilian leaders. Study of these and other cases with a focus on this question can reveal whether this pattern holds up. This has important implications for countries that, to address surprise attacks and potential disruption of communications, devolve the technical capability to use nuclear weapons to top military leaders and especially those that allow weapons operators to have this ability.

- Has there been a trade-off between increasing the diversity and dispersion of nuclear weapons to deter preemption and the need for fewer weapons sites to limit accidental or unauthorized use?

Anecdotal evidence suggests that US accident rates (particularly Broken Arrow incidents) have become less common as the United States has lowered alert rates of its bomber forces and modernized its nuclear weapons. This might be an actual trend, or it could be an artifact of the reality that more recent events could remain classified while older incidents have been declassified. In any event, study of the accident rates of states with fewer nuclear weapons (Britain, France, etc.) might provide closer analogies to the likely accident rates of recent and emerging nuclear weapons states.

- What do the answers to these questions suggest regarding new nuclear powers with different nuclear arsenals (smaller forces, reliance on aircraft or missiles for delivering nuclear weapons, reliance on secret locations to prevent preemption, etc.)?
- Have contemporaneous evaluations of the risk of nuclear weapons use differed from later historical assessments of that

risk? In what circumstances were contemporaneous assessments higher and lower than subsequent assessments?

- Do states other than the United States have a “nuclear taboo?”

Tannenwald argues that in the United States, at least, the use of nuclear weapons has become a “taboo;”⁶⁶ Paul argues that normative constraints on the use of nuclear weapons fall short of a taboo, even in the United States.⁶⁷ Case studies of other countries’ nuclear doctrine, behavior, and ethical or religious frameworks with regard to nuclear weapons can help establish what degree of “taboo-ness,” if any, there is in their attitudes regarding nuclear weapons. Countries that might be studied for this purpose include Russia, Pakistan, Israel, and China.

- How are the interactions of warning systems and decision-making processes in the past similar to and different from the likely interactions of such systems used by new nuclear powers with different technical capabilities and decision-making processes?

Here, the performance of Indian and Pakistani warning and decision systems in the Kargil crisis may be more representative of future risks than that of US and Soviet systems in Cold War crises.

- What has been the experience of previous attempts to lower the risks of nuclear weapons use? How effective have reliability and accident-prevention programs been, such as the sharing of PAL technology? Has the Moscow–Washington hotline established after the Cuban missile crisis been a success? How might this experience be relevant to new or developing hotlines with China and between India and Pakistan?

Conclusions

A famous quote often attributed to Yogi Berra notes that “it is tough to make predictions, especially about the future.” When it comes to assessing the risks of nuclear weapons use, even developing a confidence interval or an upper bound of past risks is difficult. Yet the dozens of past close calls give us clues to the lower bound of such risks, and to the paths through which they have arisen and might arise in the future. Also, although

ongoing trends will affect which paths from the past are more or less likely in the future, assessing this relationship will require the input of many experts. What is clear is that the case-study research agenda and the most relevant cases for assessing future risks are different from what they were during the Cold War, an era that still characterizes most of the research on nuclear risks. A new research agenda on nuclear risks is needed, and an essential component of that agenda is closer study of those cases from the past that are most relevant to future risks.

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