SCIENCE & DIPLOMACY

A quarterly publication from the AAAS Center for Science Diplomacy

E. William Colglazier "War and Peace in the Nuclear Age," *Science & Diplomacy*, Vol. 6, No. 4 (December 2017). http://www.sciencediplomacy.org/editorial/2018/war-and-peace-in-nuclear-age

War and Peace in the Nuclear Age

E. William Colglazier

My lifetime overlaps almost exactly with that of the Nuclear Age. As the two of us enter our eighth decade, it is reassuring that the devastating use of nuclear weapons has not been repeated. Following the end of the Cold War, I did not worry so much about the likelihood of a nuclear crisis that could potentially destroy the world as we know it. The recent confrontation with North Korea[1] has, however, reminded me that our number-one priority must be preventing nuclear weapons from ever being used again. How to do that consistent with protecting our nation and contributing to a peaceful world is the challenge.

Like many of my generation, my own personal and professional life has been affected by the disruptive threat and enormous implications of the Nuclear Age. When the atom bomb was dropped at the end of World War II, my father was an army officer on a ship in the Pacific preparing for the invasion of Japan. In October of 1962, my college classmates and I thought we might die during the Cuban Missile Crisis. Much of my subsequent involvement with science and international affairs was initially inspired by distinguished scientific mentors who spent much of their time outside science working to prevent further use of nuclear weapons.[2] "Science diplomacy" really began with the issue of nuclear weapons.

E. William Colglazier is the editor-in-chief of Science & Diplomacy.

For two decades after I had completed graduate school in physics, I worked on nuclear issues, among other areas in science policy.[3] As a university professor, the course I most enjoyed teaching was an elective—co-taught with a religious studies professor—titled "War and Peace in the Nuclear Age." In recent decades, my focus has been primarily on other aspects of science policy and science diplomacy.[4] The current political crisis with North Korea, though, has caused me to reexamine what I had learned, and perhaps forgotten, concerning war and peace in the Nuclear Age. I believe the focus of everyone—scientists, politicians, and diplomats—has to return to the nuclear challenge. We can learn much about how to proceed by reviewing the history.

The First Two Decades: 1945–1965

The university course I co-taught began with the sobering documentary *The Day after Trinity*,[5] which tells the story of J. Robert Oppenheimer and the scientists working on the Manhattan Project. It remains well worth viewing today. With the focus on winning the war and building the atom bomb, only a few scientists involved in the project thought deeply about the long-term implications prior to the Trinity test, the first of its kind, which occurred in the New Mexico desert in July 1945. An effort was made by two groups with the Franck Report and the Szilárd petition to press for demonstration of the enormous destructive power of the bomb before using it, but the government did not seriously consider this option.[6]

After presenting the many arguments offered retrospectively for and against dropping the bomb, we asked the students to evaluate these arguments and make their own judgment. Many years later, as executive officer of the National Academy of Sciences (NAS), I had the opportunity to visit the Hiroshima Peace Memorial Park. The NAS, an independent, nongovernmental American scientific organization, has partnered with Japanese scientific organizations since 1946 at the request of their governments to follow the health effects of the Hiroshima and Nagasaki survivors and their children.[7] Anyone who has visited the Peace Park and Museum cannot help but be deeply affected.

The lesson I gradually absorbed regarding the decision to drop the bomb was counter to what I previously thought. I ultimately concluded that any American president during World War II would have made the same decision as Truman. The priority of ending the war quickly by using a new weapon to which enormous resources had been devoted, and that would spare American casualties incurred in an invasion, made it almost impossible politically for a president to decide differently. That realization makes it absolutely clear to me that we must avoid a future situation in which a political leader feels he or she has no choice or that the decision is preordained. In my view, there is only one justification for having

nuclear weapons, and that is to decrease rather than increase the risk of nuclear war. In the current world-security structure, survivable nuclear weapons systems that pose the threat of retaliation are seen as necessary to deter a preemptive nuclear attack.

During the first decade after Trinity, the Soviet Union tested the atom bomb, and both superpowers developed the far more destructive hydrogen bomb (H-bomb). Oppenheimer opposed the development of the H-bomb, but approval was swift once the decision moved to the military and political levels.[8] The Korean War occurred during this weapon's development. The grim conflict, initiated by the North invading the South, resulted in the United States and its allies fighting Chinese as well as North Korean troops. In an interview after the armistice, General Douglas MacArthur said he had wanted to drop atom bombs on enemy bases but never formally recommended this action.[9]

The United Kingdom, France, and China later joined the two superpowers as nuclear weapons states. The reality of deterrence through mutually assured destruction emerged, eventually resulting in the triad of delivery systems—bombers, land-based intercontinental ballistic missiles (ICBMs), and submarine-launched ballistic missiles (SLBMs).

The greatest near-catastrophe during this two-decade period was the Cuban Missile Crisis, when the real possibility existed of a nuclear exchange. Analyzing this crisis retrospectively, as has been done by scientists and historians in the United States, Russia, and Cuba, makes clear that the existential danger was even starker than viewed at the time. The nuclear weapons in Cuba were armed, U.S. generals recommended launching an attack on Cuba, Fidel Castro argued for pre-emptive use of Soviet nuclear weapons on the U.S. if Cuba were attacked, and a Soviet submarine captain was dissuaded from using a nuclear torpedo on ships of the U.S. quarantine.[10]

Any number of missteps—including some that might have seemed reasonable in a crisis—could have triggered an initial exchange. Without active countermanding leadership, that could easily have led to a full nuclear war. President John F. Kennedy and Premier Nikita Khrushchev were able to walk back from the brink with a quiet deal to remove Soviet missiles from Cuba and American missiles from Turkey. The people of the world will forever be grateful to these two political leaders. The world has never been closer to nuclear war.

The Second Two Decades: 1965–1985

A rapid buildup in nuclear weapons occurred during this twenty-year period, with the United States holding more than 30,000 weapons in its arsenal by 1966 and the U.S.S.R possessing more than 45,000 by 1986.[11] U.S. nuclear strategy was based not on a minimal deterrent posture, but rather on a counterforce doctrine and a strategy of escalation dominance. American theater nuclear weapons were stationed in Europe to counter perceived superiority of conventional and nuclear forces from the Warsaw Pact, as the communist-aligned countries were known. The United States had a list of more than 100,000 targets in the Warsaw Pact and China. Nevertheless, deterrence continued to be a reality in preserving an unfriendly peace between the superpowers.

Arms control treaties began to emerge, first with the Partial Test Ban Treaty in 1963 and the Nuclear Non-Proliferation Treaty in 1968. The SALT I Treaty,[12] which limited strategic ballistic missile launchers (ICBMs and SLBMs), was signed in 1972. Also signed in 1972 was the Anti-Ballistic Missile (ABM) Treaty, which was advanced on the argument that an attempt to develop robust defenses against ICBMs would be destabilizing. Deterrence would be greatly weakened if either the Soviets or Americans were perceived to be able to launch—or threaten to launch—a first strike without fear of a successful retaliatory nuclear attack. The Threshold Test Ban Treaty was signed in 1974, and SALT II with its limits on warheads and long-range delivery systems was signed in 1979 but never ratified by the U.S. Senate.

India became a nuclear weapons state with a "peaceful nuclear explosion" in 1974. Israel did so covertly without declaring its status, and Pakistan probably had nuclear weapons by the mid-1980s. Nevertheless, the proliferation of nuclear weapons states moved slowly. South Africa had developed nuclear weapons but later voluntarily dismantled these weapons and its program. Other countries that had pursued nuclear weapons programs decided to forgo them, a success largely attributed to diplomacy and the NPT.

Technologies continued to progress, presenting opportunities and challenges for military planners. The United States sought to utilize highly accurate smart weapons, smart sensors, and stealth technologies to offset Warsaw Pact forces. In the nuclear realm, air-launched cruise missiles, multiple independently targetable reentry vehicles (MIRVs), Trident submarines, stealth bombers, and mobile land-based ICBMs were either in advanced development or being deployed.

The Strategic Defense Initiative (SDI), or Star Wars proposal, of the Reagan administration was promoted to develop U.S. defenses against Soviet nuclear weapons. Its logic was counter to that of the ABM Treaty, and critics saw SDI as

destabilizing and weakening deterrence. Moreover, many technical experts viewed strategic ballistic missile defense systems being developed by the United States as ineffective and easily overwhelmed with countermeasures. SDI did pose an unprecedented technological and strategic challenge to the Soviet Union, though, which ratcheted up Cold War tensions.

In 1983, in the book *Living with Nuclear Weapons*, the Harvard Nuclear Study Group examined the central question of whether nuclear war is inevitable in a world of deterrence.[13] The solution offered by the six authors from the natural and political sciences was for nations to take continual steps to reduce the risk of nuclear war. With enough time and gradual efforts to transform political relationships, even a long-term goal like nuclear disarmament might become possible. Their argument was encapsulated in this key sentence: "Living with nuclear and conventional weapons will require deliberate efforts to make sure that in a crisis, the existence of certain weapons, or the presence of armed forces, does not tempt a party to attack, or set in motion a mechanism that leaves little leeway for diplomacy, or make restoration of peace more difficult if war breaks out."[14]

Science diplomacy became one of the tools in the 1980s for discussion of nuclear security topics, including the thorny issues highlighted in the Harvard book. A series of nongovernmental engagements known as Track II diplomacy (nongovernment-to-nongovernment) included nuclear scientists, policy experts, and retired military leaders in the Committee on International Security and Arms Control (CISAC) of the U.S. NAS. The committee members had regular meetings with a similarly composed group of experts under the Soviet Academy of Sciences, and both sides briefed their governments.[15] Similar discussions were held under the aegis of the Pugwash Conferences on Science and World Affairs, which later shared in the Nobel Peace Prize in 1995, and the Center for International Security and Arms Control (now the Center for International Security and Cooperation) at Stanford University.

Influential Soviet scientists exposed to U.S. technical and strategic thinking through the dialogues pushed the Soviet government, especially the military and security services, to a new comprehension of strategic stability. These dialogues turned out to be enormously valuable when a "window of opportunity" for arms control and arms reduction emerged in the political and diplomatic spheres in the next decade.

Crossing the Millennium: 1985–2005

The 1986 summit between U.S. president Ronald Reagan and USSR general secretary Mikhail Gorbachev in Reykjavik, Iceland, was a seminal event of the Nuclear Age. Several of Gorbachev's key advisors on nuclear issues turned out to be Soviet scientists who had engaged in the Track II diplomacy, including as members and chair of the Soviet CISAC. At the summit with their foreign ministers, the two leaders "discussed dismantling all of their nuclear weapons—an agreement Reagan and Gorbachev both wanted but were unable to reach" because the Americans would not "limit the SDI program to the laboratory."[16] Even though their efforts were ultimately unsuccessful, the willingness of the superpowers to negotiate over elimination of nuclear weapons made this aspirational goal more than a pipe dream.

The next five years were also quite momentous. The United States and Soviet Union signed the Intermediate-Range Nuclear Forces Treaty in 1987, eliminating medium-range weapons in Europe. In 1989, the Berlin Wall fell, and in 1991 the Soviet Union dissolved. These events signaled an end to the Cold War and a greatly reduced risk of nuclear war.

An insightful book covering not only this twenty-year period but the whole Nuclear Age is *My Journey at the Nuclear Brink*, by former secretary of defense William J. Perry.[17] His personal involvement is quite extraordinary. He was a young American soldier during the occupation of Japan, a Silicon Valley entrepreneur developing intelligence technologies to spy on Soviet missile developments, an analyst of the photos showing covert installation of Soviet missiles in Cuba, and undersecretary of defense in the Carter administration, leading the development of smart sensors, smart precision weapons, and stealth technologies of the U.S. offset strategy. After his governmental service, Perry participated in Track II dialogues with Soviet scientists. All this was before his becoming secretary of defense in the Clinton administration.

The end of the Soviet Union created new challenges. Defense Secretary Perry and physicist Ashton Carter, another Track II dialogue participant, were instrumental in joint efforts with the Russians to remove nuclear weapons from other former Soviet states and in conceiving and implementing the U.S.-government-funded Nunn-Lugar program, named for senators Sam Nunn (D-GA) and Richard Lugar (R-IN). This latter effort was carried out in collaboration with the former Soviet weapons complex to meet treaty obligations to dismantle and destroy Soviet weapons of mass destruction and delivery systems, and to transition former Soviet weapons scientists to civilian pursuits.

Perry was also at the center of that era's nuclear crisis on the Korean Peninsula. In 1994, North Korea would not allow inspectors from the International Atomic Energy Agency to complete inspections of the nuclear reactor at Yongbyon, from which fuel could be removed and reprocessed to recover plutonium to produce nuclear bombs. The United States, in turn, updated its war plans, including the option of a preemptive cruise missile strike on the reprocessing plant. After a tense standoff, former president Jimmy Carter, serving as an envoy, relayed from Pyongyang the message that the North Koreans were willing to negotiate. The subsequent Agreed Framework resulted in suspension of reprocessing and reactor construction by North Korea in exchange for South Korea and Japan providing two light water reactors for producing electricity and the United States providing fuel oil.

In civilian life, Perry agreed to lead the North Korean Policy Review near the end of President Bill Clinton's administration. He also engaged senior North Korean military officials and hosted them in California. When President George W. Bush took office, he ended the U.S. government's dialogue with North Korea against the wishes of his secretary of state.[18] When the United States determined in 2002 that North Korea had a clandestine uranium enrichment program, both countries withdrew from the Agreed Framework. North Korea carried out its first nuclear test in 2006.

Perry continued to engage with North Korea through Track II diplomacy, and even attended the concert by the New York Philharmonic in Pyongyang in 2008. Nevertheless, the United States tightened sanctions, and North Korea kept up development of nuclear weapons and ballistic missiles. No other country has carried out nuclear testing since 1998.[19]

The September 11, 2001, attacks on the United States made even more urgent the priority of preventing terrorists from obtaining nuclear weapons. The detonation of a clandestine nuclear bomb in a major city would be beyond devastating. Making sure that does not happen has remained an overriding goal of all major powers.

In 2003, the U.S. government claimed the existence of WMD in Iraq and used this rationale for the invasion and overthrow of the Iraqi government. Needless to say, WMD were never found in Iraq. The inability of Iraq to deter the U.S. invasion, combined with the ultimate fate of Iraqi leader Saddam Hussein, most certainly caught the attention of North Korea.

Into the Future: 2005–2025

The aspirational goal of eliminating nuclear weapons was highlighted by George Shultz, Henry Kissinger, William Perry, and Sam Nunn in a remarkable *Wall Street Journal* editorial in 2007 and a follow-up in 2008.[20] The four retired statesmen advocated urgent steps to reduce the risk of nuclear war and to begin moving toward a world without nuclear weapons. Shultz, as secretary of state, had been with Reagan at Reykjavik in 1986.

In 2009, President Barack Obama delivered his famous Prague speech, stating "America's commitment to seek the peace and security of a world without nuclear weapons."[21] The president received the Nobel Peace Prize for which the selection committee lauded his vision.[22] He indicated in a meeting in 2010 with the four retired statesmen that their "views on nuclear weapons had guided his own thinking."[23] Soon thereafter, the U.S. and Russian presidents signed the New START treaty, pledging further reductions in nuclear arsenals.[24]

Sadly, the euphoria did not last. Yet even with the emergence of a new Cold War between the United States and Russia, deterrence has continued to check the possibility of nuclear conflict between the superpowers. On the other hand, North Korea accelerated under its new leader, Kim Jong-un, efforts to develop a nuclear arsenal and missile delivery systems, likely with help from Soviet missile designers. Even though the United States has successfully caused some problems for the missile program, it underestimated the pace of progress under the new leader. The fate in 2011 of Muammar Gaddafi, who had given up Libya's nuclear weapons program, was surely noted by North Korea.

The Iran nuclear deal in 2015 was a milestone in utilizing diplomacy to reduce the chance of nuclear conflict. It was also a triumph of scientists helping to advance diplomacy. The Iranian scientist and diplomat Ali Akbar Salehi, who heads that nation's Atomic Energy Organization, wanted an equal partner in knowledge of nuclear weapons issues to be involved on the U.S. side.[26] That resulted in the U.S. government selecting Secretary of Energy Ernest Moniz, a nuclear physicist, to join the negotiations. The two scientists were able to reach closure on technical aspects of the deal.

The North Korean development of a nuclear arsenal and delivery systems that could potentially threaten the U.S. mainland as well as South Korea and Japan has substantially raised the possibility of a disastrous conflict. Knowledgeable observers have even given large probabilities for the likelihood of war. I believe these frightening estimates are unrealistic, but they certainly get attention. Deterrence continues to apply even on the Korean Peninsula.[27] Nevertheless,

the estimates of hundreds of thousands of casualties if a war breaks out are not exaggerations.[28] The real danger is the possibility of the United States or North Korea taking preemptive action. I believe this would lead to total war, with both sides using all their military power.

Applying the Lessons of the Past

The prescription for avoiding nuclear war offered by the Harvard Nuclear Study Group is as relevant today as it was thirty-five years ago.[29] Following that advice obviously requires establishing a dialogue with the North Korean regime, no matter what we think of it. The bellicose rhetoric of the two heads of state has not been helpful. And both sides have issued preconditions for dialogue. Especially dangerous are redlines drawn in some of their comments and echoed by some senior military leaders. These comments have raised the risk of a serious miscalculation that could lead to war. While we continue to seek a diplomatic solution, we have no choice but to rely on deterrence to keep war from breaking out on the Korean Peninsula.

The active diplomacy of the U.S. government has been effective in securing international support for sanctions through the United Nations Security Council. This international body, which includes China and Russia, has implemented several rounds of increased sanctions on North Korea. The sanctions are intended to impose severe economic costs for continued testing of nuclear bombs and ballistic missiles. Convincing North Korea to enter into diplomatic negotiations with the United States has so far been unsuccessful, although the meeting of the North and South Korean governments in January 2018 regarding participation in the Winter Olympics gives some hope for broader engagement. If constructive dialogue does not happen soon, sanctions will likely be ratcheted up further and enforced more rigorously, and each side may persist in actions viewed as provocative by the other.

It is in times like this when Track II diplomacy by scientists might be most helpful. According to Western news reports, the scientists and engineers who lead the North Korean programs in nuclear weapons and ballistic missiles have an elevated status and many lifestyle privileges.[30] Their prominent presence in smiling photos with Kim appears to indicate that the leader values them highly. Offering a Track II dialogue with them that involves carefully selected prominent nuclear scientists and security experts from the United States could initiate a more serious dialogue. Perhaps the Chinese scientists who have been involved with American scientists from the U.S. NAS in Track II dialogues would be willing to extend an invitation and to host the first meeting.

The American side might include distinguished scientific leaders who have previously engaged with North Korea on nuclear issues, such as former Los Alamos National Laboratory director Siegfried Hecker. It could include a bipartisan group of experts who have served in Democratic and Republican administrations. Prominent candidates from Democratic administrations might include former secretary of energy Ernest Moniz and former secretary of defense Ashton Carter. The current secretary of defense, James Mattis, might be a source of names of experts who would be credible to the current U.S. administration. Even if the dialogues achieved nothing more than reinforcing deterrence and reducing the risk of actions that could be misinterpreted and lead to conflict, they would be well worthwhile. They might even accelerate serious governmental negotiations for seeking a permanent diplomatic solution to the standoff.

Endnotes

1. Democratic People's Republic of Korea (DPRK).
2. I worked for three distinguished scientists no longer alive who greatly inspired me as well as others with their efforts to reduce the threat of nuclear war. They were Paul Doty (1920–2011), founding director of the Center for Science and International Affairs at Harvard University; Wolfgang "Pief" Panofsky (1919–2007), former director of the Stanford Linear Accelerator Center (SLAC); and Sidney Drell (1926–2016), former deputy director and theory group head at SLAC.
3. After earning my undergraduate and graduate degrees in physics at the California Institute of Technology and completing a research fellowship at SLAC, I began working partly on nuclear issues, including as a postdoctoral fellow in physics at the Institute for Advanced Study, an AAAS Science and Technology Policy Fellow in Congress, a research fellow at the Center for Science and International Affairs at the Harvard Kennedy School of Government, and a physics professor at the University of Tennessee.
4. After 1991, I worked for twenty years at the National Academy of Sciences, three years at the U.S. Department of State, and since then part-time at the AAAS.
5. *The Day after Trinity* (1981) is available on YouTube: https://www.youtube.com/watch?v=Vm5fCxXnK7Y.
6. Richard Rhodes, The Making of the Atomic Bomb (New York: Simon & Schuster, 1986).
7. The Atomic Bomb Casualty Commission, created after the war, later became the Radiation Effects Research Foundation; see http://ns2.rerf.or.jp/index_e.html.
8. Richard Rhodes, *Dark Sun: The Making of the Hydrogen Bomb* (New York: Simon & Schuster, 1995).
9. "Texts of Accounts by Lucas and Considine on Interviews with MacArthur in 1954," New York Times, April 9, 1964, http://www.nytimes.com/1964/04/09/texts-of-accounts-by-lucas-and-considine-on-interviews-with-macarthur-in-1954.html?_r=0.
10. William J. Perry, My Journey at the Nuclear Brink (Stanford, CA: Stanford University Press, 2015), 1–5.
11. "List of States with Nuclear Weapons," available at *Wikipedia*, https://en.wikipedia.org/wiki/List_of_states_with_nuclear_weapons.
12. The acronym stands for Strategic Arms Limitation Talks.
13. Albert Carnesale, Paul Doty, Stanley Hoffmann, Samuel P. Huntington, Joseph S. Nye Jr., Scott D. Sagan (Harvard Nuclear Study Group), *Living with Nuclear Weapons* (New York: Bantam Books, 1983).
14. Ibid., 249.
15. The Committee on International Security and Arms Control (http://sites.nationalacademies.org/pga/cisac/index.htm) engages influential counterparts through its formal dialogues in Russia (since 1981), China (since 1988), and India (since 1999), and through projects and less formal interactions in other countries. It focuses on technical aspects of security issues at the frontiers of what the nations are able to explore on a government-to-government basis, seeking to inform

policy makers, promote mutual understanding, offer policy options, and lay the foundations for cooperation. Paul Doty and Wolfgang Panofsky were both members of CISAC. On January 19, 2011, CISAC and the U.S. Institute of Peace held a symposium with Russian and American scientists and diplomats titled "From Reykjavik to New START." The report on this event celebrating the work of CISAC is well worth reading: Micah D. Lowenthal, *Science Diplomacy for Nuclear Security*, special report (Washington, DC: U.S. Institute of Peace, 2011), https://www.usip.org/sites/default/files/SR_288.pdf.

16. Perry, 72.
17. Ibid.
18. Ibid., 168.
19. The Comprehensive Nuclear-Test-Ban Treaty was adopted by the UN General Assembly in 1996. China, Iran, Israel, and the United States have signed but not ratified the treaty. India and Pakistan did not sign the treaty and conducted tests in 1998.
20. George P. Shultz et al., "A World Free of Nuclear Weapons," *Wall Street Journal*, January 4, 2007, and "Toward a Nuclear-free World," Wall Street Journal, January 15, 2008. Physicist Sidney Drell helped draft the two op-eds. See also Philip Taubman, *The Partnership: Five Cold Warriors and Their Quest to Ban the Bomb* (New York: HarperCollins, 2012).
21. White House, "Remarks by President Barack Obama in Prague as Delivered," April 5, 2009, https://obamawhitehouse.archives.gov/the-press-office/remarks-president-barack-obama-prague-delivered.
22. "The Nobel Peace Prize for 2009," Nobelprize.org, https://www.nobelprize.org/nobel_prizes/peace/laureates/2009/press.html.
23. Perry, 186.
24. The original Strategic Arms Reduction Treaty (START) dates to the early 1990s.
25. David E. Sanger and William J. Broad, "U.S. Miscalculated the Nuclear Progress of North Korea by Years," *New York Times*, January 7, 2018, p. 1.
26. Richard Stone, "Iran's Atomic Czar Explains How He Helped Seal the Iran Nuclear Agreement," *Science*, August 12, 2015, http://www.sciencemag.org/news/2015/08/exclusive-iran-s-atomic-czar-explains-how-he-helped-seal-iran-nuclear-agreement.
27. Scott D. Sagan, "The Korean Missile Crisis," *Foreign Affairs*, November/December 2017, 72–82, https://www.foreignaffairs.com/articles/north-korea/2017-09-10/korean-missile-crisis.
28. Chetan Peddada, "A Sneak Peak at America's War Plans for North Korea," Foreign Policy, September 7, 2017, http://foreignpolicy.com/2017/09/07/a-sneak-peak-at-americas-war-plans-for-north-korea/; Jeffrey Lewis, "This Is How Nuclear War with North Korea Would Unfold," *Washington Post*, December 8, 2017, https://www.washingtonpost.com/outlook/this-is-how-nuclear-war-with-north-korea-would-unfold/2017/12/08/4e298a28-db07-11e7-a841-2066faf731ef_story.html?utm_term=.7048d9bcec60.
29. Carnesale et al., 232–55. Also worth reading for valuable insights are a recent book and three reviews. See Daniel Ellsberg, *The Doomsday Machine: Confessions of a Nuclear War Planner* (New York: Bloomsbury, 2017); Fred Kaplan, "Dr. Strangelove Was a Documentary," *Slate*, December 4, 2017; Graham Allison, "Is Nuclear War Inevitable?," New York Times, December 28, 2017; Thomas Powers, "The Nuclear Worrier," *The New York Review of Books*, January 18, 2018.
30. Choe Sang-hun et al., "Rocket Men: The Team Building North Korea's Nuclear Missile," *New York Times*, December 15, 2017, https://www.nytimes.com/interactive/2017/12/15/.../north-korea-scientists-weapons.html.