NUCLEAR U-TURNS
Learning from South Korean and Taiwanese Rollback

Rebecca K. C. Hersman and **Robert Peters**

The decisions to abandon the pursuit of nuclear weapons by South Korea and Taiwan represent two of the most important cases of nuclear rollback during the Cold War. The cases differ in significant ways: While Taiwan's rollback emphasized capability reductions, South Korea's nuclear rollback mainly reflected changes in intent. One similarity was that despite their precarious security environment, both reversed their nuclear programs in the face of tremendous U.S. pressure. The United States is likely to remain central to these states' future nuclear narratives to ensure that they do not restart their programs. Changes in the threat environment, shifts in relations with the United States, or the belief that no one is watching could produce worrisome policy shifts in Seoul and Taipei. Several key questions for examination include: Why did they suspend their nuclear weapons programs? What specific pressures influenced rollback? How important was Washington in the process? How significant were the reversals? What could induce them to restart the programs? Understanding Seoul's and Taipei's decision-making is crucial to understanding rollback writ large. Failure to do so may invite an era in which the long-feared "nuclear dominoes" may fall.

KEYWORDS: Nuclear rollback; South Korea; Taiwan

South Korea and Taiwan's decisions to give up the pursuit of nuclear weapons represent two of the most important cases of nuclear rollback during the Cold War.[1] Despite their dangerous neighborhood and precarious security environment, these two U.S. allies reversed their nuclear programs in the face of tremendous American pressure. These cases highlight the importance of the United States in influencing nuclear rollback decisions, especially among U.S. allies and partners. However, today both countries continue to face grave threats and uncertain futures—raising questions about not only their nuclear past, but also their nuclear future. Why did these countries suspend their nuclear weapons programs? What specific pressures did the United States exert to influence nuclear rollback? How important was Washington in shaping Taiwanese and South Korean decisionmaking? How significant were the reversals, and to what degree did they roll back? Are those reversals permanent? What could induce Taipei and Seoul to restart nuclear weapons programs? Finally, what do these cases teach us about managing other cases of proliferation?

While the nuclear weapons ambitions of both South Korea and Taiwan have lain dormant upwards of two decades, rollback in these two countries is not simply a matter

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for the history books. Both countries' commitment to nonproliferation appears strong, but vigilance is in order. Either country could restart its program relatively quickly, and shifts in capability or intent to develop nuclear weapons could escape detection. The history of rollback in these two countries emphasizes the central role of the United States, both in motivating these countries to pursue nuclear weapons as a hedge against a perceived weakening of American commitment to their security, as well as in pressuring them to forego pursuit of these weapons. The United States is likely to remain central to the future nuclear narrative of these states, whether through actively monitoring and tracking any changes in their nuclear aspirations; maintaining strong, stable, and predictable security commitments; or remaining engaged with these allies as they wrestle with the security challenges, most notably North Korea, that dominate the region.

South Korea

The 1954 Mutual Defense Treaty between the United States and the Republic of Korea (ROK) committed the United States to the defense of South Korea and, by implication, extended the U.S. nuclear umbrella to the Korean Peninsula.[2] Leaders in Seoul welcomed this protection, as states far more powerful than theirs surround it. The Soviet Union, the People's Republic of China (PRC), North Korea, and, to a degree, even Japan, all posed potential security threats to South Korea. Relations with the North Koreans were particularly troublesome. During the 1960s and 1970s, several events demonstrated North Korea's aggressive nature, including multiple failed assassination attempts against South Korea's president (one killed the first lady) and commando raids in the South (including one against the presidential mansion). Other North Korean provocations included the downing of an EC-121 reconnaissance plane, the capture of the USS *Pueblo*, the killing of two American soldiers within the demilitarized zone, the digging of tunnels underneath the demilitarized zone, and diplomatic moves that hinted at a possible second invasion to unify the Korean Peninsula.[3] Too small to shape its security environment, South Korea's defense strategy was largely reactive and based on a strong American presence on the peninsula.

Protected by the United States, Seoul engaged in an ambitious program of economic expansion in order to increase its relative strength in the region. In 1957, virtually bereft of natural sources of energy, South Korea joined the International Atomic Energy (IAEA) in preparation for a nuclear power industry. It established the Office of Atomic Energy in 1959, and its first research reactor began operating in 1962. Under the protection of U.S. conventional and nuclear forces, South Korea had little incentive to develop an indigenous nuclear weapons program. By most accounts, however, the 1969 announcement of the Nixon Doctrine, which emphasized the importance of an increased role for self-defense amongst the Asian allies, shook South Korean confidence in its security relationship with the United States and triggered an interest in nuclear weapons.[4]

In 1970, the United States began negotiating with the authoritarian South Korean government for the withdrawal of some U.S. forces from Korean soil. Over the next few years, the United States withdrew 24,000 American troops from South Korea. This reduction, followed by the 1972 U.S. rapprochement with the People's Republic of China,

cemented Seoul's view that it would soon be responsible for its own security and fueled support for a covert nuclear weapons program. Additionally, despite the continued presence of the U.S. 2nd Infantry Division and several hundred American nuclear weapons in South Korea,[5] some in Seoul believed that Washington's perceived weakening commitment to Taiwan foretold things to come for Korea.[6] To make up for the reduction of U.S. troops, the White House authorized $1.5 billion to South Korea over a five-year period to modernize its military. But when the United States did not provide the funds within the original timetable, Seoul again had reason to question the credibility of the American commitment to its security.[7]

Faced with growing uncertainty about the U.S. security commitment, in 1970 Seoul created the Weapons Exploitation Committee, an organization designed for the covert development of modern weapons to bolster South Korea's defenses. This group recommended to South Korean President (and dictator) Park Chung Hee that the South develop a nuclear weapons capability.[8] The Weapons Exploitation Committee and the Agency for Defense Development quickly designed a program that sought to acquire a variety of nuclear technologies and reactors. In 1970, Korea began constructing a light water reactor and initiated a clandestine weapons research effort. In 1975, France agreed to sell South Korea a plutonium reprocessing plant, and Canada contracted to supply a CANDU heavy water reactor. Such technologies, once put into operation, would have provided South Korea with the ability to produce fissile material. Additionally, it probably would not have had problems developing a workable weapons design. One scholar has pointed out that South Korea's scientists "were viewed as already possessing the theoretical knowledge and technical expertise to build nuclear explosives."[9]

By the summer of 1975, statements by various Korean officials (including Park) hinted that South Korea would and could develop nuclear weapons if the United States removed its nuclear umbrella.[10] The White House, surprised by India's 1974 nuclear test, had been closely monitoring potential clandestine developments on the peninsula, and the Central Intelligence Agency (CIA) had been gathering intelligence from South Korean nuclear physicists.[11] Based on the intelligence gathered and by the nature of the Korean purchases, American officials concluded that South Korea was indeed engaged in a clandestine weapons program.

This discovery prompted Secretary of State Henry Kissinger to pressure Park to abandon the program; the pressure included the threat of withdrawing all American forces from the peninsula.[12] The Ford administration also hinted at potential economic pressures. As the United States was South Korea's largest trading partner and held billions of dollars of its foreign debt, Washington could have inflicted tremendous economic pain on Seoul.[13] Further, Washington intervened directly in the sales of the reprocessing plant and reactor and convinced France and Canada to cancel their deals.

South Korea was still several years away from having a nuclear weapon. Mitchell Reiss points out that had the United States then terminated the security relationship with Seoul, South Korea would have lost both conventional and strategic deterrence, thereby weakening its position in relation to North Korea—at least in the short run.[14] With access to nuclear fuel supplies, the nuclear umbrella, and ultimately the entire bilateral relationship at stake, South Korea eventually succumbed to U.S. will, suspending its

nuclear weapons research program and signing the Treaty on the Non-Proliferation of Nuclear Weapons (NPT).[15] Despite its ratification of the NPT in 1975, Seoul continued to modernize its nuclear power industry and to engage in modest weapons-related research through 1976. After Seoul officially terminated the program, the United States again stated its support for and security guarantee to South Korea.

Just a few months later, during the 1976 U.S. presidential campaign, candidate Jimmy Carter promised to withdraw all U.S. ground troops and nuclear weapons from South Korea by 1982—yet again shaking confidence in the security relationship and encouraging pro-nuclear forces within South Korea. Many Koreans drew parallels between potential consequences of a U.S. withdrawal and the series of events from a quarter-century before.[16] Additionally, assertions that U.S. naval and air support could effectively support a South Korean defense of the peninsula rang hollow to South Koreans, who had recently seen U.S. air power fail to ensure victory in Vietnam.[17] Following President Carter's March 1977 announcement to carry out his promise, in May 1977 Seoul stated that it would only forego its efforts to build a nuclear arsenal if President Carter reneged on his decision.[18] During this period, the ROK restarted its dormant weapons design program and expanded upon its previous work, including development of an indigenous reprocessing and enrichment capability.[19] Following Carter's 1978 assertion that he would not remove troops from the peninsula, Seoul slowed its weapons research efforts.

The next four years were characterized by political instability resulting from Park's assassination, a series of coups, and declarations of martial law, but the nuclear weapons program continued to operate, albeit on a lesser scale. South Korea retained a small weapons design staff and conducted small-scale successful chemical uranium enrichment and plutonium separation experiments until 1982.[20] The South apparently also experimented intermittently with enrichment technologies as recently as 2000, using laser isotope separation to enrich a small amount of uranium to 77 percent.[21] Despite such nuclear "dabbling," by most accounts South Korea has not had an active weapons program in more than two decades.

Today, South Korea has a technically advanced nuclear power industry. The ROK's explosive economic and industrial growth over the past 30 years has made it one of the most developed states in the world. It maintains a highly advanced civilian nuclear power industry and research capabilities, with 20 nuclear reactors producing almost 17,000 megawatts electric (MWe); over the next decade, eight more reactors producing an additional 9,200 MWe will come online.[22]

Many U.S. analysts believe that this industry, combined with South Korea's sizable number of highly trained engineers and scientists, gives the South a robust capability to produce nuclear weapons. Therefore, should Seoul reconsider its nuclear weapons future, it could probably restart a program fairly quickly. Additionally, some segments of the South Korean government and population believe that an independent nuclear capability would provide more autonomy on the world stage and greater advantage when dealing with the United States. These groups support those who view a South Korean nuclear arsenal as being the best way to guarantee security in the emerging strategic landscape.

Politically, however, there are substantive differences between contemporary the ROK and the entity that existed in the 1970s. South Korea has been a democracy since

1988, when a new constitution embracing rule of law and democratic principles went into force. The political openness and greatly reduced military influence on politics that now characterize South Korea may inhibit secret military efforts to develop a nuclear arsenal but do not automatically rule out a potential nuclear future for the country.

Taiwan

A post-civil war partition left Communist forces in control of mainland China, and the remnants of the Nationalist forces with tiny Taiwan from 1949. The PRC's overwhelming military superiority drove the authoritarian leaders in Taipei to ally with the United States at the outset of the Cold War, resulting in a 1954 Mutual Defense Treaty that committed the United States to the defense of the island—a de facto U.S. security guarantee.[23] In fact, the U.S. commitment to Taiwan went so far as to include the stationing of nuclear-capable weapons on Taiwanese territory in the 1950s.[24]

The Chinese detonation of a nuclear weapon in 1964, however, shocked the Taiwanese leadership and raised serious concerns about the island's prospects for continued autonomy. Taiwan's leaders quickly called for preemptive U.S. action against the nascent Chinese nuclear program. Tensions across the Taiwan Strait rapidly rose, with Taiwanese leaders realizing that the PRC could conceivably annihilate nationalist forces in a sudden strike against the small island. By 1967, the absence of U.S. military action to neutralize the Chinese nuclear arsenal, combined with America's preoccupation with Vietnam, spurred the Taiwanese defense ministry and a small number of senior advisors (including President Chiang Kai-shek's son and later successor, Chiang Ching-kuo) to propose an effort to develop a secret Taiwanese nuclear arsenal.[25] The $140 million price tag was at the time an enormous cost for the still developing island. The leadership named the weapons project ''Hsin Chu'' (after the city where the first nuclear research experiments took place) and put it under the authority of the Taiwanese Institute of Nuclear Energy Research (INER).

INER was located next to, and shared the same security forces and fences with, the Chungshan Institute, a military research and development center integral to the nuclear project. While Taiwan's Atomic Energy Council oversaw the ostensibly civilian nuclear power industry, a military officer from the Chungshan Institute involved in the nuclear weapons program served on the council's oversight board, further blurring the line between the civilian and emerging military program.[26] Additionally, many INER staff members were officers in the Nationalist Army. The authoritarian nature of Taiwan's Guomindang regime and the lack of independent media sources facilitated the clandestine nature of its weapons program, giving the state several years work on its program before raising outside attention.

In 1968, Taiwan joined the NPT as a non-nuclear weapon state, even negotiating a safeguards agreement with the IAEA at the same time it was initiating its secret weapons program. Interestingly, some Taiwanese claimed that Taiwan actually qualified as a nuclear weapon state under the NPT, due to the combination of the ''one China'' principle and mainland China's nuclear weapons, perhaps providing a legal justification for a future Taiwanese arsenal.[27] After it was expelled from the United Nations (UN) in 1971 (following

the UN recognition of the PRC as the legitimate government of China) and lost its IAEA membership, Taiwan developed a trilateral agreement with the United States and the IAEA for inspections of nuclear facilities on its soil. The agreement treated Taiwanese nuclear material as though it were American nuclear material, thereby giving the United States de facto responsibility for Taiwan's status as a non-nuclear weapon state.[28]

By the early 1970s, the Taiwanese, like the South Koreans, feared that President Richard Nixon's new relationship with and later recognition of the PRC might undermine America's commitment to their country, thereby strengthening internal arguments for an independent nuclear capability. During this period, Taiwan purchased light water reactors and other nuclear technologies from the United States, West Germany, Canada, South Africa, France, and other nations, and the defense ministry began to pursue secretly a plutonium separation capability. In 1973, the island state began operating the same type of heavy water reactor that India used to produce fissile material for its 1974 nuclear detonation. By the mid-1970s, Taiwan was purchasing double the amount of fuel needed to operate its reactors and by 1978 had separated 30 kilograms of plutonium.[29] By 1973, the U.S. Embassy in Taiwan had noticed the large acquisitions of technology and uranium that had no overt corresponding research program. In 1974, the CIA concluded that Taiwan was engaged in a ''small'' nuclear weapons program.[30]

In the mid-1970s, the United States vetoed a Taiwanese proposal to Britain for the return of reprocessed Taiwanese fuel, demanding instead that Taipei send any such plutonium to America.[31] In 1975, President Chiang Kai-shek died, and his son Chiang Ching-kuo, long a proponent of a Taiwanese nuclear arsenal, succeeded to the leadership. Following inspections in 1975 and 1976, the IAEA suspected that Taiwan's nuclear ambitions might stretch beyond power production. In 1976, prominent Western media sources speculated on the possibility of a Taiwanese bomb and suggested that Taiwan might have a clandestine reprocessing capability to extract plutonium for bombs.[32]

By the fall of that year, the PRC began to have serious concerns over the possibility of a Taiwanese weapon. In a conversation between representatives from the PRC and Australia, a Chinese official accused the United States of assisting Taiwan in its pursuit of nuclear weapons, saying that the PRC would hold Washington responsible if Taiwan became a nuclear power.[33] After Chiang Ching-kuo publicly indicated that his country could produce nuclear weapons, the United States increased public and private pressure on Taiwan to end all nuclear weapons-related activities. Washington threatened to cut off all fuel supplies, demanded the return of all plutonium of U.S. origin, and hinted that Taipei's actions threatened to weaken the U.S. security guarantee and could result in a freezing of weapons sales to the island.

After a visit to Taiwan by specialists from Los Alamos National Laboratory confirmed American fears that Taiwan was serious about pursuing nuclear weapons, Washington increased pressure on Taipei. Not only did it require Taiwan to dismantle its reactor labs and reprocessing facilities, it also insisted on reducing Taiwan's ability to restart a weapons program through the return of U.S.-supplied plutonium, the conversion of Taiwan's main heavy water reactor to use low-enriched and natural uranium, and American control of the island's spent fuel.[34] Taiwan, relying on the United States to protect it against mainland China, acquiesced.

In 1979, one year after Chiang Ching-kuo became president, the United States formally recognized the PRC and terminated its Mutual Defense Treaty with Taiwan, replacing it with the 1979 Taiwan Relations Act (TRA).[35] Under the TRA, threats to Taiwan's security were considered of ''grave concern'' to the United States, but the act left the U.S. formal ''security guarantee'' fairly ambiguous. In the years that followed, while Taiwan began a long process of democratization that eventually resulted in an end to martial law and the establishment of multiparty elections, the United States continued to reduce Taiwanese capabilities by demanding close inspections of nuclear facilities and the return of 80 kilograms of spent plutonium to the United States.[36]

However, Taiwan did briefly toy with a second nuclear program in 1987, when it began constructing new enrichment facilities. Thanks to a combination of intelligence sources, the United States quickly discovered the regenerated program and again pressured Taipei to abandon its nuclear weapons-related activities. After the 1988 death of Chiang Ching-kuo, Taiwan agreed to Washington's demands. At the time, U.S. intelligence officers believed that Taiwan was one to two years away from having a new weapons capability, even though the island state had not separated enough fissile material to produce a weapons core.[37]

Today, Taiwan is a functioning multiparty democracy with a vibrant economy. The first free election took place in 1996, and Taiwan is ruled by a center-left coalition with views far different from the authoritarian policies of the Chiang family. Estimates of Taiwan's nuclear capabilities are mixed. The island has six nuclear reactors producing almost 5,000 MWe, with two additional reactors of similar output under construction.[38] While most of the scientists involved with the original weapons programs are either retired or dead and the initial reactors that supported separation and enrichment experiments remain shuttered, Taiwan has a highly educated, engineering-oriented workforce and retains strong industrial and nuclear infrastructures. Taiwan could acquire or indigenously build other key components—such as centrifuges for fissile material processing—relatively easily. Should the country choose to pursue a nuclear weapons program, it could probably do so successfully and potentially clandestinely. As one scholar puts it, ''Much of the basic technology already exists on the island; it needs only a political directive to be put into motion.''[39]

The WMD Center's Nuclear Rollback Study

In October 2005, the U.S. National Defense University's Center for the Study of Weapons of Mass Destruction (WMD Center) initiated a major project to examine cases of nuclear rollback in the hopes of developing policy-relevant recommendations and insights designed to increase the prospects of future rollback success. Finding ways to measure, characterize, and compare rollback experiences in a consistent manner is critical to shaping and prioritizing future rollback decisionmaking as well as to measuring the effectiveness of those decisions over time.

During the study, researchers (including the authors) identified 18 states that experienced a voluntary, sustained reduction in either intent or capability to develop or maintain a nuclear weapons capability (see Table 1). These 18 cases of nuclear rollback

TABLE 1
Countries That Have Engaged in Nuclear Rollback

ARGENTINA	NORWAY
AUSTRALIA	ROMANIA
BELARUS	SOUTH AFRICA
BRAZIL	SOUTH KOREA
EGYPT	SWEDEN
INDONESIA	SWITZERLAND
ITALY	TAIWAN
KAZAKHSTAN	UKRAINE
LIBYA	YUGOSLAVIA

encompass a broad range of capabilities, durations, and historical timeframes, as well as a wide variety of geographic locations and political alliances. Some countries merely dabbled in the pursuit of nuclear weapons, pursuing modest research efforts before reversing course. Others developed, but ultimately gave up, fully constituted nuclear weapons. The nuclear rollback of all of these countries is considered both successful and voluntary. This is why North Korea, which experienced a possible reduction in capability and intent in the mid-1990s only to renege on its agreements, is not included. In addition, Germany and Iraq, whose nuclear ambitions were discovered and dismantled largely through the use of force, are not considered as part of this case set.

To augment information available in the literature, the researchers relied on an expert panel to evaluate the individual cases. In February 2006, the WMD Center conducted a workshop led by the authors with former senior U.S. policymakers and scholars with expertise in the field of WMD rollback. These experts provided assessments for each instance of rollback in three major areas: the intent and capability levels of each state at the time of rollback, the impact of various factors on rollback decisionmaking, and the 2006 capability and intent of each case along with that of 10 other states of proliferation concern.[40]

Understanding Rollback: The Cases of Taiwan and South Korea

As long-standing U.S. allies, both Taiwan and South Korea rely heavily on U.S. support and security guarantees to assure their security against militarily superior neighbors. Both are modern industrial and economic giants with resources and capabilities that far exceed those of 30 years ago. And both actively pursued and later abandoned nuclear weapons programs for similar reasons. It is hardly surprising that the nuclear rollback experiences of South Korea and Taiwan share many common elements. Yet the two states also differ in terms of the character of their rollback experiences as well as the prospects for reconsidering their nuclear options.

The rollback of Taiwan's nuclear weapons program unfolded during a time of dramatic change in U.S. relations with China—Taiwan's principle security concern. Despite its long-standing commitment to the island state, initially made manifest in a formal security guarantee, the United States regarded Taiwan's potential nuclear program as a

major threat to regional security and U.S. interests. Intelligence assets were closely trained on Taiwan's program, and the U.S. response to the discovery of secret nuclear activities was swift and strong. Rollback activities were heavily focused on efforts to reduce capabilities through the physical removal of potential sources of fissile material and conversion of reactors, thereby preventing the diversion of fissile materials and greatly complicating any effort to restart illicit nuclear weapons activities.

While Taiwan's rollback experience emphasized capability reductions, South Korea's nuclear rollback largely reflected changes in intent. Unlike Taiwan, South Korea's impetus for nuclear weapons stemmed less from changes in its immediate security environment than from changes in U.S. security commitments to the peninsula. For Seoul, nuclear weapons were considered a major bargaining chip with Washington and a counterweight to repeated threats of U.S. troop withdrawal. In this case, rollback activities focused more on engaging nonproliferation norms through the NPT, utilizing IAEA safeguards to ensure transparency of South Korea's nuclear activities, and exchanging diplomatic assurances between the two governments regarding their commitments to mutual security and nonproliferation.

South Korea and Taiwan: Answering Key Questions

How far did South Korea and Taiwan roll back? [41] At the peak of its nuclear ambitions, Taiwan had established a capability to produce and maintain modest stocks of fissile material. Rollback resulted in significant reductions in this capability, with Taiwan going so far as to eliminate its ability to produce fissile material. In addition, over the course of its rollback experience, Taiwan showed more significant reductions in weapons development and intent. South Korea's fissile material capabilities were somewhat more modest at the time of rollback and its rollback experience did little to further reduce these capabilities. As for intent, Taiwan was actively pursuing nuclear weapons at the program's peak and retreated to a ''passive hedge'' position following rollback—resulting in a substantial reduction. Assessments of South Korea's intent showed more modest and gradual reductions, moving from an ''active hedge'' to a ''passive hedge'' stance.

While both countries can be considered rollback ''successes,'' Taiwan's rollback reflects deeper reductions in both capability and intent. Although both states reduced their capability and intent levels following their decisions to roll back, the experts from the WMD Center workshop believe that today they both have higher capability levels due to expanded industrial and scientific infrastructures.

Why specifically did leaders in Seoul and Taipei forego weapons programs? [42] How important was Washington's role in fomenting rollback? Not surprisingly, the experts identified U.S. security guarantees and foreign pressure as overwhelmingly important factors influencing rollback decisionmaking in both Taiwan and South Korea. With the latter, the U.S. security guarantee was overwhelmingly important. Notably, with Taiwan, foreign pressure was the overwhelming factor, the U.S. security guarantee taking second place. This outcome probably reflects the changing status of the U.S. security guarantee for Taiwan during its rollback experience. Three other factors—impediment to development, net loss of security, and international standing—were either influential or

very influential in both cases. Most of the other factors were of limited or negligible influence.

These outcomes drive home the importance of the United States in both Taiwan's and South Korea's rollback decisionmaking. In Seoul and Taipei, which have both long received U.S. assistance and protection, nuclear decisionmaking has been closely tied to perceptions of and confidence in their security relationships with Washington. The United States used carrots and sticks to convince these allies to forego nuclear weapons. In the case of South Korea, the United States appeared to explicitly link its security guarantee to Seoul's decision to do so. In both cases, Washington stated that if Taipei and Seoul developed nuclear weapons, then the United States would revoke all its military, political, and economic aid. Based on the amount of economic aid and levels of trade those countries received via the United States, substantial economic pressure could have hamstrung their economies. Of particular sensitivity in both countries was the U.S. threat to end or curtail support for their civilian nuclear industries—support deemed critical for improved energy independence. Consequently, both countries slowed and eventually terminated weapons programs after robust applications of foreign pressure.

Nature and Character of Rollback

Taiwan's nuclear experiment spanned two decades and four different U.S. administrations. It took the United States almost nine years to uncover Taiwan's secret nuclear weapons activities (1967–1976). Another 11 years passed before Taiwan achieved a reliable and successful rollback of its nuclear ambitions. During those 11 years, the Taiwanese nuclear program went through numerous fits and starts, and Taipei intensified or abated the program according to perceptions about its strategic relationship with the United States, internal domestic dynamics, and changes in its security environment. The South Korean experience is similar. The United States did not discover South Korea's nuclear program until 1974, four years after it started. Rollback successes in 1975 and 1976, resulting from extensive U.S. pressure on Seoul, unraveled shortly after the change in U.S. administration and President Jimmy Carter's promise to reduce the U.S. presence on the peninsula. It was not until 1982, more than 12 years after initiating its program, that South Korea reliably relinquished its nuclear ambitions.

For South Korea and Taiwan, as well as most other countries in this study, nuclear rollback was a slow, complex effort. Moreover, as with most nuclear reversals, neither country followed a clear linear decline in intent or capability. Rather, nuclear rollback in these two countries more closely resembled a rheostat that could be dialed up or dialed down according to a variety of conditions and factors. Both Taiwan and South Korea preserved their options about committing to or giving up a nuclear weapons program until the last possible moment. Results from this study clearly support Ariel Levite's contention that "nuclear hedging" plays a very important role in nuclear rollback by offering intermediary decision points as the rollback process unfolds.[43]

2006 and Beyond: South Korea, Taiwan, and the Future Nuclear Landscape

Have South Korea and Taiwan given up their nuclear ambitions for good? What conditions, if any might spur these two countries to roll forward? Today, both South Korea and Taiwan face serious and persistent security threats. With strong and growing economies, a highly trained workforce, and a strong technology base, these countries have the human and economic resources necessary to support a nuclear program.

A 2006 snapshot of South Korean and Taiwanese capability and intent places both countries squarely in the passive hedge, medium-capability category. Such data, combined with an understanding of their reasons for pursuing nuclear weapons, suggests that the United States must remain engaged with Seoul and Taipei to ensure that neither country feels the need to attain an indigenous nuclear capability. Should South Korea or Taiwan feel that the U.S. security relationship is weakening and a nuclear weapons program is justified, they could develop a weapons capability in a relatively short period. Alternatively, either country might seek to enhance its hedging strategy and focus on creating a latent nuclear capability short of fully constituted nuclear weapons. Relatively small shifts in intent, consistent with a hedging strategy, could quickly catapult these two states into the ''danger zone,'' but with far less chance of detection.

In addition, technology creep is certain to enhance both states' nuclear capabilities and shorten the timetable for a nuclear weapons program—regardless of intent. While Seoul and Taipei reduced their capabilities following their decisions to roll back, their explosive economic and industrial development over the past 30 years has resulted in technology creep that actually increased their capabilities. Moreover, should either country choose to ''dial up'' its nuclear weapons-related activities, it is unclear how long it might take for the United States or the IAEA to uncover such activities and respond. The IAEA maintains inspections and safeguards at Taiwanese and South Korean power and research reactors, as well as at fuel fabrication and research and development facilities.[44] In 2001, the IAEA included both countries on a list of states in which it ''found no indication of diversion of nuclear material placed under safeguards or of misuse of facilities, equipment, or non-nuclear material placed under safeguards.''[45] Although the IAEA made this statement prior to South Korea's 2004 admission of uranium enrichment experiments carried out in 2000, the IAEA today considers South Korea to be a member in good standing. However, the fact that it took nine years to discover Taiwan's initial nuclear program and nearly four years to learn of South Korea's secret program does not inspire confidence that our information will be both timely and actionable.

Conclusion

The attention currently focused on North Korea and Iran, the proliferation ''tough nuts'' of 2006, is warranted, indeed imperative, but it is also problematic. By keeping the spotlight focused on Iran and North Korea, the United States also risks keeping too much of the rest of the nuclear landscape in the shadows and opening itself to dangerous surprise. As the South Korean and Taiwanese cases demonstrated, changes in the regional threat environment, shifts in relations with the United States, or the belief that no one is paying

attention could produce sudden and worrisome shifts in this landscape, for which most traditional tools of influence might be poorly suited. History reminds us that the nuclear landscape is a system of complex, interactive, and interdependent parts that can produce alternative futures depending upon how this system interacts with its environment over time.

Finally, what might induce South Korea and Taiwan to again pursue nuclear weapons? While today, the commitment of South Korea and Taiwan to nonproliferation seems strong, recent events in North Korea could cause them to reexamine their nuclear status. Further, the record of rollback in these states emphasizes the fact that nuclear rollback is a process, not an outcome or state of being—success in the past by no means assures success in the future. Rollback in South Korea and Taiwan is not ''over''—intent could change rapidly with little warning, sending these countries back into the ''danger zone.''

Moreover, for Seoul and Taipei, Washington is at the center of this rollback process. Perceived shifts in U.S. policy triggered increased interest in nuclear weapons in both Taiwan and South Korea. American intelligence and international monitoring were essential to exposing covert nuclear weapons activities, and U.S. pressure and security assurances were the overwhelming factors influencing rollback of these nuclear programs. Sustained U.S. attention, including close intelligence monitoring, will be essential to preserving success, especially in the face of ongoing technology creep. Failure to maintain attention might invite an era in which the long-feared scenario of ''nuclear dominoes''—when one state's decision to reconsider the role of nuclear weapons in its national security calculus sets off a cascade of such decisions in other states—ultimately comes to pass.

NOTES

1. This article is based on *Nuclear U-Turns: Lessons from Experience*, a forthcoming U.S. National Defense University publication by Rebecca K. C. Hersman and Robert Peters. Opinions, conclusions, and recommendations expressed or implied within are solely those of the authors and do not necessarily represent the views of the Dept. of Defense or any other U.S. agency.
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5. Hayes, ''The Republic of Korea and the Nuclear Issue,'' p. 52.
6. Pollack and Reiss, ''South Korea,'' pp. 261–262.
7. Reiss, *Without the Bomb*, p. 81.
8. Pollack and Reiss, ''South Korea,'', p. 262.
9. Reiss, *Without the Bomb*, p. 89.
10. Ibid., p. 93.
11. Pollack and Reiss, ''South Korea,'' p. 262.
12. Hayes, ''The Republic of Korea and the Nuclear Issue,'' p. 52.
13. Englehardt, ''Rewarding Nonproliferation,'' p. 32.
14. Reiss, *Without the Bomb*, p. 99.
15. Pollack and Reiss, ''South Korea,'' p. 263.
16. Reiss, *Without the Bomb*, p. 84.
17. Ibid., p. 84.
18. Englehardt, ''Rewarding Nonproliferation,'' p. 32.
19. Ibid.
20. Kang et al., ''South Korea's Nuclear Surprise.''
21. Ibid.; Mark Hibbs, ''77% U-235 Was Peak Enrichment Reported to IAEA by South Korea,'' *Nuclear Fuel* 29 (Sept. 27, 2005), p. 1, cited in Pinkston, *South Korea's Nuclear Experiments*.
22. World Nuclear Association, ''Asia's Nuclear Energy Growth,'' <www.world-nuclear.org/info/inf47.htm>.
23. ''Mutual Defense Treaty between the United States of America and the Republic of China,'' Dec. 2, 1954, terminated by the United States in 1980.
24. David Albright and Corey Gay, ''Taiwan: Nuclear Nightmare Averted,'' *Bulletin of the Atomic Scientists* (Jan./Feb. 1998), pp. 54-60; and Robert S. Norris, William M. Arkin, and William Burr, ''Where They Were,'' *Bulletin of the Atomic Scientists* (Nov./Dec. 1999), pp. 26–35, <www.thebulletin.org/article.php?art_ofn=nd99norris_024>. For further discussion on the Taiwanese rollback, see: U.S. Dept. of State, ''Memorandum from Burton Levin, Office of Republic of China Affairs, to Oscar Armstrong, Deputy Assistant Secretary for East Asian Affairs: PRCLO Comment on Taiwan Nuclear Development,'' Oct. 12, 1976; Leonard S. Spector, *Nuclear Proliferation Today* (Cambridge, MA: Ballinger, 1984); Ariel E. Levite, ''Never Say Never Again: Nuclear Reversal Revisited,'' *International Security* 27 (Winter 2002/2003); ''Taiwan Profile,'' Nuclear Threat Initiative Web Site, <www.nti.org/e_research/profiles/Taiwan/>; and ''Asia's Nuclear Energy Growth:

August, 2005,'' World Nuclear Association Web Site, <www.world-nuclear.org/info/inf47.htm>. In particular, see the excellent article by Derek J. Mitchell, ''Taiwan's Hsin Chu Program: Deterrence, Abandonment, and Honor,'' in Campbell, Einhorn, and Reiss, *The Nuclear Tipping Point*, pp. 293–313.

25. Albright and Gay raise the possibility that Taiwan might have been interested in nuclear weapons as early as the 1950s. See ''Taiwan: Nuclear Nightmare Averted,'' p. 55.
26. Mitchell, ''Taiwan's Hsin Chu Program,'' p. 298.
27. For a more in-depth discussion on this subject, see Mitchell, ''Taiwan's Hsin Chu Program,'' p. 297.
28. Ibid., pp. 297–298.
29. Albright and Gay, ''Taiwan: Nuclear Nightmare Averted,'' p. 57.
30. Ibid.
31. Spector, *Nuclear Proliferation Today*, p. 343.
32. Ibid.
33. Dept. of State, ''PRCLO Comment on Taiwan Nuclear Development.''
34. Albright and Gay, ''Taiwan: Nuclear Nightmare Averted,'' p. 59.
35. ''Taiwan Relations Act,'' Public Law 96-8, 96th Congress. Effective Jan. 1, 1979.
36. Mitchell, ''Taiwan's Hsin Chu Program,'' p. 300.
37. Ibid.
38. World Nuclear Association, ''Asia's Nuclear Energy Growth.''
39. Mitchell, ''Taiwan's Hsin Chu Program,'' p. 303.
40. Seth Carus, Avner Cohen, David Cooper, Lewis Dunn, Torrey Froscher, Peter Lavoy, Charles Lutes, Daniel Poneman, Brad Roberts, Lawrence Scheinman, Steven Schleien, Paul Schulte, and Etel Solingen constituted the group of experts.
41. The expert group workshop reflected these different dynamics in its results. First, the experts evaluated fissile material access, weapons development, and missile delivery systems to produce a composite capability ''score'' at two points in time—the pre-rollback peak and the post-rollback low. Next, participants assessed the intent of both Taiwan and South Korea with regard to their nuclear activities by placing the countries in one of four categories: rejection, passive hedge, active hedge, and active pursuit. To help guide this assessment, the study team provided a list of potential indicators of intent, including: maintaining secret/parallel programs, a lack of programmatic transparency, violations of IAEA safeguards, military involvement in nuclear activities, degree and nature of governmental or public debate in the country about a nuclear arsenal, standing as NPT members, and the retention of capabilities lacking conventional or civilian applications. Finally, the experts scored each country's present-day intent and capability levels to give a 2006 snapshot of current nuclear weapons intent and capability. Using results from that workshop, the authors mapped the movement of the South Korean and Taiwanese capability and intent levels from the height of their program to their post-programmatic low.
42. During this literature review, the study team identified 15 major factors that influence a state's rollback decisionmaking: the cost; whether it is an impediment to foreign trade, investment, assistance, and internal development; a failure to progress; net loss of security; reassessment of threat; perceived lack of military utility; U.S. security guarantee;

bureaucratic opposition; loss of military support; personal leadership; domestic acceptance of global nonproliferation norms; desire for international standing; strengthened inspection and verification; foreign pressure; and regime change. While many factors appeared in several different cases, the lack of uniform definitions and inconsistent application of these factors made it difficult to determine their relative importance across a wider set of cases. The study team developed and defined a uniform set of factors, encompassing most major factors identified from the literature. During the workshop, the study team asked the participants to evaluate the influence of each of 15 factors for each of the cases. Participants assessed each factor on a scale of zero (not influential at all) to five (overwhelmingly influential).

43. Levite, ''*Never Say Never Again*,'' p. 59.

44. *2004 Annual Report*, International Atomic Energy Agency Web Site, <www.iaea.org/Publications/Reports/Anrep2004/index.html>.

45. International Atomic Energy Agency, Press Release, ''IAEA Board Reviews Record of Safeguards Implementation,'' <www.iaea.org/NewsCenter/PressReleases/2001/prn0114.shtml>.