

A large, glowing yellow and orange nuclear mushroom cloud is centered in the lower half of the image. The cloud has a dense, billowing base and three distinct, flat, disc-like layers of smoke or debris floating above it. The background is a deep, dark red, suggesting a sunset or a fire. The overall tone is ominous and dramatic.

**CSBA**

Center for Strategic and Budgetary Assessments

# **THE THREE-BODY PROBLEM**

**NUCLEAR COMMAND, CONTROL,  
AND COMMUNICATIONS**

**ERIC S. EDELMAN**



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2026

## **ABOUT THE CENTER FOR STRATEGIC AND BUDGETARY ASSESSMENTS (CSBA)**

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Ambassador Edelman served as the vice chair of the National Defense Strategy Commission and was a member of the bipartisan board of directors of the United States Institute of Peace for 11 years.

## ACKNOWLEDGMENTS

I would like to express my gratitude for a decade plus of conversations with Thomas Mahnken and Evan Montgomery that have clarified the key issues associated with the problem of nuclear command, control, and communications (NC3). Franklin C. Miller, former senior national security official and a national treasure, provided extremely helpful comments and suggestions especially on the origin of the Single Integrated Operational Plan (SIOP) and Operation Looking Glass. Austin Long, now a senior nuclear fellow at the Center for Nuclear Security at MIT, offered invaluable advice on the evolution of nuclear predelegation in the late 1950s and early 1960s as well as other editorial suggestions that vastly improved this monograph. Eli Glickman, during his summer at CSBA, helped me condense the case studies, and my CSBA colleague Dao Tran was indispensable in coming up with a cover and conducted a terrific copy edit of the draft text. I alone, of course, am responsible for any errors of fact or interpretation.

CSBA receives funding from a broad and diverse group of contributors, including private foundations, government agencies, and corporations. A complete list of these organizations can be found on our website at [www.csbaonline.org/about/contributors](http://www.csbaonline.org/about/contributors).

**Cover graphic:** Castle Bravo nuclear test on March 1, 1954, at Bikini Atoll, Marshall Islands. Image from the National Oceanic and Atmosphere Administration (NOAA).

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# Executive Summary

The United States is rapidly moving into an unprecedented nuclear weapons reality in which it must confront the most complex configuration of questions about nuclear weapons it has faced since the onset of the nuclear age. This novel situation largely results from quantitative and qualitative changes in the composition of the nuclear arsenals of its great power rivals and the advent of new technologies whose potential interaction with nuclear weapons creates uncertainty about what has traditionally been regarded as strategic stability.

The development of Russian and Chinese capabilities that could threaten U.S. nuclear command and control are a particular concern. Both countries have tested direct ascent anti-satellite capabilities. Russia reportedly might detonate a nuclear weapon in space to disable U.S. satellites, including those used for early warning. China tested what appears to have been a fractional orbital bombardment system (FOBS) with a hypersonic glide vehicle warhead in 2021.

Although the development of these capabilities is not dispositive evidence that Moscow and Beijing intend to launch a nuclear attack on the United States, either separately or jointly, it does raise the possibility that one or the other or both might try to execute a decapitating nuclear attack, which represents the only plausible theory of victory in nuclear war. This prospect throws into stark relief the importance of modernizing not just America's nuclear forces but also its system of national nuclear command, control, and communications (NC3).

NC3 is the key enabler of any effort to incorporate nuclear weapons into a national defense strategy because it provides positive and negative control of a nuclear force. During the Cold War the United States was largely preoccupied with the threats presented by Soviet nuclear forces. Today, the United States must contend with the challenge of deterring two nuclear peers simultaneously as well as the fact that those peers are tightening their political-military cooperation. The potential that they might take joint, concerted action against U.S. nuclear forces further complicates the calculus of deterrence.

Strategic thought on how to maintain a stable nuclear balance and maintain deterrence during the Cold War was based on the notion that both sides needed nuclear forces that could ride out a nuclear first strike in order to retain sufficient forces to execute a retaliatory

second strike. With two nuclear peers, U.S. force planners need to consider how large a reserve force would need to be retained after a retaliatory strike to deter a potential second aggressor. Moreover, nuclear force planners need to consider, given the increasingly close ties between Russia and China, the potential for a joint attack by a combined nuclear force.

The question of what kind of adjustments to the U.S. strategic posture should be made in the face of the two-peer nuclear challenge is complicated. It will require a good deal of conceptual and analytical work before clear solutions emerge. But it took almost a decade and a half after the emergence of nuclear weapons during World War II before U.S. thinking about nuclear deterrence crystalized. The ongoing modernization of U.S. nuclear forces will be accompanied, necessarily, by modernization of NC3, which is sometimes referred to as the fourth leg or fifth pillar of the U.S. nuclear deterrent. Traditionally, NC3 has been given short shrift by students of nuclear strategy, but the growing strategic cooperation between Russia and China underscores the primacy of NC3 modernization in the face of a growing threat of nuclear decapitation.

## Chinese and Russian Nuclear Modernization

The emergence of the three-body problem has been driven by the People's Republic of China (PRC)'s dramatic and persistent modernization of its nuclear forces, which has enabled it to field new nuclear capabilities at a faster pace than at any time in its history. The increasing size of China's intercontinental ballistic missile (ICBM) force is a striking example of its move away from a minimum deterrent posture. The Chinese arsenal, which experts had estimated at roughly 200 warheads as recently as a few years ago, has expanded significantly. Today, China has roughly 600 warheads, and its arsenal is expanding rapidly. Department of Defense reports suggest that the PRC is on its way to possessing nearly 1,000 warheads by 2030 and likely 1,500 by 2035.

Perhaps the most disturbing parts of China's nuclear modernization are the combination of capabilities that it has tested in recent years and new information suggesting it is undertaking projects that would be associated with nuclear warfighting. Taken together, these ventures raise the danger that the PRC could develop a capability for nuclear decapitation that would reawaken anxieties that U.S. decision makers last experienced during the Cold War.

Russia's nuclear modernization, which has been underway for decades, is expected to be completed soon. In addition to modernizing its nuclear triad, Russia has also developed a suite of exotic nuclear weapons unveiled by Putin in 2018: the Sarmat ICBM, the Peresvet anti-satellite laser, the Avangard hypersonic glide vehicle, the Kinzhal air-launched ballistic missile, the Burevestnik nuclear-powered cruise missile, and the Poseidon nuclear-powered underwater vehicle. Most alarmingly, Russia appears to be developing a satellite that would carry a nuclear weapon in space.

Russia increased its reliance on nuclear weapons during the post-Cold War period because it had lost much of its conventional military capability. Astronomical Russian losses of troops and equipment in the war against Ukraine will take years to reconstitute. In the meantime, Russia's reliance on nuclear weapons will likely increase.

Both the PRC and Russia have developed a FOBS capability, and both have emphasized and tested ASAT capabilities. Both have historically invested in the development of deep underground command posts that would be suitable for fighting a nuclear war. Whether separately or because of collaborative nuclear planning, the existence of these capabilities raises concerns among U.S. policymakers about the potential for a decapitating nuclear first strike, concerns that have not been on the policy agenda in a serious way since the early 1980s.

## **U.S. Nuclear Modernization**

The United States is currently modernizing its triad of nuclear weapons systems: a new bomber (the B-21 Raider), the Sentinel ground-based strategic deterrent to replace the Minuteman III ICBMs, and the new Columbia-class nuclear-powered ballistic missile submarine (SSBN) to replace the aging Ohio-class submarines. The program is expected to cost \$946 billion over the next decade.

Despite being regarded by many experts as the fourth leg of America's nuclear arsenal, U.S. NC3 has traditionally received much less attention than the weapons and delivery vehicles it supports. In recent years, however, analysts have been sounding the alarm over a range of challenges that could decrease confidence in the viability of those systems.

Perhaps the single biggest source of strain on the NC3 architecture is age. After decades of deferred recapitalization, the NC3 architecture includes many systems that have remained in service long past their anticipated lifespans. Ultimately, an aging NC3 infrastructure raises concerns about the reliability and responsiveness of U.S. nuclear forces; that is, whether the options the president chooses will be available and can be executed when they choose them.

The U.S. program for NC3 modernization includes upgrades to ensure that national authorities can communicate with and control the new capabilities making up the U.S. strategic triad, including making the NC3 system more resilient against emerging counterspace and offensive cyber capabilities. Key elements include: upgraded early warning radars; the Space-Based Infrared System and its successor Next-Gen Overhead Persistent Infrared (OPIR); the Advanced Extremely High Frequency satellite constellation and its successor Evolved Strategic Satellite Communications (SATCOM); the Survivable Airborne Operations Center to replace the aging E-4B National Airborne Operations Center; and the Navy's effort to recapitalize its Take Charge and Move Out (TACAMO) aircraft for strategic connectivity with the ballistic missile submarine fleet.

## Case Studies on the History of NC3 During the Cold War

Although nuclear strategy frequently dominated policymakers' attention throughout the Cold War, NC3 was often neglected, except when heightened tensions and fears of technological breakthroughs raised the prospect of nuclear decapitation. This history identifies three throughlines relevant for NC3 modernization today: (a) NC3 capabilities tend to be under-resourced and neglected; (b) technological changes can rapidly outstrip NC3 amid ongoing modernization; and (c) high-level attention to NC3 was a precondition for modernization, but such attention tended to be episodic, emerging in the wake of crises that made the threat of decapitation strikes more salient.

In general, those periods of attention coincided with technological developments in the strategic arms competition that threatened the survival of U.S. nuclear forces and called into question the ability of the national command authority to survive the threat of a decapitating nuclear strike. The first instance was triggered by the launch of Sputnik and the development of ICBMs and submarine-launched ballistic missiles (SLBMs). The so-called missile gap and studies of how vulnerable U.S. Air Force bases were to preemption prompted Secretary McNamara to seriously consider whether the Soviet Union might be able to execute a nuclear strike that could knock out the U.S. national command authority and inhibit America's ability to respond with a devastating retaliatory blow.

The Carter and Reagan administrations devoted unprecedented senior leader attention to NC3. Brzezinski, Odom, and eventually Brown recognized that the ever-changing technology of nuclear weaponry and delivery systems made it especially challenging for those charged with NC3 systems to keep pace with developments. In particular, the advent of more accurate ballistic missiles, multiple independently targetable reentry vehicles (MIRVs) on warheads and the threat they presented to ICBMs, and the potential for a depressed trajectory SLBM that could execute a short-warning attack on the nation's capital prompted extensive work on NC3 modernization and continuity of government planning.

Because no one in the bureaucracy owned NC3 and because, as Odom pointed out to Brown, there was no connection between the guidance for employment of nuclear weapons and the system of defense acquisition, it should not be surprising that, without presidential-level attention, NC3 would suffer from neglect. Concerns about nuclear decapitation that arose from specific developments in nuclear weaponry could increase senior officials' attention to NC3, but ultimately it was direct observation and participation by senior officials, including the president, in rigorous NC3 exercises that were crucial to the small band of government officials who were determined to remedy ongoing U.S. vulnerabilities to nuclear decapitation.

## Conclusion

The United States is facing a novel and even more challenging version of the problems that past cohorts of policymakers confronted during the Cold War. The United States must now

simultaneously deter two nuclear peers—something it has never done. China and Russia are developing and deploying capabilities that could threaten the U.S. NC3 system. As a result, U.S. government officials are facing an issue that last bedeviled their predecessors some 40 years ago—the prospect of nuclear decapitation.

A nuclear decapitation attack would seek to eliminate the U.S. president and their designated successors in the national command authority and to degrade the NC3 system enough to prevent a U.S. retaliatory strike. The possibility of such a decapitation attack, however slight, is probably the only imaginable route to decisive victory in nuclear war. As the late Ashton Carter observed in 1985, even the best nuclear weapons and doctrine were useless if the nation's leaders did not have the ability to pierce the fog of nuclear war with situational awareness of impending attack, the means to make decisions, and the capability for orders to be executed in real time with precision.

The record of waxing and waning attention to NC3 issues demonstrated by the history recounted above suggests that support for NC3 modernization can diminish over time. These elements of the warning and assessment system and key communications links must be fully modernized and not be subject to budget reductions or reallocation of resources. In addition, some elements of the NC3 system demand special attention to ensure the survivability of the national command authority in the face of a decapitating strike.

First and perhaps most important, continuity of government and continuity of operations programs need to be thoroughly refreshed. The principal officers of government need to be fully briefed on all aspects of these plans and need to exercise them regularly. Exercising these capabilities and making the fact of the exercise public would reinforce deterrence by underscoring that the U.S. government will retain the ability to execute emergency action messages to its forces, come what may.

Finally, the survivability of the national command authority will rely in no small part on mobile alternative command posts, and their role will be critical to injecting doubt into Russian and Chinese calculations about the chances of a decapitating nuclear strike succeeding. The United States maintains a number of fixed sites as alternatives to the Pentagon's National Military Command Center. These sites, however, are well known to America's adversaries and would likely be targeted and destroyed in any nuclear decapitation attempt. Ever since the 1960s, the United States has invested in an airborne component of the NC3 architecture to provide a survivable command center. The U.S. Air Force is currently modernizing the E-4B National Airborne Operations Center through the Survivable Airborne Operations Center program. Meanwhile, the Navy is upgrading the TACAMO aircraft to extend their service life. Both programs ought to be resourced as fully as possible to keep them on schedule.

The challenge of deterring two nuclear peers at the same time is a problem that will challenge U.S. strategic planners for many years. If history is any guide, it may take as much as a decade to sort out the changes to U.S. nuclear posture that may be necessary to sustain and

reinforce the credibility of the nuclear deterrent. Ensuring that NC3 remains enduring and survivable and that programs to support it are fully funded so they can deliver upgraded capabilities on time should be regarded as low-hanging fruit and an easy first step for the nation's strategic planners and political leaders to take as they address the longer-term three-body problem of deterring two nuclear peers.

## CHAPTER 1

# Introduction

The United States is rapidly moving into an unprecedented nuclear weapons reality in which it must confront the most complex configuration of questions about nuclear weapons it has faced since the onset of the nuclear age. This novel situation largely results from quantitative and qualitative changes in the composition of the nuclear arsenals of its great power rivals and the advent of new technologies whose potential interaction with nuclear weapons creates uncertainty about what has traditionally been regarded as strategic stability.

Three years ago, Senate Armed Services Committee Chairman Senator Jack Reed said, “We seriously need to consider that we are entering a new, trilateral nuclear competition era” in which the United States and its allies would have to “deter not one, but two near-peer nuclear adversaries.”<sup>1</sup> A little more than a year later, the October 2023 report of the congressionally mandated Strategic Posture Commission concluded:

The United States faces a strategic challenge requiring urgent action. Given current threat trajectories, our nation will soon encounter a fundamentally different global setting than it has ever experienced: We will face a world where two nations possess nuclear arsenals on a par with our own. In addition, the risk of conflict with these two nuclear peers is increasing. It is an existential challenge for which the United States is ill-prepared, unless its leaders make decisions now to adjust the U.S. strategic posture.<sup>2</sup>

The development of Russian and Chinese capabilities that could threaten U.S. nuclear command and control are a particular concern. Both countries have tested direct ascent anti-satellite (DA-ASAT) capabilities. Chairman Michael Turner of the House Permanent

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1 Reed, quoted in Eric S. Edelman and Franklin C. Miller, “United States Nuclear Strategy and Policy,” U.S. Senate Comm. on Armed Services, September 20, 2022, <https://www.armed-services.senate.gov/imo/media/doc/Edelman-Miller%20Opening%20Statement%20SASC%20Hearing%20Sept.%2020%2020226.pdf>. The full transcript of the hearing is available at [https://www.armed-services.senate.gov/imo/media/doc/22-66\\_09-20-2022.pdf](https://www.armed-services.senate.gov/imo/media/doc/22-66_09-20-2022.pdf).

2 Madelyn R. Creedon, Jon L. Kyl, et al., *America’s Strategic Posture: Final Report of the Congressional Commission on the Strategic Posture of the United States* (Washington, DC: Institute for Defense Analysis, 2023), p. vii.

Select Committee on Intelligence recently drew attention to the prospect that Russia might launch an orbital nuclear weapon, raising the possibility that Russia might detonate a nuclear weapon in space to disable U.S. satellites, including those used for early warning. Finally, China tested what appears to have been a fractional orbital bombardment system (FOBS) with a hypersonic glide vehicle (HGV) warhead in 2021. Although the development of these capabilities is not dispositive evidence that Moscow and Beijing intend to launch a nuclear attack on the United States, either separately or jointly, it does raise the possibility that one or the other or both might try to execute a decapitating nuclear attack, which one scholar has suggested is the only plausible theory of victory in nuclear war. This prospect must be taken seriously, even if it is a low probability event, because of the disproportionate impact it would have were it to occur. It also throws into stark relief the importance of modernizing not just America’s nuclear forces but also its system of national nuclear command, control, and communications (NC3).<sup>3</sup>

As a recent study pointed out, NC3 is “the key enabler of any effort to incorporate nuclear weapons into a national defense strategy because it provides positive and negative control of a nuclear force.” The Air Force recently defined nuclear command and control as “the exercise of authority and direction by the President to command and control United States military nuclear weapons operations,” although the national command system enables the president to control conventional forces as well. This flexibility is a crucial arrow in the president’s quiver, allowing him to adjust force posture and redeploy forces for signaling purposes in times of crisis.<sup>4</sup>

As Ash Carter pointed out in a seminal study of the subject 40 years ago, NC3 “is an all important facet of the problem of deterring nuclear war, fully as important as weapons and doctrine.” A few years earlier, John Steinbruner had suggested that “command vulnerability is the most significant problem of modern strategic forces.” Decapitation strikes intended to “incapacitate leadership and destroy critical sensor and communication networks” offer adversaries a means to cut off nuclear weapons and other forces from legitimate central

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3 “Turner Warns of Russia’s Nuclear Anti-Satellite Weapons Program During Speech at CSIS,” House Permanent Select Committee on Intelligence, June 20, 2024, <https://intelligence.house.gov/2024/06/20/turner-warns-of-russias-nuclear-anti-satellite-weapons-program-during-speech-at-csis/>; John D. Steinbruner, “Nuclear Decapitation,” *Foreign Policy*, 45, Winter 1981–1982, pp. 16–28; and Benjamin W. Bahney, Jonathan Perl, and Michael Markey, “Antisatellite Weapons and the Growing Instability of Deterrence,” in Jon R. Lindsay and Erik Gartzke, eds., *Cross-Domain Deterrence: Strategy in an Era of Complexity* (New York: Oxford University Press, 2019), pp. 122–143. For a much more sanguine view of the threat to American NC3 assets that argues the problem is manageable, see James M. Acton, “The Survivability of Nuclear Command-and-Control Capabilities,” *Journal of Strategic Studies* 48, no. 2, 2025, pp. 407–464.

4 James J. Wirtz, “Deterrence: The Role of Nuclear Command, Control and Communications,” in James J. Wirtz and Jeffrey A. Larsen, eds., *Nuclear Command, Control and Communications: A Primer on U.S. Systems and Future Challenges* (Washington, DC: Georgetown University Press, 2022), pp. 15, 13. The Air Force directive quoted on p. 13 can be found at <https://irp.fas.org/doddir/usaf/afi13-550.pdf>, which spells out the five mission areas of NC3: force management, planning, situation monitoring, decision-making, and force direction. See also John R. Harvey and John K. Warden, “Command and Control of U.S. Nuclear Forces,” in Charles Glaser, Austin Long, and Brian Radzinsky, eds., *Managing U.S. Nuclear Operations in the 21<sup>st</sup> Century* (Washington, DC: Brookings Institution Press, 2022), p. 167.

political direction. As James Wirtz has noted, “NC3 might just be the Achilles’ heel of nuclear deterrence. It might not be possible to destroy all the weapons in a large nuclear arsenal to avoid nuclear retaliation, but it might be possible to destroy an opponent’s ability to fire those weapons by disrupting or destroying its NC3.” Unfortunately, the characteristics of command systems are rarely considered in assessments of the nuclear balance, much less in the context of a three-way nuclear competition like today’s.<sup>5</sup>

The risk of decapitation is increased by the emergence of a second nuclear peer. Although nothing should gainsay the challenges to nuclear deterrence during the Cold War, the United States was then largely preoccupied with the threats presented by Soviet nuclear forces. After the 1964 Chinese nuclear weapons test, the dangers that force posed to the United States were mitigated by the reliance of the People’s Republic of China (PRC) on a strategy of minimum nuclear deterrence and later by the Sino-Soviet split and the ability of U.S. diplomacy to seek better relations with each of the communist powers than they had with one another. Today, the United States must contend with the challenge of deterring two nuclear peers simultaneously as well as the fact that those peers are tightening their political–military cooperation. The potential that they might take joint, concerted action against U.S. nuclear forces further complicates the calculus of deterrence.<sup>6</sup>

The unprecedented challenge of the PRC’s rapidly expanding nuclear force is moving more quickly than many anticipated. The Chinese arsenal, which experts had estimated at roughly 200 warheads as recently as a few years ago, has expanded significantly. Today, China has roughly 600 warheads, and its arsenal is expanding rapidly. The most recent Department of Defense (DoD) reports on Chinese military power suggest that the PRC is on its way to possessing nearly 1,000 warheads by 2030 and likely 1,500 by 2035. It is no wonder that the former commander of U.S. Strategic Command (STRATCOM), Admiral Charles Richard, described the growth of China’s arsenal as “breathtaking” and that former Vice Chairman of the Joint Chiefs of Staff General John Hyten called it “unprecedented.”<sup>7</sup>

Projections of the growth of nuclear arsenals are always subject to uncertainty, but given the PRC’s rapid overall development of military capabilities, frequently delivering them on a faster timeline than the U.S. intelligence community anticipates, it would be prudent to

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- 5 Ashton Carter, “The Command and Control of Nuclear War,” *Scientific American* 252, no. 1, January 1985, p. 32; Steinbruner, “Nuclear Decapitation,” p. 21; and Wirtz, “Deterrence: The Role of Command, Control, and Communications,” p. 19.
  - 6 Jeffrey Lewis, *The Minimum Means of Reprisal: China’s Search for Security in the Nuclear Age* (Cambridge, MA: Massachusetts Institute of Technology Press, 2007); and Andrea Kendall Taylor and Nicholas Lokker, *The Axis of Upheaval: Gauging the Military Cooperation Among Russia, China, Iran and North Korea* (Washington, DC: Center for A New American Security, July 2025).
  - 7 U.S. Department of Defense (DoD), *Annual Report to Congress: Military and Security Developments Involving the People’s Republic of China 2024* (Washington, D.C. DoD, December 2024), pp. ix, 101–111. For statements by Richard and Hyten, see Demetri Sevastoulo, “China’s Nuclear Build-Up: One of the Largest Shifts in Geostrategic Power Ever,” *Financial Times*, November 15, 2021, <https://www.ft.com/content/d7c50283-18c8-4f2e-8731-970d9a547688>; and John Grady, “Hyten: China’s ‘Unprecedented Nuclear Modernization’ Chief Concern,” *USNI News*, September 14, 2021, <https://news.usni.org/2021/09/14/hyten-chinas-unprecedented-nuclear-modernization-chief-concern>.

plan on China becoming a true nuclear peer of the United States and Russia sooner rather than later.

Experts on nuclear deterrence have referred to the challenge of simultaneously deterring two nuclear peer weapons states as the “three-body problem,” an arch reference to the Chinese science fiction novel by Cixin Liu and the Netflix series based on it, which in turn refer to an unsolved physics and astronomy problem.

The “three-body problem” has been defined as “the problem of determining the motion of celestial bodies moving under no influence other than that of their mutual gravitation. No general solution of this problem...is possible as the motion of the bodies becomes chaotic.” The fact that the three-body problem seemingly has no answer highlights the serious challenge that the relationship among three nuclear peers presents for the practice of nuclear deterrence in an era of great power competition.<sup>8</sup>

As Richard noted: “The global security environment is now, today, a three-party nuclear peer reality where the PRC and Russia are stressing and undermining the rules-based international order. This is real. We are witnessing conditions that my command, STRATCOM, and the nation haven’t experienced in over 40 years.” He went on to say:

We have never faced two peer, nuclear-capable opponents at the same time who have to be deterred differently. And the theory just doesn’t account for that very well.... A three-party problem does not devolve into two simultaneous two-party problems, right? That is the first step and that doesn’t work. So maintaining stability, particularly in crisis, will be much more challenging than in a bi-polar world.<sup>9</sup>

Richard continued:

I’m not sure what strategic stability looks like in a three-party world, and a lot of terms have been kicked around. Oh, that’s stabilizing, that’s not stabilizing. That’s de-stabilizing. That’s based on a Cold War two-party problem, and I’m kind of reminded here.... I’m an engineer and I talk about dynamics. I’m talking about that status and dynamics class that probably half the room had when we were freshmen in college. I do know that there are many passively stable two-body orbital regimes that you can stick stuff in. There are exactly zero stable, passively stable three body orbital regimes. They all [inaudible] stabilization, and I don’t even know what that means. But, of course, we can’t even describe it [inaudible]. We have got to think through this much harder than we have in the past.”<sup>10</sup>

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8 Britannica, “Three-Body Problem,” last updated January 10, 2026, <https://www.britannica.com/science/three-body-problem>.

9 See Richard’s comments at the 2022 Space and Missile Defense Symposium in Huntsville, Alabama, on August 11, 2022, at <https://www.stratcom.mil/Media/Speeches/Article/3126694/2022-space-and-missile-defense-symposium/>.

10 Ibid.; see also Theresa Hitchens, “The Nuclear 3 Body Problem: STRATCOM ‘Furiously’ Rewriting Deterrence Theory in Tripolar World,” *Breaking Defense*, August 11, 2022, <https://breakingdefense.com/2022/08/the-nuclear-3-body-problem-stratcom-furiously-rewriting-deterrence-theory-in-tri-polar-world/>.

The essential problem is that strategic thought on how to maintain a stable nuclear balance and maintain deterrence during the Cold War was based on the notion that both sides needed nuclear forces that could ride out a nuclear first strike in order to retain sufficient forces to execute a retaliatory second strike. The idea of assured second-strike retaliatory capability was deemed to be the basis of strategic stability because the two superpowers were subject to mutual assured destruction (MAD). As Robert Jervis argued, this was not a strategy or force posture, but rather an inescapable condition that confronted both sides' policymakers. Some strategists contested this notion of strategic stability because the search for comparative strategic advantage motivated both sides during the Cold War, but the notion has had a durable life.<sup>11</sup>

With two nuclear peers, U.S. force planners need to consider how large a reserve force would need to be retained after a retaliatory strike to deter a potential second aggressor. Moreover, nuclear force planners need to consider, given the increasingly close ties between Russia and China, the potential for a joint attack by a combined nuclear force. Although it is easy to discount the possibility of joint action or diminish the difficulty of deterring it, U.S. officials have conceded that they need to plan against just such a possibility. Recent joint actions by Russia and China have underscored the importance of doing so.<sup>12</sup>

In the face of these daunting challenges, the U.S. government is engaging in a belated modernization of its nuclear forces, including all three legs of its nuclear triad: intercontinental ballistic missiles (ICBMs), strategic bombers, and nuclear-powered ballistic missile submarines (SSBNs). As the Strategic Posture Commission noted, ongoing modernization entailed in the program of record is a necessary but insufficient response to the emerging strategic circumstances in which the United States finds itself. The report also noted:

Due to China's nuclear build-up, the United States will no longer be able to treat the Chinese nuclear threat as a "lesser included case" of the Russian nuclear threat. As a result, the United States must re-evaluate the size and composition of the U.S. nuclear forces that would be adequate to fulfill longstanding roles of that force. These roles include deterrence, assurance, achieving objectives should deterrence fail, and hedging against adverse events.<sup>13</sup>

The current trajectory of Russian and Chinese nuclear programs, furthermore, highlights the degree to which "the rate at which nuclear force modernization is proceeding will likely

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11 Robert Jervis, *The Meaning of the Nuclear Revolution: Statecraft and the Prospect of Armageddon* (Ithaca, NY: Cornell University Press, 1989), pp. 74–109; and Elbridge A. Colby and Michael S. Gerson, eds., *Strategic Stability: Contending Interpretations* (Carlisle, PA: U.S. Army War College Press, February 2013, in particular, see Chapter 10, Austin Long, "Proliferation and Strategic Stability in the Middle East," pp. 383–432, which highlights the important of context for understanding strategic stability.

12 For the potential of joint action by Russia and China, see Edelman and Miller, "United States Nuclear Strategy and Policy"; see also Heather Williams, Kari A. Bingen, and Lachlan Mackenzie, "Why Did China and Russia Stage a Joint Bomber Exercise Near Alaska," Center for Strategic and International Studies, July 30, 2024, <https://www.csis.org/analysis/why-did-china-and-russia-stage-joint-bomber-exercise-near-alaska>.

13 Creedon et al., *America's Strategic Posture*, p. 7.

add unacceptable risk.” The Strategic Posture Commission concluded, as a result: “The current multi-program, multi-decade U.S. nuclear modernization program is necessary but not sufficient to...address an unprecedented two-nuclear peer threat environment. To avoid additional risk and meet emerging challenges, the United States must act now to pursue additional measures and programs [which could include] either or both qualitative and quantitative adjustments in the U.S. strategic posture.”<sup>14</sup>

The question of what kind of adjustments to the U.S. strategic posture should be made in the face of the two-peer nuclear challenge is complicated. It will require a good deal of conceptual and analytical work before clear solutions emerge. But it took almost a decade and a half after the emergence of nuclear weapons during World War II before U.S. thinking about nuclear deterrence crystalized. The ongoing modernization of U.S nuclear forces will be accompanied, necessarily, by modernization of NC3, which is sometimes referred to as the fourth leg or fifth pillar of the U.S. nuclear deterrent. Traditionally, NC3 has been given short shrift by students of nuclear strategy, but the growing strategic cooperation between Russia and China underscores the primacy of NC3 modernization in the face of a growing threat of nuclear decapitation.<sup>15</sup>

As the Strategic Posture Commission’s final report noted, “The potential for simultaneous conflicts with China and Russia in Asia and Europe, whether those conflicts result from opportunistic or collaborative aggression, must be addressed.” Although some observers have downplayed the prospect of a simultaneous Sino-Russian attack, the Commission’s report noted that “dismissing the possibility of opportunistic or simultaneous two-peer aggression because it seems improbable, and thus not addressing U.S. defense strategy and strategic posture, is likely to have the perverse effect of making such aggression more likely.” Given that Russia and the PRC have developed capabilities that would allow a decapitation strike and their growing military collaboration, it would be foolish in the extreme to rule out a potential joint preemptive strike.<sup>16</sup>

This is not the first time the United States has faced inflection points in dealing with a changing nuclear balance and the danger of nuclear decapitation. The John F. Kennedy, Richard Nixon, Gerald Ford, Jimmy Carter, and Ronald Reagan administrations all faced similar concerns. Despite today’s very different context of contending with two nuclear peers, a short review of that history can help one think through responses to today’s questions about reinforcing nuclear command and control as a first step to deterrence in a two-peer nuclear world.

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14 Ibid, pp. 33–34.

15 Heather Williams, “Updating Nuclear Command, Control, and Communication,” Center for Strategic and International Studies, January 3, 2025, <https://nuclearnetwork.csis.org/updates-nuclear-command-control-and-communication/>; David A. Deptula and William A. LaPlant, with Robert Haddick, *Modernizing U.S. Nuclear Command, Control, and Communications* (Arlington, VA: Mitchell Institute for Aerospace Studies; MITRE Corporation, February 2019), p. 34; and Wirtz, “Deterrence,” p. 7.

16 Creedon et al., *America’s Strategic Posture*, p. 29.

This report has six chapters. The next two describe the Chinese and Russian nuclear buildups, in particular developments that may call into question U.S. NC3. The fourth describes the ongoing U.S. nuclear modernization, including efforts to upgrade NC3. The fifth examines some case studies of Cold War threats to U.S. NC3 and U.S. responses. The sixth chapter concludes by suggesting some early steps the United States should take to redress some of the challenges that an emerging two-peer nuclear competition presents to U.S. NC3.



## CHAPTER 2

# Chinese Nuclear Modernization

The emergence of the three-body problem has been driven by the PRC’s dramatic and persistent modernization of its nuclear forces, which has enabled it to field “new nuclear capabilities at a faster pace than at any time in its history.” For years, the PRC had maintained a minimum nuclear deterrent based on a doctrine of assured retaliation. This emphasis on the minimum means of reprisal seemed consistent with a nuclear force posture constrained by the limits imposed by Maoist strategic culture’s emphasis on people’s war and by the PRC’s ability to produce fissile material. These ideational and material limits, however much they restricted the growth of China’s nuclear forces during the Cold War and post–Cold War eras, have given way to a decade and a half of nuclear modernization that has accompanied the reemergence of great power competition. China’s nuclear buildup complements the large-scale conventional buildup that has been underway since the turn of the century.<sup>17</sup>

The scale and scope of the buildup is impressive, and the Pentagon’s reports on Chinese military power say it is accelerating. “Over the next decade,” its most recent report noted, “the PRC probably will continue to rapidly modernize, diversify, and expand its nuclear forces,” with the aim of providing the Chinese leadership with “options at every rung of the escalation ladder.” As noted above, DoD estimates that the PRC has now “surpassed 600 operational nuclear warheads in its stockpile” and will have 1,000 by 2030 before it completes its modernization program in the middle of the next decade. Earlier estimates suggested China’s force will cap out at 1,500 warheads. That would make it a full nuclear peer with the United States and Russia which, under the terms of the now expired New Strategic Arms Reduction Treaty (New START), were allowed 1,550 deployed nuclear warheads. The previous limitations on the production of fissile material to build up China’s nuclear force structure will likely be ameliorated by the PRC’s fast breeder reactors and

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17 Defense Intelligence Agency (DIA), *Nuclear Challenges: The Growing Capabilities of Strategic Competitors and Regional Rivals* (Washington, DC: DIA, 2024), pp. 1–8.

reprocessing capabilities, which will enable it to produce enough plutonium to build out its force.<sup>18</sup>

As the most recent unclassified assessment of China’s nuclear modernization noted:

Within the past five years, China has significantly expanded its ongoing nuclear modernization program by fielding more types and greater numbers of nuclear weapons than ever before. Since our previous edition on China in May 2024, China has continued to develop its three new missile silo fields for solid-fuel intercontinental ballistic missiles (ICBMs), continued the construction of new silos for its liquid-fuel DF-5 ICBMs, has been developing new variants of ICBMs and advanced strategic delivery systems, and has likely produced excess warheads for these systems once they are deployed. China has also further expanded its dual-capable DF-26 intermediate-range ballistic missile force, which appears to have completely replaced the medium-range DF-21 in the nuclear role. At sea, China has been refitting its Type 094 ballistic missile submarines with the longer-range JL-3 submarine-launched ballistic missile. In addition, China has recently reassigned an operational nuclear mission to some of its bombers with an air-launched ballistic missile that might have nuclear capability. In all, China’s nuclear expansion is among the largest and most rapid modernization campaigns of the nine nuclear-armed states.<sup>19</sup>

One of the most striking examples of the PRC’s move away from minimum deterrent posture is the increasing size of its ICBM force. According to unclassified assessments, the Chinese are updating their ability to “deliver multi-megaton warheads” by doubling the number of silos for China’s DF-5 liquid-fueled missile force, increasing the number of brigades and launchers per brigade, and conducting large-scale construction of three new fields of ICBM silos across north-central China. Consisting of approximately 320 silos, these three fields will accommodate solid-fueled DF-31 ICBMs and potentially the DF-41, which features greater range and accuracy than the DF-31. The DF-41 is currently deployed in a road-mobile mode.<sup>20</sup>

As Hans Kristensen et al. have noted, “Combined, these construction efforts for silo-based ICBMs (in addition to new road-mobile ICBM bases) constitute the largest expansion of the Chinese nuclear arsenal ever. The 350 new Chinese silos under construction exceed the number of silo-based ICBMs operated by Russia and constitutes about three-quarters the size of the entire US ICBM force.”

Although it is not yet known exactly what the silo-based mix of DF-31s and DF-41s might be in the future, Kristensen et al. noted, “[the] ICBM force could potentially reach 648 warheads during the 2030s, more than twice as many as today. In addition, if all the new

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18 DoD, *Military and Security Developments Involving the People’s Republic of China 2024*, pp. 101–110.

19 Hans M. Kristensen, Matt Korda, Eliana Johns, and Mackenzie Knight, “Chinese Nuclear Weapons, 2025,” *Bulletin of the Atomic Scientists* 81, no. 2, March 2025, pp.135–160.

20 Hans M. Kristensen and Matt Korda, “Chinese Nuclear Forces,” in *SIPRI Yearbook 2024: Armaments, Disarmament and International Security* (Stockholm: Stockholm International Peace Research Institute (SIPRI), 2024), pp. 315–324.

silos were loaded with DF-41 ICBMs (each carrying up to three warheads), then the active Chinese ICBM force could potentially carry more than 1,200 warheads once all three silo fields are completed.” This would clearly have a major impact on U.S. target planning at STRATCOM as U.S. planners seek to hold Chinese military targets at risk.<sup>21</sup>

China has also been modernizing its road-mobile ICBM force and may be planning to deploy the DF-41 in rail-mobile mode. The road-mobile force consists of the DF-31 class and the DF-41 missiles, with one and potentially three multiple independently targetable reentry vehicle (MIRVed) warheads respectively. As the DoD China Military Power report noted, the strategic arsenal of mobile missile forces are “complemented by road-mobile DF-26 intermediate-range ballistic missiles capable of ranging targets in the Indo-Pacific region.” The DF-26 force has grown from some 15–30 launchers just a few years ago to as many as 250 launchers servicing 500 missiles today. The DF-26, which is dual capable, provides the PRC with a capability for escalation in regional contingencies that could provide a plausible, and perhaps the most likely, path to a nuclear confrontation with the United States. As Kristensen et al. observed, “The dual-capable role of the DF-26 raises some thorny issues about command and control and the potential for misunderstandings in a crisis. Preparations to launch—or the actual launch of—a DF-26 with a conventional warhead against a U.S. base in the region could potentially be misinterpreted as the launch of a nuclear weapon and trigger nuclear retaliation or even pre-emption.”

The risks of miscommunication or misunderstanding are heightened by the fact that the DF-26 is “*hot swappable*, or able to switch rapidly between conventional and nuclear warheads on a launch-ready missile. DF-26 brigades have held drills in which units launch a conventional attack and then reload with a nuclear warhead to prepare for nuclear counterattacks.”<sup>22</sup>

China has also been expanding and upgrading its sea-based nuclear systems. After years of fitful and incremental progress, DoD says it now has a “credible sea-based deterrent.” China now fields six *Jin*-Class (Type 094) SSBNs capable of continuous at-sea deterrence (CASD) patrols. As observers have noted, engaging in CASD would mark a considerable shift in how the PRC conducts nuclear operations. According to Kristensen et al., “Giving custody of nuclear warheads to deployed submarines during peacetime would constitute a significant departure from Chinese declaratory policy and a significant change for China’s Central Military Commission, which has historically been reluctant to hand out nuclear warheads to the armed services.”<sup>23</sup>

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21 Ibid. See also Kristensen et al., “Chinese Nuclear Weapons, 2025.”

22 DoD, *Military and Security Developments Involving the People’s Republic of China 2024*, pp. 101–110; Kristensen et al., “Chinese Nuclear Weapons, 2025”; Kristensen and Korda, “Chinese Nuclear Forces”; and U.S.-China Economic and Security Review Commission, *2021 Annual Report to Congress*, chap. 3, sec. 2, November 2021, [https://www.uscc.gov/sites/default/files/2021-11/Chapter\\_3\\_Section\\_2--Chinas\\_Nuclear\\_Forces\\_Moving\\_beyond\\_a\\_Minimal\\_Deterrent.pdf](https://www.uscc.gov/sites/default/files/2021-11/Chapter_3_Section_2--Chinas_Nuclear_Forces_Moving_beyond_a_Minimal_Deterrent.pdf).

23 DoD, *Military and Security Developments Involving the People’s Republic of China 2024*, pp. 101–110; Kristensen et al., “Chinese Nuclear Weapons, 2025,” pp. 153–154.

The PRC has also upgraded the ballistic missiles on its SSBNs from the JL-2 to the extended range (10,000 kilometers) JL-3, “giving the PRC the ability to target CONUS (continental United States) from littoral waters and enabling the [People’s Liberation Army Navy] to consider bastion operations to enhance the survivability of its sea-based deterrent. The [South China Sea] and Bohai Gulf probably are the PRC’s preferred options for employing this concept.” The PRC is producing more *Jin*-class submarines, even as it continues to develop the more advanced Type 096 ballistic missile submarine that would probably operate more quietly and at greater range than the Type 094. As the DoD China Military Power report noted, “It is unclear whether continued Jin class SSBN production is the result of delays in the development of the PRC’s next-generation Type 096 SSBN or an effort to accelerate its sea-based nuclear capability as Xi has directed.” A truly survivable CASD capability would also require the PRC to develop an upgraded NC3 “to ensure reliable communication with the SSBNs when needed and prevent the crew from launching nuclear weapons without authorization.”<sup>24</sup>

The People’s Liberation Army Air Force (PLAAF) appears to be developing a new role in China’s emerging nuclear triad. For a variety of reasons, including concerns about political reliability during the Cultural Revolution and its ability to penetrate modern air defenses, the PLAAF (which had played a role in nuclear testing) never had a dedicated strategic bomber force like those of the United States and the Soviet Union. Recent studies of the PLAAF argued that the nuclear mission simply atrophied during the Cold War. That changed in 2018, when the PLAAF was given a renewed nuclear mission, and in 2019, with the introduction of the H-6N bomber that, according to DoD, has “an air-to-air refueling probe as well as...recessed fuselage modifications that enable external carriage of a nuclear capable air-launched ballistic missile.” The ALBM carried by the H-6N appears to be armed with a maneuvering reentry vehicle optimized for “nuclear precision strikes against targets in the Indo-Pacific Theater.” According to PRC media reports, the Chinese are also “developing a strategic stealth bomber,” the H-20, which with aerial refueling would provide an intercontinental bombing capability.<sup>25</sup>

As one might expect, the rapid development of a modernized, diversified nuclear force has also entailed across-the-board modernization of the PRC’s NC3, including both space-based ISR and ground-based large, phased-array radars. These improved ISR capabilities will enable additional missions like early warning and potentially missile defense. “As a result, the size and capabilities of China’s nuclear forces will soon clearly exceed those required for the minimum and purely retaliatory deterrent it claims to have.” China’s traditional no-first-use policy coupled with an assured second-strike capability may give way to consideration of “options for highly calibrated nuclear use, be that in the context of retaliation or first use.”

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24 DoD, *Military and Security Developments Involving the People’s Republic of China 2024*, pp. 101–110; Kristensen et al., “Chinese Nuclear Weapons, 2025,” pp. 153–154.

25 DoD, *Military and Security Developments Involving the People’s Republic of China 2024*, pp. 101–110; Kristensen et al., “Chinese Nuclear Weapons, 2025,” pp. 153–154.

Some Chinese writings suggest a new early-warning counterstrike posture similar to U.S. concepts like launch on warning or launch under attack. The PRC's larger and more diversified nuclear force will provide it with more options at every rung of the escalation ladder, which will offer China "more efficient ways of deploying, responding, and coercing with nuclear or dual-capable forces." This is more than just a set of technical changes. It has been accompanied by an extraordinary centralization of decision-making in the person of Xi Jinping, as opposed to the Politburo or Central Military Commission, which enables the kind of timely decision-making needed for an early warning strike. This stands in stark contrast to most of the post-Mao period.<sup>26</sup>

Perhaps the most disturbing parts of China's nuclear modernization are the combination of capabilities that it has tested in recent years and new information suggesting it is undertaking projects that would be associated with nuclear warfighting. Taken together, these ventures raise the danger that the PRC could develop a capability for nuclear decapitation that would reawaken anxieties that U.S. decision makers last experienced during the Cold War.

In 2007, China conducted an unannounced DA-ASAT test against a decommissioned weather satellite. It was an early indication that the PRC places great store in developing counterspace capabilities. As Chief of Space Operations Chance Salzman has noted, the Chinese test was a "pivot point" for how to think about space capabilities. The PRC clearly sees counterspace operations as an Achilles heel for modern American warfighting and a way to "blind and deafen the enemy." In 2013, the PRC launched a ballistic object that appeared to reach its apogee at roughly 30,000 feet, which U.S. officials concluded probably was a test of a concept for satellite intercept in geosynchronous orbit. China has also been developing an inspection and repair capability that was tested in 2022, when the Shijian-21 satellite was able to move an inoperative navigation satellite to a graveyard orbit beyond geosynchronous. This capability could be used to grapple and remove other satellites in the future. The PRC has also developed multiple ground-based lasers that can disrupt, degrade, or damage space-based sensors; by late this decade, systems with more power could damage satellite structures. China also regularly employs jammers during military exercises against "space-based communications, radars, and navigation systems and may be developing capabilities to target U.S. military protected extremely high frequency systems." Most recently, China has had some of its satellites engage in dog-fighting in space. According to Vice Chief

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26 Kristensen et al., "Chinese Nuclear Weapons, 2025," pp. 141–143. I am indebted to Austin Long for drawing my attention to the centralization of authority by Xi Jinping; see also Susan L. Shirk, "China in Xi's 'New Era': The Return to Personalistic Rule," *Journal of Democracy* 29, no. 2, April 2018, pp. 22–36; and "CCP Decision-Making and Xi Jinping's Centralization of Authority," in U.S.–China Economic and Security Review Commission, 2022 Report to Congress (Washington, DC: Government Printing Office, 2022) pp. 25–120.

of Space Operations General Michael Guetlein, “They are practicing tactics, techniques, and procedures to do on-orbit space operations from one satellite to another.”<sup>27</sup>

In July 2021, China tested a system that circled the globe and dispensed an HGV over China that missed its target. That system could theoretically circumnavigate the globe from the south, thus avoiding U.S. early warning systems. It would appear to provide China with something like the capability of the FOBS that the Soviet Union developed during the Cold War. The advantage of such a system is that it could be used for a low- or no-warning first strike. In January 2025, *Financial Times* reported that satellite photography showed “a roughly 1,500-acre construction site 30km south-west of Beijing with deep holes that military experts assess will house large, hardened bunkers to protect Chinese military leaders during any conflict—including potentially a nuclear war.” This huge facility, 10 times the size of the Pentagon, would be the “world’s largest military command centre [sic],” and, according to a former Central Intelligence Agency (CIA) national intelligence officer for China, Dennis Wilder, would provide the PRC with “an advanced nuclear warfighting capability.”<sup>28</sup>

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- 27 Greg Hadley, “Saltzman: China’s ASAT Test Was ‘Pivot Point’ in Space Operations,” Air and Space Forces, January 13, 2023, <https://www.airandspaceforces.com/saltzman-chinas-asat-test-was-pivot-point-in-space-operations/>; “Space Threat Fact Sheet,” Headquarters Space Force Intelligence, <https://nssaspace.org/wp-content/uploads/2024/12/20241205-S2-Space-Threat-Fact-Sheet-v6-RELEASE.pdf>; and Courtney Albion, “China Demonstrated ‘Satellite Dogfighting,’ Space Force General Says,” Defense News, March 18, 2025, <https://www.defensenews.com/space/2025/03/18/china-demonstrated-satellite-dogfighting-space-force-general-says/>.
- 28 Demetri Sevastopulo and Kathrin Hille, “China Tests New Space Capability with Hypersonic Missile,” *Financial Times*, October 16, 2021, <https://www.ft.com/content/baoa3cde-719b-4040-93cb-a486e1f843fb>.; For the Soviet FOBS, see Asif A. Siddiqi, “The Soviet Fractional Orbital Bombardment System (FOBS): A Short Technical History,” *Quest: The History of Space Flight Quarterly* 7, no. 4, Spring 2000, pp. 22–32; Braxton Eisel, “The FOBS of War: The Soviet Union Wanted a Nuclear Weapon That Could Stage a ‘Backdoor’ Strike on U.S. Soil,” *Air Force Magazine*, June 2005, pp. 72–75; and Demetri Sevastopulo, Joe Leahy, Ryan McMorrow, Kathrin Hille, and Chris Cook, “China Builds Huge Wartime Military Command Centre in Beijing,” *Financial Times*, January 30, 2025, <https://www.ft.com/content/f3763e51-8607-42b9-9ef9-5789d5bf353d>.

## CHAPTER 3

# Russian Nuclear Modernization

Russia's nuclear modernization, which has been underway for decades, is expected to be completed soon. As a recent Defense Intelligence Agency (DIA) report noted, nuclear modernization "has been one of Moscow's top budgetary priorities over the past decade" and has led to "new intercontinental ballistic missiles, ballistic missile submarines and long-range cruise missiles." Modernization has ranged well beyond replacement of older Soviet-era systems that were reaching the end of their service lives to include adding several exotic nuclear weapons to the nation's nuclear arsenal. Russian President Vladimir Putin publicly revealed these weapons during a 2018 public address.<sup>29</sup>

Under the terms of the New START Treaty (which was renewed for a five-year term at the outset of the Joe Biden administration and expired in February 2026), Russia, like the United States, is limited to 1,550 deployed nuclear warheads, though the treaty's bomber-counting rule says a bomber only counts as one deployed warhead no matter how many warheads are on it. With Russian bombers loaded out, its overall deployed strategic warhead count is estimated to be 1,710 warheads, with roughly another 1,100 strategic warheads in storage and some 1,558 nonstrategic warheads in the nation's inventory.<sup>30</sup>

The Russian ICBM inventory is roughly "equally split between road-mobile and silo-based ICBMs." The ICBM force is organized into three missile armies made up of 12 divisions and 40 regiments. The 326 ICBMs are capable of carrying up to 1,246 warheads, but the

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29 DIA, *Nuclear Challenges*, pp. 11–18.

30 DIA, *Nuclear Challenges*, p. 14; Hans M. Kristensen and Matt Korda, "Russian Nuclear Forces," in *SIPRI Yearbook 2024: Armaments, Disarmament and International Security* (Stockholm: SIPRI, 2024), pp. 287–301; and Hans M. Kristensen, Matt Korda, Eliana Johns, and Mackenzie Knight, "Russian Nuclear Weapons, 2024," *Bulletin of the Atomic Scientists* 80, no. 2, 2024, pp. 118–145. The 2025 update was published after this report had been drafted; see Hans M. Kristensen, Matt Korda, Eliana Johns, and Mackenzie Knight, "Russian Nuclear Weapons, 2025," *Bulletin of the Atomic Scientists* 81, no. 3, 2025, pp. 208–237.

Stockholm International Peace Research Institute (SIPRI) has estimated that the current loadout is limited to about 872 warheads to keep Russia in compliance with New START limits.<sup>31</sup> Although Russia has nearly completed the replacement of Soviet-era ICBMs with new types, this process has taken much longer than expected. All its Soviet-era road-mobile ICBMs have been replaced by new models. Some of the older Soviet-era SS-19 missiles are being rearmed with the new Avangard HGV. Russia has been developing the SS-29 Sarmat, a liquid-fueled heavy ICBM that could carry between 10 to 14 warheads (though probably 10, like the SS-18 it is intended to replace) at a range of up to 15,000 kilometers. Russian officials have said that the Sarmat, which has been plagued by test failures and is behind schedule, could be fired over either the North or South Poles (an animation of its flight path used during Putin's 2018 speech suggested a trajectory over the South Pole). If it were launched in the latter trajectory, it would provide the equivalent of a FOBS capability. Russia's ICBM modernization has involved "upgraded silos with new air- and perimeter- defense systems," and the new Peresvet laser has been deployed with at least five road-mobile ICBM divisions for the purpose of "covering up their maneuvering operations...possibly implying that one role of Peresvet is to blind spy satellites."<sup>32</sup>

Russia is also modernizing its SSBN fleet, which now consists of five *Delta*-class SSBNs and seven of the more modern *Borei*-class SSBNs. It appears that the Russians intend to replace the remaining *Deltas* with *Borei*-class submarines by the early 2030s (based on current production timelines). The submarines would be evenly divided between the Northern and Pacific Fleets. Each SSBN carries 16 submarine-launched ballistic missiles (SLBMs) with MIRVed warheads. The maximum loadout would be 992, but estimates suggest that only 640 are actually deployed at any given time to remain within the New START limits and because a couple of submarines are undergoing maintenance, repair, or refueling at any given time. The *Delta*-class submarines carry the older SS-N-22 Mod 2 or 3 SLBMs, and the *Boreis* are armed with the more modern SS-N-32 Bulava SLBMs. The Russians have already unveiled designs for a follow-on SSBN that would replace the *Borei*-class submarines in the late 2030s.<sup>33</sup>

Russia maintains a long-range aviation force of strategic bombers composed of 15 Tupolev Tu-160 Blackjack and 52 Tu-95MS Bear H aircraft housed at two bomber bases in Saratov and Amur Oblasts respectively (some of these were destroyed or damaged by Ukraine's recent Operation Spiderweb). Only 58 of the aircraft appear to be deployed under New START, with a total warhead count of roughly 580 warheads. The bombers carry a mix of older Kh-55 and more modern Kh-102 air-launched cruise missiles (ALCMs). Russia has

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31 Although Russia announced in February 2023 that it would suspend its participation in the treaty and not permit U.S. inspectors to verify compliance, it said at the same time that it would abide by the central limits of the treaty.

32 Kristensen and Korda, "Russian Nuclear Forces," p. 291; DIA, *Nuclear Challenges*, p. 17; and Kristensen et al., "Russian Nuclear Weapons, 2024," pp. 124–129.

33 Kristensen et al., "Russian Nuclear Weapons, 2024," pp. 135–136; and Kristensen and Korda, "Russian Nuclear Forces," pp. 292–293.

been modernizing the engines and avionics for these aircraft, as well as the nuclear cruise missiles, but they serve as “a temporary bridge to the next-generation bomber known as PAK DA, the development of which has been underway for several years. The subsonic aircraft will reportedly have a reduced radar signature and will be able to carry long-range cruise missiles and hypersonic missiles” and will allegedly enter full-scale production at the end of the 2020s or early 2030s.<sup>34</sup>

As part of and in addition to the modernization of its nuclear triad, Russia has also developed a suite of exotic nuclear weapons, some of which were unveiled by Putin in 2018 along with an animated display to demonstrate their alleged capabilities. These are the so-called “big six”—two of which, the Sarmat ICBM and the Peresvet ASAT laser, have been discussed above. The others are the Avangard HGV; the Kinzhal ALBM; the Skyfall or Burevestnik, a nuclear-powered cruise missile; and the Poseidon or Status-6, a nuclear-powered underwater vehicle.<sup>35</sup>

The Avangard, an HGV, was integrated in 2019 into the SS-19 Mod 4 ICBM, making it the first HGV to be deployed. Designed to avoid U.S. homeland missile defense, the Avangard uses the ICBM booster “to reach an altitude of 100 kilometers, staying below the reach of ballistic missile defenses and then descends to reach the target at 33,000 km/hr.”<sup>36</sup>

The Kinzhal is an air-launched ballistic missile that Putin suggested would fly at hypersonic speed and be able to maneuver to avoid air and missile defenses. The conventional version of the Kinzhal has been used during the Ukraine conflict and was shot down by Patriot missile interceptors, thereby somewhat diminishing its luster and leading the British Ministry of Defence to conclude that its operational performance in Ukraine has been “poor.”<sup>37</sup>

The Burevestnik is a cruise missile that the Russian Ministry of Defence has described as having “a nuclear-powered engine, which would theoretically give it intercontinental range, in addition to the ability to fly for several days.” The missile has been plagued by test failures, however, including a catastrophic failure in 2019. Although Putin suggested in 2023 that a “final successful test has been held,” the system has yet to be “formally certified for combat.”<sup>38</sup>

The final weapon that Putin announced was the Poseidon or Status-6 (Kanyon), a nuclear-powered torpedo with a multimegaton warhead. The existence of this weapon had leaked

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34 Kristensen et al., “Russian Nuclear Weapons, 2024,” pp. 131–134; and Kristensen and Korda, “Russian Nuclear Forces,” pp. 296–297.

35 DIA, Nuclear Challenges, p. 17.

36 Ibid.

37 Ibid. See also Thibault Spiriet, “Russia Keeps Proving Its ‘Undefeatable’ Missile Doesn’t Work That Well, UK Intel Says,” Business Insider, December 19, 2023, <https://www.businessinsider.com/russia-showing-undefeatable-missile-doesnt-work-that-well-uk-intel-2023-12>.

38 DIA, Nuclear Challenges, p. 17.

in 2015 during a televised meeting between Putin and military leaders in Sochi. During his announcement, Putin described it this way: “Unmanned submersible vehicles that can move at great depths (I would say extreme depths) intercontinentally, at a speed multiple times higher than the speed of submarines, cutting-edge torpedoes and all kinds of surface vessels, including some of the fastest. It is really fantastic. They are quiet, highly maneuverable and have hardly any vulnerabilities for the enemy to exploit. There is simply nothing in the world capable of withstanding them.”

Putin also noted that the torpedo can carry “massive nuclear ordnance,” leading to speculation that the warhead could be as large as the 52 megaton Tsar Bomba that the Soviet Union tested in 1961, or that it might have a cobalt warhead, as the Russian newspaper *Rossiskaya Gazeta* speculated, that would lead to widespread radioactivity. What reasonable purpose such a weapon could possibly serve remains something of a mystery, but a healthy fear of U.S. technological prowess and memories of the Cold War arms competition offer possible motivations. Putin suggested the Poseidon could target carrier task forces, ports, or infrastructure. Arms control expert Jeffrey Lewis dubbed it a “doomsday machine.” The Poseidon was apparently tested twice in 2023 and will be carried on specially kitted-out submarines of which there may ultimately be three to four.<sup>39</sup>

Like the PRC, Russia has experimented with a DA-ASAT which it has tested a dozen times in the past several years. In November 2021, the Russians destroyed a defunct Soviet-era communications satellite in low earth orbit (LEO) using a Nudol DA-ASAT missile, endangering other spacecraft in LEO, including the International Space Station and China’s Tiangong Space Station, with 1,500 pieces of trackable debris and many more nontrackable fragments. They have also deployed prototype orbital anti-satellite weapons (ASATs), including one that “ejected an object” near a Russian satellite, and they may be developing satellites in other orbits “under the guise of servicing assets.” Most alarmingly, the Russians appear to be developing a satellite that would carry a nuclear weapon in space. U.S. and Soviet tests of nuclear weapons in space during the Cold War have shown that use of such a weapon would threaten commercial satellites as well as military objects in space. The fact that Russia, in April 2024, vetoed a United Nations Security Council Resolution that

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39 DIA, *Nuclear Challenges*, p. 17; Vladimir Putin, “Presidential Address to the Federal Assembly,” President of Russia, March 1, 2018, <http://www.en.kremlin.ru/events/president/transcripts/messages/56957>; and Matthew Kroenig, Mark J. Massa, and Christian Trotti, “Russia’s Exotic Nuclear Weapons and Implications for the United States and NATO,” Atlantic Council, March 6, 2020, <https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/russias-exotic-nuclear-weapons-and-implications-for-the-united-states-and-nato/>; Jeffrey Lewis, “Putin’s Doomsday Machine,” *Foreign Policy*, November 12, 2015, <https://foreignpolicy.com/2015/11/12/putins-doomsday-machine-nuclear-weapon-us-russia/>.

reaffirmed the Outer Space Treaty, which bans nuclear weapons in space, underscores the concerns that news of this development aroused.<sup>40</sup>

Yet another concerning aspect of Russian nuclear modernization is its approach to the modernization of its nuclear command and control. Throughout the Cold War, the U.S. intelligence community was concerned about the deep underground facilities for leadership protection that would enable the Soviet Union to wage a nuclear war. Despite occasional sneering references to the “mine-shaft gap” lampooned in Stanley Kubrick’s film *Dr. Strangelove*, U.S. officials continued to worry that ongoing construction efforts were indicative of a nuclear-war-fighting mindset among senior Russian military leaders.<sup>41</sup>

As the Cold War waned, one declassified assessment noted:

For over 40 years the Soviets have had a comprehensive program designed to ensure leadership survival in wartime. This multifaceted program has involved the construction of hardened bunkers, tunnels, and special subway lines beneath Moscow, other major Soviet cities, and the sites of major military commands. Although the majority of these hardened facilities are near-surface bunkers, many critical sites are built deep underground.<sup>42</sup>

In the aftermath of the Cold War, construction activity at places like Yamantau and Kosvinsky Mountain continued. As DIA Director Ronald Burgess noted in his 2011 world-wide threat briefing, “Russia is upgrading massive underground facilities that provide command and control of its strategic nuclear forces.”

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- 40 “Space Threat Fact Sheet,” Headquarters Space Force Intelligence, <https://nssaspace.org/wp-content/uploads/2024/12/20241205-S2-Space-Threat-Fact-Sheet-v6-RELEASE.pdf>; “Fact Sheet: Russian Direct Ascent Anti-Satellite Testing,” Secure World Foundation, December 2024, [https://cdn.prod.website-files.com/66dcc6872f6ed23bce1db235/6840784259433586aa149203\\_FS24-06\\_Russian%20Direct%20Ascent%20Anti-satellite%20Testing.pdf](https://cdn.prod.website-files.com/66dcc6872f6ed23bce1db235/6840784259433586aa149203_FS24-06_Russian%20Direct%20Ascent%20Anti-satellite%20Testing.pdf); and “Turner Warns of Russia’s Nuclear Anti-Satellite Weapons Program During Speech at CSIS,” June 20, 2024, <https://intelligence.house.gov/news/documentsingle.aspx?DocumentID=1425>; on Russia’s veto, see “Statement From National Security Adviser Jake Sullivan on Russia’s Veto of the UN Security Council Resolution on the Outer Space Treaty,” White House, April 24, 2024, <https://bidenwhitehouse.archives.gov/briefing-room/statements-releases/2024/04/24/statement-from-national-security-advisor-jake-sullivan-on-russias-veto-of-the-un-security-council-resolution-on-the-outer-space-treaty/>; and Aaron Bateman, “Why Russia Might Put a Nuclear Weapon in Space: The New Threat Behind an Old Idea,” *Foreign Affairs*, March 7, 2024, <https://www.foreignaffairs.com/russian-federation/why-russia-might-put-nuclear-weapon-space>. For U.S. and Russian tests in space during the Cold War, see Gilbert King, “Going Nuclear over the Pacific,” *Smithsonian Magazine*, August 15, 2012, <https://www.smithsonianmag.com/history/going-nuclear-over-the-pacific-24428997/>; and Anatoly Zak, “The ‘K’ Project: Soviet Nuclear Tests in Space,” *The Nonproliferation Review* 13, no. 1, 2006, pp. 143–150.
- 41 Edward Geist, “Was There a Real ‘Mineshaft Gap’? Bomb Shelters in the USSR, 1945–1962,” *Journal of Cold War Studies* 14, no. 2, 2012, pp. 3–28.
- 42 DoD, *Soviet Military Power: An Assessment of the Threat 1988* (Washington, DC: Government Printing Office, 1988), pp. 59–62, <https://nsarchive2.gwu.edu/NSAEBB/NSAEBB372/docs/Document05.pdf>; and DoD, *Military Forces in Transition* (Washington, DC: DoD, 1991), pp. 40–41, <https://apps.dtic.mil/sti/tr/pdf/ADA243946.pdf>. See also “Yamantau Mountain Underground Construction Project: USSR,” Central Intelligence Agency (CIA), January 1984, <https://www.cia.gov/readingroom/docs/CIA-RDP84T00171R0003013>.

In late 2020, Putin, meeting with military leaders in Sochi, noted the completion of “an absolutely secure facility for controlling strategic nuclear forces, among others, is nearing completion, and that it will have a very high safety margin.”<sup>43</sup>

As one account of the meeting noted:

It’s not completely clear from these comments whether Putin was talking about an entirely new facility or the refurbishment, improvement, and/or expansion of an existing one. His remarks about the need to protect the overall command and control infrastructure against any threats, including a nuclear attack, strongly point to the site he’s talking about being a deeply buried underground bunker of some kind. Russia already understood to have two sites that would match this general description, one at Kosvinsky Kamen in the Northern Ural Mountains and another under Mount Yamantau in the Southern Ural Mountains.<sup>44</sup>

The Russian NC3 system has evolved from the remains of the political and technological inheritance of the Soviet Union. Although the workings of the Russian NC3 system were shrouded in secrecy for much of the Cold War, the United States has learned a good deal about how the system works since the end of the superpower confrontation. It now has a much better handle on Russian NC3 than on the nascent PRC system, and it is worth working through in some detail how the Russian system works.<sup>45</sup>

When the Soviet Union collapsed and during the turbulent years that followed, the Russian NC3 system faced numerous, seemingly insuperable, problems. The early warning system was undermined by gaps created by the fact that some early warning radars were no longer on Russian territory. Many of its early warning satellites were aging out and in need of replacement, many of the military officers in the chain of custody and command of nuclear weapons were poorly paid and motivated, and Russia lacked funding for modernization of key capabilities. Under the Putin presidency and Russia’s economic recovery, generated in part by higher global oil prices, the Russian government made a major investment in nuclear capabilities to compensate for its shrunken conventional capabilities.<sup>46</sup>

As was the case in the Soviet Union, maintaining strict control over the nuclear arsenal remains a critical requirement for Russia, which has led it to develop “a centralized

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43 DIA, “Ronald L. Burgess, Jr. Lieutenant General, U.S. Army Director, Defense Intelligence Agency: World Wide Threat Assessment” Statement Before the Committee on Armed Services, March 10, 2011, [https://irp.fas.org/congress/2011\\_hr/031011burgess.pdf](https://irp.fas.org/congress/2011_hr/031011burgess.pdf); and Joseph Trevithick, “Putin Reveals Existence of New Nuclear Command Bunker,” *The War Zone*, January 26, 2021, <https://www.twz.com/37569/putin-reveals-existence-of-new-nuclear-command-bunker-and-says-its-almost-complete>.

44 Trevithick, “Putin Reveals.”

45 Valery Yarynich, *C3: Nuclear Command, Control, Cooperation* (Washington, DC: Center for Defense Information, 2003), pp. 135–179; Bruce Blair, *The Logic of Accidental Nuclear War* (Washington, DC: Brookings Institution, 1993), pp. 59–67; Pavel Podvig, ed., *Russian Strategic Nuclear Forces* (Cambridge: Massachusetts Institute of Technology Press, 2001), pp. 49–66; and Pavel Podvig, “History and the Current Status of the Russian Early-Warning System,” *Science and Global Security* 10, no. 1, 2002, pp. 21–60.

46 Podvig, “History and Current Status.”

nuclear C2 system capable of meeting its three primary requirements: reliability, speed, and security. To accomplish these goals, strategic planners designed a complex system-of-systems that protects weapons from unauthorized or accidental use and centralizes command authority at the highest echelon, while guaranteeing the ability to quickly launch when necessary.<sup>47</sup>

In 2014, the Russian Ministry of Defence established a National Defense Command and Control Center that houses three subordinate control centers, including the Nuclear Strategic Forces Command and Control center, which manages nuclear weapons use at the direction of Russia's civilian and military political leaders. This includes oversight of Russia's version of the nuclear triad: the Strategic Rocket Forces (SRF), Air Force Strategic Aviation, and the naval SSBNs. The Soviet Union's initial NC3 was quite primitive. It was based on extant systems of command and control used for artillery. Over time, these systems were upgraded to incorporate electronic computers, more advanced communications systems, and space satellites. Now the SRF has its "own Main Command, Main Staff, and Central Command Post, with a Communication Center, Computing Center and other departments and services." The Central Command Post, a facility built 30 meters underground, is in Vlasikha, a work settlement in Moscow Oblast, and provides the ability to maintain "constant communications with all SRF combat posts with almost six thousand officers on duty."<sup>48</sup>

The combat management system for the SRF has several elements. Early warning of incoming missile launches is provided by ground-based radars across Russia and in some neighboring countries of the former Soviet Union—Kazakhstan, Belarus, and Tajikistan—and by early warning radars. The Soviet Union never had an early warning system as thorough or complete as the American one. Although the Soviet Union deployed both above- and over-the-horizon radars, there were persistent gaps in coverage, some of which were exacerbated by the breakup of the Soviet Union. Moreover, although the Soviets were the first into space with the Sputnik satellite, they trailed the United States by almost a decade when it came to the deployment of early warning satellites. They relied disproportionately on satellites in highly elliptical orbits (HEO) or Molniya orbits, rather than geosynchronous Earth orbits (GEO). In addition, Soviet and Russian space satellites have been plagued by hardware and software failures that have led to short service lives and the requirement for frequent maintenance and replacement of satellites.<sup>49</sup>

These failures led some observers to worry in the early part of this century that the Russian early warning system was useless and was perhaps undermining Russia's nuclear deterrent. As Pavel Podvig has explained, however, "the role given to the Russian early warning

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47 Valery Yarynich, cited in DIA, *Russian Military Power: Building a Military to Support Great Power Aspirations* (Washington, DC: DIA., 2017), pp. 26–27.

48 Leonid Ryabikhin, "Russia's NC3 and Early Warning Systems," NAPSNet Special Reports, July 11, 2019, <https://nautilus.org/napsnet/napsnet-special-reports/russias-nc3-and-early-warning-systems/?view=pdf>.

49 Podvig, "History and Current Status."

system in nuclear operations is rather limited.” This is in part because the Soviet Union never had “a complete early-warning system that would be able to detect all possible missile launches.” The Soviets made their peace with this fact because “the major requirement of the early-warning system was that it had to be able to detect a large-scale attack that could endanger the ability of the Soviet Union (and now Russia) to launch a retaliatory strike.” Due to the limitations of its early warning systems, the Russians never adopted stringent requirements for dual phenomenology (requiring confirmation of missile launch via both radar and satellite sensors before implementing nuclear weapons launch protocols) as part of its NC3 procedures.<sup>50</sup>

Furthermore, it appears to be the case that despite the shortfalls created by political and economic consequences of the Soviet Union’s end, the system’s decline was “very unlikely to affect the command and control procedures in a way that would increase risk of an error or misunderstanding.”<sup>51</sup>

Although these accounts of the disrepair of Russian NC3 should be treated with caution, it is clear that as part of their nuclear modernization, the Russians have upgraded their radars and early warning satellites. In the last 10 years, Russia has closed gaps in the early warning radar system by building new phased array radars in Orsk, Barnaul, and Yeniseisk and upgrading radars at Baranovichi, Murmansk, and Pechora. Replacing the early Oko early warning satellites with more modern YeKS-Tundra models has taken a bit longer. The process began in 2015 and has resulted in a number of satellites in HEO (although at least two have ended their service). These satellites are meant to be part of an integrated space system (YeKS) that will include several satellites in GEO. “Unlike their Soviet predecessors, the Tundra satellites should have enough computing power to do much of the data processing on board, allowing operators on the ground to make swift recommendations to the country’s leadership on the need to activate anti-ballistic missile systems to launch a retaliatory strike.”<sup>52</sup>

Once a launch has been detected, that information would flow to satellite ground stations like Serpukhov-15 in Kaluga Oblast in central Russia and Komsomolsk-on-Amur in the far east. This missile attack signal would in turn have to be “confirmed at the central command post of the Air Defense forces and the central command post of the General Staff,” where duty officers would attempt to assess and characterize the signal. Simultaneously, “a report of the detected event would be sent to the Krokus terminals of the highest military officers,

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50 Ibid.

51 Ibid.

52 Pavel Podvig, “Russia Lost All Its Early-Warning Satellites,” Russian Strategic Nuclear Forces (blog), February 11, 2015, [https://russianforces.org/blog/2015/02/russia\\_lost\\_all\\_its\\_early-warn.shtml](https://russianforces.org/blog/2015/02/russia_lost_all_its_early-warn.shtml); Pavel Podvig, “Space Segment of Russia’s Early-Warning System Seems to Be Down to Three Satellites,” Russian Strategic Nuclear Forces (blog), March 30, 2025, [https://russianforces.org/blog/2025/03/space\\_segment\\_of\\_russias\\_early.shtml](https://russianforces.org/blog/2025/03/space_segment_of_russias_early.shtml); and Bart Hendrickx, “EKS: Russia’s Space-Based Missile Early Warning System,” The Space Review, February 8, 2021, <https://www.thespacereview.com/article/4121/1>.

which would display information about the scale of the possible attack and the projected impact area of the warheads.” It would then be relayed through the Combat Management Automated System or Kazbek system. The system has portable terminals known as Cheget or nuclear briefcase, like the so called “football” carried by the U.S. president’s military aides at all times. There are three such terminals: one with the president of Russia, one with the minister of defense, and one with the chief of the General Staff. The Kazbek system has two additional elements. Besides the Cheget, it uses the Kavkaz-7 communications system through which the Russian president, minister of defense, and chief of the General Staff can discuss and send messages to key command posts where they would be displayed on the final element of Kazbek, the Baksan terminals.

Permission to launch is only valid when the proper codes are received from at least two of the terminals.<sup>53</sup>

The Russians also established an automated system to deal with a circumstance in which the national leadership had been decapitated in a first strike. This was called Perimeter, and it is sometimes referred to in Western journalistic accounts as Dead Hand. Perimeter was developed and deployed in the early 1980s when the Cold War was at its height. At a time when U.S. nuclear doctrine called for holding Soviet leadership targets at risk as the highest priority and the U.S. was deploying Pershing II missiles in Europe that had only an eight-minute flight time to Moscow, Soviet leaders worried about the potential for a decapitating U.S. first strike. Amid these developments, Soviet leaders in 1983 came to fear that a NATO exercise—Able Archer—was a cover for a preemptive nuclear strike. As *Washington Post* journalist David Hoffman has written, “Soviet leaders feared they could perish in a decapitating missile attack before they had a chance to respond. They drew up plans for a system to guarantee a retaliatory strike.”<sup>54</sup>

Originally, the Soviets envisioned Perimeter as an automated system:

According to the original plan, later rejected, if the command station of the Perimeter systems was activated in advance and did not receive an order to stop the combat algorithm within a certain period of time, the launch of the command rockets and transmission of the order to deliver a retaliatory strike would be automatic. This was supposed to guarantee the delivery of a retaliatory strike in the event of the elimination of the top leadership while reserving the possibility of the cancellation of the order in the event of a false signal.

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53 Podvig, *Russian Strategic Nuclear Forces*, pp. 61–62. See also “Russian Nuclear Command, Control and Communications,” Nuclear Information Service, [https://www.nuclearinfo.org/wp-content/uploads/2022/01/Russian\\_Nuclear\\_Command\\_Control\\_and\\_Communications\\_nd\\_volume\\_1\\_of\\_2.pdf](https://www.nuclearinfo.org/wp-content/uploads/2022/01/Russian_Nuclear_Command_Control_and_Communications_nd_volume_1_of_2.pdf). This document is part of the archive of UK nuclear researcher John Ainslie, who was the coordinator of the Scottish Campaign for Nuclear Disarmament until his death in 2016.

54 Podvig, *Russian Strategic Nuclear Forces*, pp. 65–66; and David E. Hoffman, *The Dead Hand: The Untold Story of the Cold War Arms Race and Its Dangerous Legacy* (New York: Random House, 2009), p. 23.

It appears the system was not deployed in an automatic mode. The Soviets intended for a human in the loop at one of the hardened command centers, likely Yamantau or Kosvinsky Mountain, to give the order for the retaliatory strike if the Soviet leadership were eliminated in a decapitating first strike.<sup>55</sup>

Russian willingness to consider automated nuclear decision-making is nevertheless extremely relevant in today's world of three nuclear peers, or near peers, as national leaders consider the rapidly accelerating role of artificial intelligence (AI) in military systems and nuclear weapons systems. Russian interest in the military dimensions of AI stretches back long before the development and deployment of Perimeter. As early as the 1960s, Soviet research institutes were considering the role of neural networks for missile defense. In 1962, the Ministry of Defence published a work by Colonel-Engineer Viktor Bokarev, *Cybernetics and Military Affairs*, in which the author “concluded that artificial reasoning could be feasible in the future, yet the push towards it had many obstacles and the possibility was not guaranteed.” Bokarev pondered “how humans and machines would interact and what that would mean for warfare.”<sup>56</sup>

More recent writing on the subject by Russian experts has “embraced the idea that AI is about to become a crucial—if not the key—technology that would determine the future of warfare.” Andrey Kokoshin, an influential scholar on military affairs and a former deputy minister of defense, has suggested that AI can “provide state leadership and commanders at all levels with the highest possible degree of awareness of the political-military, operational strategic and tactical situations under conditions of active information and cyber warfare. Thus the ‘fog of war’ noted by Clausewitz should be reduced.” Many uses for AI in the nuclear realm discussed by Russian experts are related to planning, logistics, communication network management, signals processing, and other day-to-day management tasks for handling nuclear weapons. When it comes to the command of nuclear forces in wartime, the bulk of the writing seems to suggest an important role for AI in “threat assessment and damage prediction.... This can help understand the scale of the attack, its source and possible intentions as well as quickly develop an adequate response scenario.” Russian writing continues to emphasize the importance of keeping humans in the decision-making loop but also that the idea of “predelegation of authority to ‘machines’” may return to the agenda if there is a rapid deterioration in strategic stability.<sup>57</sup>

In conclusion, Russia increased its reliance on nuclear weapons during the post–Cold War period because it had lost much of its conventional military capability and the conventional force overmatch it had enjoyed during the Cold War. Astronomical Russian losses

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55 Podvig, *Russian Strategic Nuclear Forces*, pp. 65–66; Hoffman, *The Dead Hand*, pp. 23–24, 150–151, 152–154, 364–366, 369, 421–423; and DIA, *Russian Military Power*, p. 26.

56 Oleg Shakirov, “Russian Thinking on AI Integration and Interaction with Nuclear Command and Control, Force Structure, and Decision-Making,” *European Leadership Network*, November 2023, p. 3, <https://europeanleadershipnetwork.org/wp-content/uploads/2023/11/Russian-bibliography.pdf>.

57 *Ibid.* pp. 4, 6–9.

of troops and equipment in the premeditated, unprovoked war of aggression that Moscow launched against Ukraine in February 2022 will take some years to reconstitute. British Ministry of Defence assessments suggest that Russian casualties have reached one million killed and wounded since fighting began, and equipment losses exceed the Russian defense industry's ability to replace them (despite being on a war footing). It will take many years for Russia to reconstitute those catastrophic losses. In the meantime, Russia's reliance on nuclear weapons will likely increase even beyond what was evident after the collapse of the Soviet Union.<sup>58</sup>

The weaknesses of Russia's space-based constellation of early warning satellites, although partially remedied by the launching of more modern EMK-Tundra satellites over the past few years, mean that Russia is simply less reliant on space than the United States. This perhaps explains why it appears to be willing to at least contemplate using a nuclear weapon in space. The effect of such a weapon would disproportionately affect U.S. early warning capabilities.

Both the PRC and Russia have developed a FOBS capability, and the PRC tested it in 2021. Both the PRC and Russia have emphasized and tested ASAT capabilities, and both have historically invested in the development of deep underground command posts and appear to have announced the existence of (in the case of Russia) or appear to be building (in the case of China) facilities that would be suitable for fighting a nuclear war. One must add to this mix the prospect of Sino-Russian collaboration on nuclear weapons issues. Although the potential of such collaboration has frequently been dismissed, recent years have seen joint naval and other exercises, and in the summer of 2024, flights of strategic bombers near U.S. airspace in Alaska. The two countries have cooperated on the development of China's fast breeder reactors and have agreed to jointly place a nuclear power plant on the surface of the moon.

Whether separately or because of collaborative nuclear planning, the existence of these capabilities raises concerns among U.S. policymakers about the potential for a decapitating nuclear first strike, concerns that have not been on the policy agenda in a serious way since the early 1980s. Although after the 9/11 attack there was renewed thinking about continuity of government (COG), that concern has waned in recent years. Current nuclear developments may force policymakers to return to the issue in a serious way. Later chapters will consider some steps that might be taken.<sup>59</sup>

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58 Kristin Ven Bruusgaard, "Russian Nuclear Strategy and Conventional Inferiority," *Journal of Strategic Studies* 44, no. 1, 2021, pp. 3–35; and UK Ministry of Defence (@DefenceHQ), X, "Latest Defence Intelligence update on the situation in Ukraine," June 12, 2025 <https://x.com/DefenceHQ/status/1933073278408478992>.

59 Steinbruner, "Nuclear Decapitation," pp. 16–28.



## CHAPTER 4

# U.S. Nuclear Modernization

The United States is currently modernizing its triad of nuclear weapons systems, a process initiated under the Barack Obama administration in part as a requirement for winning Senate ratification of the New START Treaty of 2010. This program includes a new bomber, the B-21 Raider, for the air breathing leg; the Sentinel ground-based strategic deterrent (GBSD), a new ICBM to replace the Minuteman III ICBMs first designed in the 1960s and deployed in the 1970s; and the new *Columbia*-class SSBN to replace the aging *Ohio*-class SSBNs, which first went to sea in 1981. The program is expected to cost \$946 billion over the next decade.<sup>60</sup>

This overdue recapitalization of U.S. nuclear forces leaves the United States trailing the extensive modernization efforts that the PRC and Russia have had underway for many years, as described above. In its 2023 report, the congressionally mandated Strategic Posture Commission, recognizing that the U.S. modernization effort was long overdue, recommended “fully and urgently executing the U.S. nuclear modernization Program of Record which includes replacement of all U.S. nuclear delivery systems, modernization of their warheads, comprehensive modernization of U.S. nuclear command, control and communications (NC3), and recapitalizing the nuclear enterprise infrastructure at the DOD and DOE/NNSA.”<sup>61</sup>

According to a recent unclassified assessment, the U.S. nuclear force today consists of some 3,708 nuclear warheads, with roughly 1,770 of them deployed. An additional 1,938 warheads remain in reserve as a hedge against dramatic negative changes in the international security environment, and another 1,300 or so warheads await dismantlement. The hedging policy

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60 “Projected Cost of U.S. Nuclear Forces, 2025–2034,” Congressional Budget Office (CBO), April 2025, [https://www.cbo.gov/publication/61362#:~:text=in%20March%202024,-,Costs%20of%20Current%20Plans,growth%20\(see%20Figure%201\).](https://www.cbo.gov/publication/61362#:~:text=in%20March%202024,-,Costs%20of%20Current%20Plans,growth%20(see%20Figure%201).)

61 Creedon et al., *America’s Strategic Posture*, p. viii; Hans M. Kristensen and Matt Korda, “United States Nuclear Forces,” in *SIPRI Yearbook 2024: Armaments, Disarmament and International Security* (Stockholm: SIPRI, 2024), pp. 273–286; and “Defense Primer: Strategic Nuclear Forces,” Congressional Research Service (CRS), May 1, 2025, [https://www.congress.gov/crs\\_external\\_products/IF/PDF/IF10519/IF10519.26.pdf](https://www.congress.gov/crs_external_products/IF/PDF/IF10519/IF10519.26.pdf).

was articulated by Secretary of Defense William Perry after the 1994 nuclear posture review (NPR), which concluded that the United States needed to maintain a capability for uploading or reconstituting its nuclear forces if relations with Russia were to change for the worse or if START I and START II were not fully implemented. As Perry explained in the press conference announcing the NPR, the U.S. government wanted to “hedge against the reversal of reform in Russia. The return to an authoritative military regime hostile to the United States and still armed with 25,000 nuclear weapons.” Perry added that although he thought such a reversal unlikely, “we still feel it is prudent to provide some hedge against that happening.”<sup>62</sup>

The number of deployed warheads, consistent with the limits of the 2010 New START Treaty that was extended for five years by the Biden administration in February 2021, can no longer be tracked exactly from open sources because in early 2023 the Russians suspended the data exchanges called for under the treaty in the wake of the war in Ukraine. The United States published its numbers in May 2023, declaring 1,419 warheads deployed on 662 ballistic missiles and bombers, but since that time it has either provided no updates or republished the May 2023 data.<sup>63</sup>

Before the New START Treaty was implemented, the United States maintained 450 Minuteman III missiles deployed at F. E. Warren Air Force Base in Wyoming, Malmstrom Air Force Base in Montana, and Minot Air Force Base in North Dakota. After New START, the United States reduced the number of missiles to 400. The 50 empty holes could be used to reconstitute additional missiles and warheads, now that New START has expired. Each Minuteman missile carries a single warhead but can carry up to three. Over the past 20 years, the Minuteman missiles have undergone several service life extension programs (SLEPs) to improve their accuracy and reliability and to assure their operational capability, as they were expected to have a 10-year service life. The most recent SLEP was completed in 2015; it extended the service life of the Minuteman force until 2030. Further life extensions are becoming more and difficult because spare parts and even the original drawings are no longer available.<sup>64</sup>

The Minuteman III force is meant to be replaced by the GBSD Sentinel program. In September 2020, a \$13 billion contract was awarded for engineering and manufacturing the new missile. The program was intended to be completed by 2029 but has been subject to multiple delays and cost overruns, not least because of the complications of securing land use permissions and the civil engineering of the new silos and launch control facilities. As

62 Kristensen and Korda, “United States Nuclear Forces,” p. 273; and William J. Perry, “DoD Review Recommends Reduction in Nuclear Force,” Office of Assistant Secretary of Defense (Public Affairs), September 22, 1994, <https://nautilus.org/wp-content/uploads/2015/07/dodpro92294.pdf>. For background on the 1994 NPR, see “1994 Nuclear Posture Review,” Nuclear Strategy, December 31, 2001, <https://nautilus.org/projects/nuclear-strategy/1994-nuclear-posture-review/>. For historical numbers on the U.S. stockpile of nuclear weapons, see “Transparency in the U.S. Nuclear Weapons Stockpile,” Department of Energy (DOE), <https://www.energy.gov/nnsa/transparency-us-nuclear-weapons-stockpile>.

63 Kristensen and Korda, “United States Nuclear Forces.”

64 Kristensen and Korda, “United States Nuclear Forces.”

an authoritative account of U.S. nuclear forces noted: “In addition to an entirely new missile, the Sentinel program includes renovating all 450 launch facilities, constructing new missile alert facilities, new command and control facilities and systems, and new launch centers, and establishing over 3,000 miles of new utility corridors—not to mention new training sites and curriculum for USAF personnel.”

With costs rising 37 percent over the original projections, DoD reported to Congress that the program was in a Nunn–McCurdy breach, which, by legislation, required DoD to conduct a program review. Upon completion of the review, Under Secretary of Defense for Acquisition and Sustainment Bill LaPlante concluded that the “majority of the cost growth is in Sentinel’s command and launch segment, which includes the launch facilities, launch centers, and the process, duration, staffing, and facilities to execute the conversion from Minuteman III to Sentinel.” Furthermore, he noted, “We are fully aware of the costs, but we are also aware of the risks of not modernizing our nuclear forces and not addressing the very real threats we confront.” The program will continue albeit with a delay that most anticipate will last several years. Construction of new facilities has already begun at F. E. Warren and will be followed seriatim at Malmstrom and Minot.<sup>65</sup>

When the program is complete, the U.S. Air Force plans to purchase 659 missiles so it can deploy 400 and have the remainder available for testing and for use as spares. The Sentinel missiles will each be able to carry two warheads and will feature a new warhead and reentry vehicle, although the production of new warheads will depend on the ability of the National Nuclear Security Administration (NNSA) to produce enough plutonium pits to support the new warhead.<sup>66</sup>

The United States maintains a fleet of 14 *Ohio*-class SSBNs, home ported in bases on each coast with eight at Kitsap Naval Base in Washington state and six at Kings Bay in Georgia. At any given time, 12 SSBNs should be in an operational status while two are undergoing maintenance. All the SSBNs have undergone a mid-life refueling and should be available until 2027, when the U.S. Navy will begin retiring the *Ohio*-class submarines. As an unclassified survey noted, “Each Ohio-class SSBN was built to carry up to 24 Trident II SLBMs, but to meet the New START limit on deployed launchers, 4 of the 24 initial missile tubes on each submarine were deactivated so that the 12 SSBNs that are usually operational can carry no more than 240 missiles.... The US SSBN fleet conducts about 30 deterrence patrols per year.”

The D-5LE missiles on board can each carry up to eight warheads, but the normal load is four to five, made up of two types: the W76 and W88. The former has been modified as the W76-2 to include a low-yield variant that was deployed to fill gaps in the escalation ladder given Russia’s large numerical advantage in so-called theater nuclear weapons and its

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65 Hans M. Kristensen, Matt Korda, Eliana Johns, and Mackenzie Knight, “United States Nuclear Weapons, 2025,” *Bulletin of the Atomic Scientists* 81, no. 1, 2025, p. 60; and “Department of Defense Announces Results of Sentinel Nunn–McCurdy Review,” DoD, July 8, 2024, <https://www.defense.gov/News/Releases/Release/Article/3829985/departments-of-defense-announces-results-of-sentinel-nunn-mccurdy-review/>.

66 Kristensen and Korda, “United States Nuclear Forces”; and Kristensen et al., “United States Nuclear Weapons, 2025.”

escalate to de-escalate strategy for concluding regional conflicts on favorable terms with limited nuclear use, as the Biden administration’s 2022 NPR explained. The higher-yield W88 warhead is currently undergoing a life extension and modernization program.<sup>67</sup>

The 12 new *Columbia*-class SSBNs will replace the current *Ohio*-class fleet of 14 SSBNs. The first of these, the *District of Columbia*, is meant to commence patrols in 2031. The *Columbia*-class SSBNs will carry 16 missiles each, as opposed to the 20 carried by the *Ohio*-class vessels. They will initially carry D5LE warheads. The Navy is undertaking a SLEP for the D5LE, and the *Columbia*-class SSBNs will eventually be kitted out with D5LE2 missiles. Those missiles will ultimately carry the W93 warhead, which will be the first new warhead the United States will build after the end of the Cold War. The *Columbia* class is behind schedule; as a result, “The *Ohio*-class retirement and *Columbia*-class production schedules are not completely aligned, this means that the total number of operational SSBNs will dip below the full complement of 12 boats for three years during the acquisition/retirement process.” As the Strategic Posture Commission noted: “Further delays in delivering modernized systems or early aging out of legacy systems, could create shortfalls in U.S. nuclear capabilities if adequate mitigation measures are not developed and implemented.”<sup>68</sup>

The U.S. Air Force strategic nuclear bomber fleet currently consists of 19 B-2A and 46 B-52H nuclear-capable aircraft, although a smaller number are fully operational at any given time. The B-2s can be armed with a variety of gravity bombs, and the B-52s carry the AGM-86B ALCM. The Air Force is developing a modernized cruise missile, the AGM 181 long-range stand-off (LRSO) missile, as well as a modernized gravity bomb, the B-61-12, that features a variable yield. The current fleet is based at Minot Air Force Base in North Dakota, Whiteman Air Force Base in Missouri, and Barksdale Air Force Base in Louisiana.<sup>69</sup>

The Air Force’s major bomber modernization program is to develop the B-21 Raider while modernizing the command-and-control capabilities of the existing bomber fleet. Although much about the new stealth bomber’s capabilities remains classified, the aircraft’s rollout in 2022 suggests it shares many design characteristics with its predecessor, the B-2. It is designed to defeat adversary anti-access / area denial (A2/AD) systems, although its weapons load will be a bit less than the B-2. The Air Force anticipates that it will acquire at least 100 B-21s and possibly more. The Raider will likely enter service in 2027 and gradually replace the B-2 force in the 2030s. It will be capable of carrying the B61-12 and B61-13 gravity bombs, whose tail kits provide greater accuracy (the B61-13 has a higher yield than the B61-12 and provides more capability against hardened and wide-area military targets). The B-21s will also be the first stealth bomber to carry a cruise missile—the LRSO, which

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67 Kristensen and Korda, “United States Nuclear Forces”; Kristensen et al., “United States Nuclear Weapons, 2025”; and DoD, 2022 Nuclear Posture Review, Federation of American Scientists, October 27, 2022, <https://fas.org/wp-content/uploads/2023/07/2022-Nuclear-Posture-Review.pdf>.

68 Kristensen et al., “United States Nuclear Weapons, 2025,” p. 64; Creedon et al., *America’s Strategic Posture*, p. 44.

69 Kristensen et al., “United States Nuclear Weapons, 2025.” Another 30 B-52s were converted to conventional missions only.

will also replace the AGM-86B ALCM currently arming the B52Hs. The “LRSO will be capable of penetrating and surviving advanced Integrated Air Defense System from significant stand-off range to prosecute strategic targets in support of the Air Force’s global attack capability and strategic deterrence core function.” In short, it will be stealthier, more accurate, and have greater range than the ALCM it is replacing.<sup>70</sup>

The B-21 will first be deployed to Ellsworth Air Force Base in South Dakota, followed by additional squadrons to be deployed at Whiteman Air Force Base in Missouri and Dyess Air Force Base in Texas. This will bring the total number of bases capable of handling nuclear weapons from the current two (Minot and Whiteman) to five (Barksdale Air Force Base will have its earlier nuclear weapons storage capability restored as part of the modernization process). The diversification of basing for strategic nuclear bombers will complicate Russian and Chinese targeting of U.S. nuclear capabilities once the process is complete.<sup>71</sup>

## Role of NC3

Despite being regarded by many experts as the fourth leg of America’s nuclear arsenal or the fifth pillar of its nuclear enterprise,<sup>72</sup> American NC3 has traditionally received much less attention than the weapons and delivery vehicles it supports. Nevertheless, the personnel, procedures, facilities, and equipment that compose the NC3 enterprise underpin U.S. nuclear policy and strategic stability with nuclear-armed rivals. For example, the ability to accurately detect and assess an impending or incoming attack, quickly decide whether and how to respond, reliably authenticate any launch orders that are issued by the president or the president’s designated successor, and securely transmit those orders to the military personnel responsible for conducting nuclear strike operations guarantees that Washington can retaliate against an attacker.<sup>73</sup>

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70 Kristensen and Korda, “United States Nuclear Forces”; “B-21 Raider,” U.S. Air Force, accessed December 17, 2025, <https://www.af.mil/About-Us/Fact-Sheets/Display/Article/2682973/b-21-raider/>; “10 Facts About Northrop Grumman’s B-21 Raider,” Northrop Grumman Corporation, <https://www.northropgrumman.com/what-we-do/aircraft/b-21-raider/10-facts>; and “DoD Fiscal Year (FY) 2025 Budget Estimates,” in Air Force Justification Book, vol. 1, Missile Procurement, Department of the Air Force, March 2024, <https://www.saffm.hq.af.mil/Portals/84/documents/FY25/FY25%20Air%20Force%20Missile%20Procurement.pdf>

71 Kristensen and Korda, “United States Nuclear Forces.”

72 The fifth pillar includes the three legs of the triad and the nondeployed warhead stockpile.

73 John A. Tirpak, “The End of Nuclear ‘Kick the Can,’” Air Force Magazine, February 1, 2020; and Deptula et al., *Modernizing U.S. Nuclear Command, Control, and Communications*, p. 34. The classic studies of nuclear command and control and its role in strategic stability are Ashton B. Carter, “The Command and Control of Nuclear War,” *Scientific American* 252, no. 1, January 1985; Paul Bracken, *The Command and Control of Nuclear Forces* (New Haven, CT: Yale University Press, 1983); and Bruce G. Blair, *Strategic Command and Control: Redefining the Nuclear Threat* (Washington, DC: Brookings Institution Press, 1985). For more recent accounts of the current NC3 architecture, see Harvey and Warden, “Command and Control of U.S. Nuclear Forces”; *Nuclear Matters Handbook 2020*, Office of the Deputy Assistant Secretary of Defense for Nuclear Matters, chap. 2, [https://www.acq.osd.mil/ncbdp/nm/NMHB2020rev/docs/NMHB2020rev\\_Ch2.pdf](https://www.acq.osd.mil/ncbdp/nm/NMHB2020rev/docs/NMHB2020rev_Ch2.pdf); and Jeffrey A. Larsen, “U.S. Nuclear Command, Control and Communications: An Overview,” in Wirtz and Larsen, eds., *Nuclear Command, Control, and Communications*, pp. 71–92.

In recent years, however, government officials and nongovernment analysts alike have been sounding the alarm over a range of challenges—not just entanglement problems and external threats from emerging technologies that are increasing the vulnerability of NC3 systems but also technical and fiscal hurdles to modernization that could decrease confidence in the viability of those systems.<sup>74</sup>

Perhaps the single biggest source of strain on the NC3 architecture is age. As described above, after decades of deferred recapitalization, the U.S. nuclear arsenal is about to undergo a near-wholesale replacement. The NC3 architecture is no exception, as it includes many systems that have remained in service long past their anticipated lifespans. Consequently, those systems often rely on outdated technology to perform critical functions. Perhaps the most notorious example is the Strategic Automated Command and Control System, the primary means of transmitting emergency actions messages across the nuclear arsenal, which until very recently continued to use 1970s-era floppy disks.<sup>75</sup> An aging architecture raises a host of thorny issues, even if some legacy technologies have the unintended benefit of being much less vulnerable than newer systems to threats such as computer network attacks. One of the most notable issues is the difficulty of sustainment. According to the head of U.S. Air Force Global Strike Command, “there are components that suffer from diminishing manufacturing sources and material shortages across the NC3 enterprise.”<sup>76</sup> Another issue is the anticipated cost of replacement. Although estimates of current and planned nuclear spending can be contentious, particularly given the tendency of some analysts to include dual-use systems in their accounting, a recent Congressional Budget Office study put the price tag for NC3 modernization at \$154 billion over the next decade, although that number is up for debate.<sup>77</sup>

An older, and in many cases smaller, nuclear arsenal also has a shrinking margin of error when it comes to unanticipated disruptions. This concern is usually associated with the possibility of warhead degradation that afflicts an entire class of weapons, which is one of the primary reasons the United States maintains an inactive warhead stockpile as a hedge to supplement its operationally deployed forces. Nevertheless, this concern also applies to the NC3 architecture. In general, the United States has spent decades prioritizing military

74 Wirtz and Larsen, eds., Nuclear Command, Control, and Communications. For a cross-national summary of nuclear use procedures, see Jeffrey G. Lewis and Bruno Tertrais, “The Finger on the Button: The Authority to Use Nuclear Weapons in Nuclear-Armed States,” Occasional Paper No. 45, James Martin Center for Nonproliferation Studies, February 2019, <https://nonproliferation.org/wp-content/uploads/2019/02/Finger-on-the-Nuclear-Button.pdf>

75 Valerie Insinna, “The U.S. Nuclear Forces’ Dr. Strangelove-Era Messaging System Finally Got Rid of Its Floppy Disks,” C4ISRNet, October 17, 2019, <https://www.defensenews.com/air/2019/10/17/the-us-nuclear-forces-dr-strangelove-era-messaging-system-finally-got-rid-of-its-floppy-disks/>.

76 Timothy M. Ray, “Department of the Air Force Presentation to the Senate Armed Services Committee, Subcommittee on Strategic Forces,” U.S. Senate Comm. on Armed Services, May 1, 2019, p. 8, [https://www.armed-services.senate.gov/imo/media/doc/Ray\\_05-01-19.pdf](https://www.armed-services.senate.gov/imo/media/doc/Ray_05-01-19.pdf).

77 CBO, “Projected Cost”. For an overview of the fiscal debates surrounding nuclear sustainment and modernization, see Todd Harrison and Evan Braden Montgomery, *The Cost of U.S. Nuclear Forces: From BCA to Bow Wave and Beyond* (Washington, DC: Center for Strategic and Budgetary Assessments, 2015).

efficiency over military effectiveness, especially when it comes to its conventional capabilities. This has entailed extending the life of existing systems rather than investing in new ones, as well as reducing and consolidating forces and facilities to shed excess capacity, avoid redundancy, and streamline logistics. Efficiency might be beneficial in peacetime by keeping costs down, but it also drives fragility up: It can create single points of failure in crises and magnify the effects of attrition in conflict. By contrast, the nuclear arsenal is traditionally associated with effectiveness rather than efficiency. Complementary capabilities, redundant modes of communication, and a reserve stockpile all help avoid single points of failure and ensure that the United States can still achieve its objectives after sustaining some attrition. Yet the efficiency paradigm has crept into the nuclear domain as well, the natural result of trying to preserve a safe and effective arsenal during a period of arms reductions, budget cuts, and postponed recapitalization. In fact, the U.S. nuclear arsenal can be seen as a triumph of efficiency, given that the United States has “squeezed about all the life we can out of the systems we currently possess,” in the words of one senior official.<sup>78</sup> Yet this means that even unexpected accidents like ground collisions or random acts like bird strikes can decrement U.S. capabilities in dangerous ways, for instance by taking high-demand/low-density NC3 assets like airborne command posts offline.<sup>79</sup>

Ultimately, an aging NC3 infrastructure raises concerns about the reliability and responsiveness of U.S. nuclear forces; that is, whether the options the president chooses will be available and can be executed when they choose them. Not surprisingly, Hyten, the former commander of STRATCOM and a former vice chairman of the Joint Chiefs of Staff, has argued that “any delay, deferment or cancellation of NC3 modernization will create a capability gap that potentially degrades the president’s ability to respond appropriately to a strategic threat.”<sup>80</sup> This is even more the case given the emerging Russian and Chinese capabilities for a decapitation strike described earlier.

The U.S. program for NC3 modernization includes a few significant upgrades intended to ensure that national authorities can communicate with and control the new capabilities making up the U.S. strategic triad. These upgrades include making the NC3 system of systems more resilient against the emerging counterspace and offensive cyber capabilities of China and Russia. The upgraded system will need to operate during and after an attack to detect potential attacks and assess the operational environment; provide secure conferencing to permit presidential decision-making; and transmit authenticated orders to the

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78 Cheryl Pellerin, “Selva: Nuclear Deterrent Is the Joint Force Modernization Priority,” DoD News, March 8, 2017, <https://www.war.gov/News/News-Stories/Article/Article/1107141/selva-nuclear-deterrent-is-the-joint-force-modernization-priority/>

79 In two separate incidents in 2019, two different Navy E6-B aircraft—a command-and-control platform that can be used to relay presidential nuclear orders to SSBNs at sea and land-based ICBMs, as well as launch ICBMs if their launch control centers are no longer functional—suffered Class-A mishaps. Geoff Ziezulewicz, “Here’s What Happened to a Navy Plane That’s Vital to America’s Nuclear Triad,” Navy Times, February 20, 2019; and Courtney Mabeus, “Birdstrike Grounds Navy ‘Doomsday’ Aircraft,” Navy Times, October 17, 2019.

80 Pellerin, “Selva.”

land-based ICBM force, the strategic bombers, and SSBNs at sea. The program of record consists of the elements spelled out below.<sup>81</sup>

NC3 begins with the system of early warning radars used to track the trajectory of ICBMs and SLBMs launched against the United States. These include the Precision Acquisition Vehicle Entry Phased Array Warning System (PAVE PAWS), the Perimeter Acquisition Radar Attack Characterization System (PARCS), and the Cobra Dane radar. The PAVE PAWS and PARCS were upgraded through the Upgraded Early Warning Radar program, and there are plans to digitize them “to maintain their missile defense and space surveillance operability amid evolving threats.”<sup>82</sup>

For more than a decade, the Space Force has been deploying satellites and ground systems to detect the launch of missiles by U.S. adversaries. These replace the older Defense Support Program satellites. This Space-Based Infrared System (SBIRS) operates in both GEO and HEO to provide the best coverage for observation of missile launches. The Space Force is also developing the Next-Generation Overhead Persistent Infrared (Next-Gen OPIR) system, composed of satellites operating in both GEO and polar orbits, to replace SBIRS. As a senior DoD official suggested in testimony in 2024, Next-Gen OPIR would serve “as a bridge to enable the eventual transition” to a “proliferated and resilient missile warning architecture.”<sup>83</sup>

For the communications piece of NC3, the advanced extremely high frequency (AEHF) constellation of satellites operated by the Space Force provides hardened communications. The AEHF, which launched some 15 years ago, replaced the Reagan-era Milstar constellation. “Paired with the Family of beyond Line-of-Sight Terminals command post terminals, AEHF aims to provide assured communications for nuclear and conventional forces.” A successor system, the Evolved Strategic SATCOM (ESS) program, is projected to replace the AEHF constellation, with an initial operating capability by 2032.<sup>84</sup>

U.S. NC3 requires dual phenomenology to determine whether a missile attack is taking place on North America, U.S. facilities, or U.S. allies. That requires “two independent information sources using different physical principles, such as radar and infrared satellite sensors associated with the same event, to help clarify the operational situation and ensure the highest

81 “Defense Primer: Nuclear Command, Control, and Communications (NC3),” CRS, May 1, 2025, [https://www.congress.gov/crs\\_external\\_products/IF/PDF/IF11697/IF11697.6.pdf](https://www.congress.gov/crs_external_products/IF/PDF/IF11697/IF11697.6.pdf); and Deptula et al., *Modernizing U.S. Nuclear Command, Control, and Communications*, pp. 29–33.

82 CRS, “Defense Primer.”

83 Assistant Secretary of the Air Force for Space Acquisition and Integration Frank Calvelli quoted in CRS, “Defense Primer.” See also “Space Based Infrared System,” U.S. Space Force, updated March 2023, <https://www.spaceforce.mil/about-us/fact-sheets/article/2197746/space-based-infrared-system/>; and “Next Generation Overhead Persistent Infrared Program Selects Mission Payload Suppliers,” Space Systems Command, March 1, 2022, <https://www.ssc.spaceforce.mil/Portals/3/Documents/PRESS%20RELEASES/Next-Generation%20Overhead%20Persistent%20Infrared%20Program%20Selects%20Mission%20Payload%20Suppliers%20v4.pdf>.

84 CRS, “Defense Primer.”

possible assessment credibility.” Attack assessment and characterization is provided by the Integrated Tactical Warning / Attack Assessment (ITW/AA) system headquartered at the Cheyenne Mountain complex in Colorado. The ITW/AA judgment is communicated to the president and senior military leaders who make up the national command authority. The ITW/AA system is also receiving periodic upgrades.<sup>85</sup>

Since the 1960s, the Air Force has operated an air mobile alternative to the fixed command posts at the Pentagon and alternative fixed sites outside of Washington, DC. If the fixed command posts are destroyed or rendered inoperable by a nuclear strike, the National Airborne Operations Center (NAOC) would provide “a highly survivable command, control and communications center to direct U.S. forces, execute emergency war orders, and coordinate actions by civil authorities.” According to the DoD Nuclear Matters Handbook, “a NAOC aircraft is continuously ready to launch within minutes from random basing locations, thus enhancing the survivability of the aircraft and the mission.” The current version is the E-4B NAOC, a modified version of the Boeing 747 that is “based on the E4A originally delivered to the Air Force in the 1970s.” These older aircraft are approaching the end of their service life and urgently need replacement. The Air Force has awarded a contract for a new Survivable Airborne Operations Center (SAOC), which is meant to develop a successor based on a commercial derivative aircraft that will provide a survivable command, control, and communications (C3) platform to direct U.S. nuclear forces, execute emergency action messages, and coordinate continuing government operations. It will “feature enhancements to withstand electronic and nuclear threats, including secure communications, self-defense systems, air refueling capabilities, and a modular open systems approach allowing for swift upgrades to enhance its operational effectiveness.” As yet, there is no date for the SAOC’s initial operating capability.<sup>86</sup>

The final piece of NC3 modernization is the Navy’s effort to recapitalize its system for maintaining strategic connectivity with the SSBN fleet at sea, the E-6B Take Charge and Move Out (TACAMO) airborne command post. As an alternative to the Global Operations Center, TACAMO has “the ability to launch Minuteman III ICBMs as backup to the land-based launch control facilities” and “can relay presidential nuclear control orders to...Air Force nuclear missile control centers and bombers,” in addition to the SSBNs. The E-6B is a modified Boeing 707 that entered service in 1989 and was upgraded in 1998. The Navy is extending the service life of the E6-B until 2038 while studying the mission profile for a successor aircraft, the E-XX, which would be based on the C-130J-30.<sup>87</sup>

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85 Office of the Deputy Assistant Secretary of Defense for Nuclear Matters, *Nuclear Matters Handbook 2020*, chap. 2; and CRS, “Defense Primer.”

86 Office of the Deputy Assistant Secretary of Defense for Nuclear Matters, *Nuclear Matters Handbook 2020*, chap. 2; CRS, “Defense Primer”; and Stefano D’Urso, “SNC Receives Second Boeing 747-8 for SAOC Conversion as Aircraft Gets E-4C Designation,” *The Aviationist*, November 1, 2024, <https://theaviationist.com/2024/11/01/second-boeing-747-8-for-saoc-e-4c/>

87 Office of the Deputy Assistant Secretary of Defense for Nuclear Matters, *Nuclear Matters Handbook 2020*, chap. 2; and CRS, “Defense Primer.”

The 2010 Obama administration NPR called for “strengthening the U.S. command and control system to maximize Presidential decision time in a nuclear crisis,” but it did not address specific threats to NC3. The 2013 Nuclear Weapons Employment Guidance concluded that the nation faced a “significantly diminished possibility of a disarming surprise nuclear attack,” although it suggested that launch on warning remained an option for national leaders. Today, Russian and Chinese capabilities have created a dramatically different situation, and the threats to U.S. NC3 are more real than ever. These threats should be thought of as the first and most urgent challenge of the three-body problem era.<sup>88</sup>

Threats to U.S. NC3, however, unlike the three-body problem, are not novel. Threats to the ability of the U.S. national command authority to maintain command, control and communication with its nuclear forces became a crucial issue for U.S. policymakers once the Soviet Union tested a nuclear weapon in 1949. At key inflection points during the Cold War, threats to NC3 led national leaders to focus on the need to maintain robust abilities in this area to sustain deterrence. Their focus, however, was intermittent and wrapped up with nuclear strategy, force posture, and procuring new weapons systems. When the threat of decapitation receded, so did interest in NC3.

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88 DoD, Nuclear Posture Review Report, DoD, April 2010, p. x, <https://www.govinfo.gov/content/pkg/GOVPUB-D-PURL-LPS121566/pdf/GOVPUB-D-PURL-LPS121566.pdf>; and DoD, Report on Nuclear Employment Strategy of the United States Specified in Section 491 of 10 U.S.C., DoD, June 12, 2013, p. 13, <https://apps.dtic.mil/sti/pdfs/ADA590745.pdf>.

## CHAPTER 5

# Case Studies on the History of NC3 During the Cold War

Although nuclear strategy frequently dominated policymakers' attention throughout the Cold War, NC3 was often neglected, except when heightened tensions and fears of technological breakthroughs raised the prospect of nuclear decapitation. This chapter delves into that history and identifies three throughlines relevant for NC3 modernization today: (a) NC3 capabilities tend to be underresourced and neglected; (b) technological changes can rapidly outstrip NC3 amid ongoing modernization; and (c) high-level attention to NC3 was a precondition for modernization, but such attention tended to be episodic, emerging in the wake of crises that made the threat of decapitation strikes more salient.

While America had a nuclear monopoly in the late 1940s, national leaders paid relatively little attention to the size of the nuclear stockpile, the importance of political guidance to war planners on the potential use of nuclear weapons, and the question of command and control of nuclear weapons. The 1948 Soviet blockade of Berlin forced policymakers to deliberate in a serious way about the potential use of nuclear weapons in a conflict and the chain of command that would be necessary to authorize such use. The result was the formal establishment of the president of the United States as the national command authority in NSC 30. However, "while placing final control over nuclear use in the hands of the President, NSC 30 gave the military complete freedom to plan and prepare for nuclear war according to their own best judgment."<sup>89</sup>

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89 Scott Sagan, *Nuclear Strategy and National Security* (Princeton, NJ: Princeton University Press, 1989), pp. 15–17. For the text of NSC 30, see Neal H. Petersen, Ralph R. Goodwin, Marvin W. Kranz and William Z. Slany, eds. "Report to the National Security Council by the Executive Secretary (Souers)," September 10, 1948, and "Draft Report by the National Security Council on United States Policy on Atomic Warfare," in *Foreign Relations of the United States (FRUS), 1948 General: The United Nations, vol. I, part 2* (Washington, DC: Government Printing Office, 1976), Documents 41 and 42, <https://history.state.gov/historicaldocuments/frus1948v01p2/d41>; and David Alan Rosenberg, "Constraining Overkill: Contending Approaches to Nuclear Strategy, 1955–1965," in "More Bang For the Buck": U.S. Nuclear Strategy and Missile Development, 1945–1965, Colloquium on Contemporary History, January 12, 1994, <https://www.history.navy.mil/research/library/online-reading-room/title-list-alphabetically/m/more-bang-buck.html>.

After the first Soviet nuclear test in the fall of 1949, President Harry S. Truman decided to dramatically increase the size of the U.S. nuclear arsenal, in part to meet the requirements of extended deterrence that the United States had taken on as a result of the North Atlantic Treaty, and to proceed with the construction of the hydrogen bomb, the so-called “super.” These decisions suggested that the United States would henceforth rely on a large arsenal of nuclear weapons to deter the Soviet Union rather than on a minimal deterrent.<sup>90</sup>

Truman had insisted on a very strict interpretation of sole presidential authority to order the use of atomic weapons in wartime, lest “some dashing lieutenant colonel decides when would be the proper time to drop one.” He insisted on keeping the actual nuclear weapons in the hands of the Atomic Energy Commission rather than the uniformed Services. As the size of the arsenal grew, weapons were deployed to Europe; as new administrations arrived, these strict requirements would be modified by subsequent presidential guidance. During the years before the Soviet nuclear test, “[Strategic Air Command (SAC)] had a virtual monopoly of the means of delivery of atomic bombs.... Therefore, no coordination problems in planning and executing the atomic offensive existed in these years. By the early 1950s, however, this situation was being transformed by the proliferation of both weapons and delivery systems.”<sup>91</sup>

Several developments prompted President Dwight D. Eisenhower to consider modifying Truman’s restrictive guidance. These included the policy decision to make NATO a nuclear alliance as part of the “new look” strategy adopted by the administration, the needs of U.S. continental air defense, and increasing concerns about the potential of a surprise attack on the CONUS that resulted from concerns about the “bomber gap.” These concerns would be exacerbated by the shock of the Soviet launch of Sputnik in 1957.

The so-called “solarium review” of policy that Eisenhower led at the beginning of his term resulted in the adoption of a strategy that relied on massive retaliation by U.S. nuclear forces to deter and, if deterrence failed, respond to Soviet aggression. The document that memorialized the strategic shift, NSC 162/2, stated, “In the event of hostilities, the United States will consider nuclear weapons to be as available for use as other munitions.” Eisenhower noted that although, like Truman, he reserved the right to be the sole authority for release of nuclear weapons, in some cases the use of nuclear weapons was likely to be automatic. Technological developments (particularly the prospect of a nuclear air-to-air rocket for continental air defense against Soviet attack), more tactical nuclear weapons entering the

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90 Eric S. Edelman, “Nuclear Strategy in Theory and Practice: The Great Divergence,” in Hal Brands, ed., *The New Makers of Modern Strategy* (Princeton, NJ: Princeton University Press, 2023), pp. 670–673.

91 Truman’s remark is reported in Walter Millis, ed. *The Forrestal Diaries* (New York: Viking Press, 1951), p. 458, and quoted in Peter J. Roman, “Ike’s Hair Trigger: U.S. Nuclear Predelegation, 1953–1960,” *Security Studies* 7, no. 4, 1998, p. 123; and in L. Wainstein et al., *The Evolution of U.S. Strategic Command and Control and Warning, 1945–1972* (Arlington, VA: Institute for Defense Analyses, 1975), p. 50, <https://www.si.edu/media/NASM/NASM-Doc2-strategiccommandandcontrol---evolutionofoccr.pdf>.

inventory, and NATO's evolving strategy for extending U.S. deterrence to allies established a predicate for predelegating authority for nuclear use.<sup>92</sup>

As one historian noted, "The first six months of 1955 brought heightened concerns throughout the Eisenhower Administration over Soviet offensive capabilities and the United States' ability to deter, defeat, and retaliate after a Soviet attack." The alarms resulted from a dire report by the Technological Capabilities Panel of the Science Advisory Committee (the Killian Commission), chaired by Science Advisor James Killian. The report spurred the emergence of fears that the Soviet Union had opened a bomber gap with the United States, which led to Operation Alert.<sup>93</sup>

Eisenhower had directed the Killian Commission to examine technological solutions to potential U.S. vulnerability to a surprise attack. The commission's sweeping approach to the issue examined "offensive nuclear forces, warning and intelligence systems, active defenses, communications systems, and the impact of technology on force size." With respect to continental air defense, the panel called for rapid development of nuclear warheads for air defense. Nuclear anti-air missiles had a nearly perfect prospect of downing slow-moving bomber aircraft. The only catch was that, according to the commission report, "The effective use of atomic warheads in air defense requires a doctrine of instant use as soon as a hostile act has been confirmed." Although the prospect of developing these weapons was several years away, the administration's acceptance of the recommendations on atomic air defense implied "a significant departure from the command and control relationship established by Truman and continued by Eisenhower." This development coincided with erroneous reporting from U.S. defense attachés monitoring a Soviet flyby during the 1955 May Day Parade. The attachés' reports inflated estimates of Soviet bomber capability because the Soviets flew the bombers in a circle overhead, leading to double counting. In June, the administration ordered an exercise, Operation Alert, intended to provide the first test of the extant command and communications system. The results exposed serious procedural delays in communications among senior officials. The administration began planning extensive changes to the command-and-control protocols.<sup>94</sup>

The Killian Commission made other recommendations that had implications for the command and control of nuclear weapons. In addition to the recommendations on air defense, the commission called for the development of ICBMs and SLBMs; reconnaissance

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92 "Report to the National Security Council by the Executive Secretary (Lay)," NSC 162/2, October 30, 1953, in FRUS, 1952–1954 National Security Affairs, vol. II, part 2, p. 583, <https://history.state.gov/historicaldocuments/frus1952-54v02p2>; and Roman, "Ike's Hair Trigger." For NATO's evolving strategy, see Eric S. Edelman, Josh Chang, and Tyler Hacker, *Arming America's Allies: Historical Lessons for Implementing a Post-INF Treaty Missile Strategy* (Washington, DC: Center for Strategic and Budgetary Assessments, 2022), pp. 7–12.

93 Roman, "Ike's Hair Trigger," p. 129.

94 The account here follows Roman, "Ike's Hair Trigger," pp. 129–139. A summary of the Killian Commission recommendations can be found in "Report by the Technological Capabilities Panel of the Science Advisory Committee," February 14, 1955, in FRUS, 1955–1957, National Security Policy, vol. XIX, Document 9, <https://history.state.gov/historicaldocuments/frus1955-57v19>.

and surveillance capabilities, like the U-2 and satellites; and changes in the “policies governing nuclear weapons custody, employment, and rules of engagement. By the end of 1956, the first nuclear predelegation order had been issued to five unified and specified commanders-in-chief.” The change was reflected in guidance that superseded what had been provided in NSC 30. The Eisenhower National Security Council (NSC) approved NSC 5602/1 in April 1956, which provided for authorization “given in advance” by the president. The changed language reflected discussions that had been ongoing since the end of 1955 about the need for predelegation for the air defense mission. Working out the rules of engagement would occupy the better part of the year.<sup>95</sup>

Even before the predelegation order for use of nuclear weapons in air defense was issued, the Eisenhower administration was considering a second order that would seek to remedy concerns over the Soviet Union’s projected increase in offensive nuclear capabilities by preauthorizing “retaliatory strikes and defensive uses beyond air defense.” Senior officials, however, recognized that expanding predelegation entailed significant risks of “nuclear escalation, collateral damage, and alienation of allies.” The Eisenhower administration spent the next three years trying to craft a more expansive predelegation policy that kept the dangers as small as possible.<sup>96</sup>

Eisenhower approved a second predelegation order that reflected his concerns that commanders should be able to use nuclear weapons in a retaliatory attack, preauthorized by the president, if communication between the president and commanders were rendered impossible by a Soviet attack. This policy for the expenditure of nuclear weapons under emergency conditions by appropriate commanders raised a host of complications. The State Department, as one might expect, was concerned about potential allied reactions. As a result, it would take almost until the end of the Eisenhower administration to work out the implementing instructions for the order. Although Kennedy would later deny that he had delegated nuclear release authority to anyone else, the Eisenhower orders would remain on the books and were reaffirmed in 1964 by President Lyndon B. Johnson.<sup>97</sup>

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95 Roman, “Ike’s Hair Trigger,” p. 132–133. The text of NSC 5602/1 can be found at “National Security Council Report: NSC 5602/1 Basic National Security Policy,” March 15, 1956, in FRUS, 1955–1957, National Security Policy, vol. XIX, Document 66, <https://history.state.gov/historicaldocuments/frus1955-57v19>; and Rosenberg, “Constraining Overkill,” p. 4. Eisenhower’s comment that “we were now talking chiefly of defensive nuclear weapons” during the NSC discussions makes the context clear. See “Memorandum of Discussion at the 277th Meeting of the National Security Council,” February 27, 1956, in FRUS, 1955–1957, National Security Policy, vol. XIX, Document 61, <https://history.state.gov/historicaldocuments/frus1955-57v19/d61>.

96 Roman, “Ike’s Hair Trigger,” p. 145.

97 Roman, “Ike’s Hair Trigger,” pp. 145–164; for the text of Eisenhower’s second predelegation order, see “Memorandum for the Secretary of State, Secretary of Defense, the Chairman of the Atomic Energy Commission, Subject: Policy Regarding Use of Atomic Weapons,” National Security Archive, May 16, 1957, <https://nsarchive2.gwu.edu/news/predelegation/8.pdf>. For Kennedy’s statement, see Theodore Sorensen, *Kennedy* (New York: Harper and Row, 1965) p. 605. For Johnson’s reauthorization, see “Memorandum for the Secretary of Defense,” National Security Archive, March 26, 1964, <https://nsarchive2.gwu.edu/news/predelegation/16.pdf>.

## Nuclear Plenty, Sputnik, and the SIOP

Even before the advent of ICBMs, some nuclear strategists were concerned about the possibility of a decapitation strike. Albert Wohlstetter, a researcher at the RAND Corporation, led several studies on the vulnerability of SAC bases to a preemptive Soviet strike in the mid-1950s.<sup>98</sup> The last of these studies assessed that the United States relied on a handful of soft bases to house its nuclear forces, that an attack on these targets would be difficult to recognize, that SAC forces were too slow in responding to warning, and that SAC would struggle to “recover and to strike with evacuated elements.”<sup>99</sup> These studies eventually informed his seminal *Foreign Affairs* essay, “The Delicate Balance of Terror,” in which he argued that nuclear deterrence was difficult and required an assured retaliation capability.<sup>100</sup> Collectively, Wohlstetter’s studies made clear the inadequacies of SAC’s ability to communicate with its bases, both overseas and in CONUS. Without the ability to reliably communicate with its forces, SAC would struggle to disperse its forces in a timely manner and execute a subsequent counterstrike. Redressing this vulnerability would require enhanced communications and early warning infrastructure like radars, sensor arrays, and airborne communications centers.<sup>101</sup>

In October 1957, the Soviet Union shocked the U.S. military into action by launching the first satellite, Sputnik, into space. Historian W.J. Rorabaugh noted that Sputnik “demonstrate[d] that the Soviets could send missiles into space. The fact that the United States did not have this same capacity was proof for many of a Soviet technological and military edge.”<sup>102</sup> One month later, the Security Resources Panel of the Science Advisory Board to the president, colloquially known as the Gaither Committee, concluded that the “threat posed to SAC by the prospects of an early Russian ICBM capability...call for prompt remedial action.”<sup>103</sup> To address this vulnerability, the panel recommended raising the SAC bombers’ alert status, developing more capable early warning systems, and accelerating the development of

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98 Project RAND, *The Selection of Strategic Air Bases* (Santa Monica, CA: RAND Corporation, 1953), <https://www.rand.org/content/dam/rand/pubs/reports/2021/R244.pdf>; A.J. Wohlstetter et al., *Selection and Use of Strategic Air Bases* (Santa Monica, CA: RAND Corporation, 1954), <https://www.rand.org/content/dam/rand/pubs/reports/2006/R266.pdf>; and Project RAND, *Protecting U.S. Power to Strike Back in the 1950’s and 1960’s* (Santa Monica, CA: RAND Corporation, 1956), <https://www.rand.org/content/dam/rand/pubs/reports/2021/R290.pdf>

99 Project RAND, *Protecting U.S. Power to Strike Back*, p. 2.

100 Albert Wohlstetter, “The Delicate Balance of Terror,” *Foreign Affairs* 37, no. 2, 1959, pp. 211–234.

101 Project RAND, *Protecting U.S. Power to Strike Back*, pp. 68–69.

102 W.J. Rorabaugh, *The Real Making of the President: Kennedy, Nixon, and the 1960 Election* (Lawrence: University Press of Kansas, 2009), p. 22.

103 Security Resources Panel of the Science Advisory Committee, *Deterrence & Survival in the Nuclear Age* (Washington, DC: National Security Council, 1957), p. 5, <https://www.cia.gov/readingroom/docs/CIA-RDP86B00269R000300020003-3.pdf>; and David L. Snead, *The Gaither Committee, Eisenhower and the Cold War* (Columbus: Ohio State University Press, 1999).

intermediate-range ballistic missiles, ICBMs, and SLBMs. In this regard, the Gaither panel doubled down on the earlier work of the Killian-chaired Technological Capabilities Panel.<sup>104</sup>

An expanded and increasingly diverse nuclear arsenal gave rise to additional plans by the Services and regional commanders. Eisenhower “may have entertained notions of controlling the execution of U.S. war plans in circumstances other than a surprise attack, but the plans themselves had become exceedingly complex, requiring careful adherence to time of attacks and bomber routes to insure success.” As the arsenal was en route to doubling over the next two years, the prospect was for even more complexity.<sup>105</sup>

In 1958, Eisenhower charged the NSC with investigating whether “future requirements for strategic forces could be reduced without weakening the U.S. defense posture” and “whether counterforce or urban industrial targets were best suited to deterrence.” The NSC committee charged with this task produced its report in February 1960. It called for an “optimum mix” of counterforce and urban industrial targets, and its report became the guidance document provided by Secretary Thomas S. Gates, Jr., when he created the Joint Strategic Target Planning Staff (JSTPS) “to consolidate the Services’ nuclear planning,” which in turn created “the first Single Integrated Operational Plan (SIOP).” Establishing a bureaucracy to plan joint strategic operations was an important step toward addressing the vulnerabilities the Gaither Committee had identified, but executing the SIOP effectively would require a more capable NC3 system.<sup>106</sup>

Foremost, NC3 depended upon COG and continuity of operations (COOP), which became more challenging as the Soviets improved their capabilities for strategic attack.<sup>107</sup> A related challenge was ensuring that the NC3 system could survive a decapitation strike to “eliminate the need for quick reactions.”<sup>108</sup> To achieve these objectives, DoD would require command posts that were survivable and could maintain control over both nuclear and conventional operations.<sup>109</sup> The Air Force established a command post in the Pentagon and an alternative post at Fort Ritchie, Maryland. The Joint Chiefs established a Joint War Room, which later became the National Military Command Center (NMCC). The Fort Ritchie post was later

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104 Deterrence & Survival in the Nuclear Age, pp. 6–7.

105 Rosenberg, “Constraining Overkill,” pp. 5–7.

106 Rosenberg, “Constraining Overkill,” pp. 5–7; and David Alan Rosenberg, “The Origins of Overkill: Nuclear Weapons in American Strategy, 1945–1960,” *International Security* 7, no. 4, 1983, pp. 3–71. See also Franklin C. Miller, “Counterforce and Countervalue in U.S. Nuclear Targeting: A Historical Review,” in Brad Roberts, ed, *Counterforce in Contemporary U.S. Nuclear Strategy* (Livermore, CA: Center for Global Security Research, Lawrence Livermore National Laboratory, 2025), pp. 21–37; and “History of the Joint Strategic Target Planning Staff: Background and Preparation of SIOP-62,” History and Research Division, Headquarters Strategic Air Command, [https://ia600803.us.archive.org/35/items/HistoryOfJointStrategicTargetPlanningStaffBackgroundAndPreparationOfSIOP-62/ELS004-031a\\_text.pdf](https://ia600803.us.archive.org/35/items/HistoryOfJointStrategicTargetPlanningStaffBackgroundAndPreparationOfSIOP-62/ELS004-031a_text.pdf).

107 Wainstein et al., *Evolution of U.S. Strategic Command and Control and Warning*, p. 113.

108 Carl Berger, “USAF Strategic Command and Control Systems, 1958–1963,” U.S. Air Force Historical Division Liaison Office, November 1964, p. 9, <https://media.defense.gov/2011/mar/21/2001330250/-1/-1/0/AFD-110321-033.pdf>.

109 Wainstein et al., *Evolution of U.S. Strategic Command and Control and Warning*, p. 113.

redesignated as the Alternative National Command Center (ANCC). DoD also considered mobile alternatives, including an emergency command post afloat operated by the Navy and an Air Force National Emergency Airborne Command Post (NEACP).

While DoD was developing survivable command posts, it was also fielding early warning and attack assessment systems. By 1960, the Air Force and SAC established “a worldwide communication network for rapid transmission of information and action directives.”<sup>110</sup> The network included the Distant Early Warning system to detect aircraft attacks, the Semi-Automatic Ground Environment system to integrate data streams, the Ballistic Missile Early Warning System, and reconnaissance satellites.<sup>111</sup> These systems were not, however, built in a coordinated fashion, nor were they designed to operate amid a general nuclear war.<sup>112</sup>

The SIOP presented senior decision makers with other problems. The JSTPS and SAC staff briefed the plan to the secretary of defense, Joint Chiefs, and other senior military commanders at Offutt Air Force Base on December 1, 1960.<sup>113</sup> SAC had briefed George Kistiakowsky, Eisenhower’s science advisor, earlier in November, and he left concerned that the damage criteria selected by JSTPS might be too conservative, resulting in “over-kill” and “unjustified additional ‘force requirements.’”<sup>114</sup> Upon hearing Kistiakowsky’s report, Eisenhower told his Navy aide, “I’m hearing some things about this Omaha deal that really frighten the devil out of me.”<sup>115</sup> On his last day as secretary of defense, Gates left a note suggesting that the Joint Chiefs review the SIOP because “he felt that planning needed refinement to provide for various conditions of warning and that the damage criteria should be reevaluated.”<sup>116</sup> The task of modifying the SIOP fell to the incoming Kennedy administration.

## Flexible Response and Its Implications for NC3

Kennedy had advocated for a new nuclear strategy on the campaign trail. Before assuming office, he argued that the United States had “been preparing primarily to fight the one kind

110 Berger, “USAF Strategic Command and Control Systems,” p. 1.

111 “A Historical Study of Strategic Connectivity, 1950–1981,” Historical Division, Joint Secretariat, Joint Chiefs of Staff, July 1982, p. 4, [https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Other/92-A-0781\\_A\\_Historical\\_Study\\_of\\_Strategic\\_Command\\_1950-1981.pdf](https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Other/92-A-0781_A_Historical_Study_of_Strategic_Command_1950-1981.pdf).

112 Ibid.

113 History and Research Division, “History of the Joint Strategic Target Planning Staff,” p. 24.

114 Edward C. Keefer and David W. Mabon, eds., “Memorandum from the President’s Special Assistant for Science and Technology (Kistiakowsky) to President Eisenhower, Nov. 25, 1960,” in FRUS, 1958–1960, vol. III, National Security Policy: Arms Control and Disarmament (Washington, DC: Government Printing Office, 1996), Document 127, <https://history.state.gov/historicaldocuments/frus1958-60v03/d127>.

115 Edward C. Keefer and David W. Mabon, eds., “Record of Meeting Between Burke and Aurand, Nov. 25, 1960,” in FRUS, 1958–1960, vol. III, National Security Policy: Arms Control and Disarmament Microfiche Supplement (Washington, DC: Government Printing Office, 1998), Document 275, <https://history.state.gov/historicaldocuments/frus1958-60v03mSupp/d275>.

116 Robert J. Watson, *Into the Missile Age, 1956–1960* (Washington, DC: Office of the Secretary of Defense Historical Office, 1997), p. 495.

of war we least want to fight and are least likely to fight. We have been driving ourselves into a corner where the only choice is all or nothing at all, world devastation or submission.” Kennedy and his secretary of defense, Robert McNamara, advocated for replacing the doctrine of massive retaliation with a policy of flexible response, a policy that owed a great deal to the strategic thinking done at the RAND Corporation in the late 1950s.<sup>117</sup>

McNamara identified three principal concerns for U.S. nuclear strategy. First and foremost, the United States had to deter deliberate attacks. “This deterrence,” he argued, “depends critically on our ability to strike back after a direct Soviet attack designed to destroy our retaliatory forces.” Second, the United States needed to reduce the prospect of accidental war by “avoid[ing] exposed strategic systems that depend for their survival on quick decision that might have to be made in ambiguous circumstances.” Finally, DoD had to plan for deterrence failing, rejecting the notion that nuclear war would be uncontrollable once initiated and planning to “terminate it under favorable military conditions, and to limit damage to our allies and ourselves.” Each of these tasks depended upon survivable NC3, something the United States did not have.<sup>118</sup>

Despite receiving attention from senior leaders in the Eisenhower administration, the U.S. NC3 system was, according to McNamara’s assessment, “highly vulnerable in almost every link.”<sup>119</sup> Roughly a month before he penned those words in a letter to Kennedy, the Weapons Systems Evaluation Group (WSEG) had briefed McNamara on strategic forces issues, including NC3. The WSEG briefing elucidated the deficiencies of the U.S. NC3 system: Senior decision makers could be struck by a relatively small number of Soviet nuclear ballistic missiles with little to no warning, and the few alternative command posts could likewise be destroyed easily, making retaliation unlikely.<sup>120</sup> Qualitative and quantitative advances in Soviet offensive forces seemed to have quickly rendered Eisenhower’s changes to NC3 obsolete.

The WSEG report made clear the inadequacies of the NC3 system. If the Soviet Union were to use a mere 35 ICBMs to attack 14 installations in a decapitation strike, it would have at least “a 90 percent probability of destroying the entire higher political-military command of strategic nuclear forces [emphasis in original].” The chain of command was extremely vulnerable to a decapitation strike, such that a single event could kill the president, the Joint

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117 Quoted in Jane E. Stromseth, *The Origins of Flexible Response: NATO’s Debate over Strategy in the 1960s* (Houndsmills, UK: Macmillan Press, 1988), p. 26. For RAND’s strategic thinking, see Andrew May, “The RAND Corporation and the Dynamics of American Strategic Thought, 1946–1962” (PhD diss., Emory University, 1998).

118 David W. Mabon, ed., “Letter from Secretary of Defense McNamara to President Kennedy, February 20, 1961,” in *FRUS, 1961–1963, vol. VIII, National Security Policy* (Washington, DC: Government Printing Office, 1996), Document 17, <https://history.state.gov/historicaldocuments/frus1961-63v08/d17>.

119 *Ibid.*

120 Fred Kaplan, *The Wizards of Armageddon* (New York: Simon and Schuster, 1983), p. 258–262.

Chiefs, and “nearly all of those” in the line of presidential succession. U.S. NC3 was therefore vulnerable to decapitation, which would paralyze the rest of the system.<sup>121</sup>

Vulnerability aside, McNamara also wanted an NC3 system capable of managing the flexible, controlled employment of nuclear weapons. In 1962, he approved a National Military Command System (NMCS) that integrated the NMCC, the ANCC, the NEACP and the National Emergency Command Post, Afloat (NECPA).<sup>122</sup>

McNamara’s emphasis on flexible response meshed well with ongoing thinking at SAC about the alert status of the nation’s nuclear forces and “the need for a survivable SAC Command Post as a key component of adequate U.S. deterrence and security.” To deal with the vulnerabilities that had been identified in the earlier RAND studies, SAC planners “proposed to keep SAC’s bombers and tankers on alert with weapons loaded and crews ready for immediate takeoff.” The goal, a product of training and logistical requirements, was to keep a third of SAC’s “aircraft on ground alert at all times.”<sup>123</sup>

In 1960, SAC initiated another effort to “preserve and protect the nation’s nuclear muscle”: the testing of an airborne command post. Specially configured KC-135 aircraft were “placed on ground alert and periodically tested to determine its ability to takeoff within 15 minutes. Once airborne, the KC-135’s primary mission was to serve as an alternate command post, one that could assume control over the SAC combat forces in the event an enemy attack destroyed the underground command facility at Offutt and other command posts collocated with the numbered air force headquarters.” After successful testing, the alternative command post began flying continuous missions on February 3, 1961, shortly after Kennedy was inaugurated. This program, with the moniker Looking Glass, would fly safely and continuously until July 1990. A few years after the first Looking Glass flight, several EC-135J aircraft (based on the KC-135s) began flying Operation Nightwatch, meeting the NEACP requirement set by McNamara to provide the president egress from Washington D.C. in “the event of a nuclear attack.”<sup>124</sup>

Shortly thereafter, the Cuban Missile Crisis focused senior decision makers’ attention on NC3. It laid bare the real-world requirements of crisis management under the nuclear shadow, and its “net impact was to upgrade national level interest in the new NMCS and to accelerate its development as a general purpose, national military command and control

121 Wainstein et al., *Evolution of U.S. Strategic Command and Control and Warning*, pp. 242–243.

122 “The Worldwide Military Command and Control System: A Historical Perspective (1960–1977),” Historical Division, Joint Secretariat, Joint Chiefs of Staff, September 1980, p. 18, [https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Joint\\_Staff/World\\_Wide\\_Military\\_Command\\_Control\\_System.pdf](https://www.esd.whs.mil/Portals/54/Documents/FOID/Reading%20Room/Joint_Staff/World_Wide_Military_Command_Control_System.pdf).

123 “History of the Post Attack Command and Control System (PACCS),” SAC Airborne Command Control Association, <https://sac-accs.com/history>; and Office of the Historian, *Strategic Air Command and the Alert Program: A Brief History* (Offutt AFB, NE: Headquarters Strategic Air Command, April 1, 1988), p. 1.

124 Office of the Historian, *Strategic Air Command and the Alert Program*, p. 8; and SAC Airborne Command Control Association, “History of the Post Attack Command and Control System.”

system.” Benefitting from high-level attention, DoD instantiated formal infrastructure and procedures for the NMCS throughout the remainder of the decade. Although the NECPA was phased out in 1970, the Navy assumed a separate mission in NC3, developing and fielding the TACAMO aircraft to maintain communications with the SSBN fleet at sea.<sup>125</sup>

The remainder of the 1960s saw tensions cool between Washington and Moscow, as demonstrated by the installation of a “hot line” connecting the capitals. The Soviet nuclear arsenal continued to grow, however, eventually reaching parity and then surpassing the U.S. arsenal. This reality confronted decision makers in Washington with a new set of nuclear challenges.<sup>126</sup>

## Nixon and Ford Confront Soviet Nuclear Parity

When Nixon took office in 1969, he confronted the related problems of the Soviet nuclear buildup and the nascent Strategic Arms Limitation Talks (SALT), which had important antecedents in Johnson’s administration. After they were briefed on the SIOP, Nixon and National Security Adviser Henry Kissinger were just as horrified as their predecessors had been, and they shared a determination to seek more flexible nuclear options and an end to the arms race with the Soviet Union.<sup>127</sup>

To that end, Kissinger promulgated National Security Study Memorandum (NSSM) 64, directing Secretary of Defense Melvin Laird to study the nuclear arsenal’s capability to “deter and respond to less than all-out or disarming Soviet attacks,” including “consideration of the actual and required capabilities of the U.S. command and control system under the postulated operational situations.”<sup>128</sup> Laird and the Joint Chiefs resisted this initiative, however, as they were not confident that flexibility could be injected into the SIOP in practice. Indeed, DoD’s response to NSSM 64 stated that ““Command Centers do not possess the combination of survivability and capability which is required for the conduct of limited strategic nuclear war.”<sup>129</sup> That finding notwithstanding, NC3 received little attention during Nixon’s first term; although his 1969 Blue Ribbon Defense Panel did

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125 Wainstein et al., *Evolution of U.S. Strategic Command and Control and Warning*, p. 310.

126 See, inter alia, Desmond Ball, “Improving Communications Links Between Moscow and Washington,” *Journal of Peace Research* 28, no. 2, 1991, pp. 135–159; and Steven E. Miller, “Nuclear Hotlines: Origins, Evolution, Applications,” *Journal for Peace and Nuclear Disarmament* 4, 2021, pp. 176–191, <https://doi.org/10.1080/25751654.2021.1903763>.

127 William Burr, “The Nixon Administration, the ‘Horror Strategy,’ and the Search for Limited Nuclear Options, 1969–1972,” *Journal of Cold War Studies* 7, no. 3, 2005, pp. 34–78, <https://doi.org/10.1162/1520397054377188>; and William Burr, “‘Is This the Best They Can Do?’ Henry Kissinger and the U.S. Quest for Limited Nuclear Options, 1969–75,” in Vojtech Mastny, Sven S. Holtsmark, and Andreas Wenger, eds., *War Plans and Alliances in the Cold War: Threat Perceptions in the East and West* (London, UK: Routledge, 2006), p. 118–140.

128 “National Security Study Memorandum 64, July 8, 1969,” Richard Nixon Presidential Library and Museum, p. 1, [https://www.nixonlibrary.gov/sites/default/files/virtuallibrary/documents/nssm/nssm\\_064.pdf](https://www.nixonlibrary.gov/sites/default/files/virtuallibrary/documents/nssm/nssm_064.pdf).

129 Wainstein et al., *Evolution of U.S. Strategic Command and Control and Warning*, p. 431.

study the issue, its conclusions were overshadowed by its contentious recommendations for reorganizing the Pentagon.<sup>130</sup>

Other pressing issues, like the Vietnam War, distracted the Nixon team from focusing on command-and-control issues during its first term in office. But as they faced a second term in 1973, attention shifted back to NC3. Kissinger promulgated NSSM 169, which called for a review of U.S. nuclear policy, on February 13, 1973.<sup>131</sup> Secretary of Defense James Schlesinger announced revisions to nuclear employment planning and the SIOP in 1974. National Security Decision Memorandum (NSDM) 242, issued on January 17, 1974, directed the creation of a more flexible nuclear policy guided by “the most critical early employment objective,” which was “to seek early war termination on terms acceptable to the United States and its allies, at the lowest level of conflict feasible.” It also called for upgrading NC3 capabilities to a level commensurate with the requirements of a more flexible nuclear policy.<sup>132</sup> Despite this high-level attention to the issue, Schlesinger encountered staunch resistance in the bureaucracy. Although his successor as secretary of defense, Donald Rumsfeld, approved the revised SIOP in 1976, Kissinger did not believe that it was sufficiently flexible.<sup>133</sup>

During this time, the U.S. NC3 system remained inadequate. A Defense Nuclear Agency study found that, regardless of U.S. nuclear forces’ alert status, a “massive Soviet nuclear attack” would inflict “‘severe’ physical damage” on U.S. NC3, resulting in the destruction of “most fixed, land-based primary and alternative command centers and communications systems” and “hinder[ing]” the “airborne elements of the Minimum Essential Emergency Communications Net.”<sup>134</sup>

As DoD was wrestling with issues of flexible nuclear employment and NC3 survivability, the Soviet Union was expanding its nuclear arsenal. Despite Nixon’s efforts to arrest the Soviet buildup through SALT and a separate treaty limiting both sides’ antiballistic missile deployments, developments in Soviet strategic forces were becoming increasingly problematic. Both sides were developing MIRVs, but Soviet ICBMs were heavier with greater throw weight and could therefore carry more warheads if they were MIRVed. The arms control agreements reached at the end of the first Nixon term failed to prevent either side from qualitatively enhancing its nuclear arsenal, leaving the Soviet Union in a position to acquire the

130 Richard A. Hunt, Melvin Laird and the Foundation of the Post-Vietnam Military, 1969–1973 (Washington, DC: Office of the Secretary of Defense Historical Office, 2015), p. 22; “Blue Ribbon Defense Panel Report on National Command and Control and Defense Intelligence,” CIA Freedom of Information Act Electronic Reading Room, <https://www.cia.gov/readingroom/docs/CIA-RDP79M00097A000100030006-3.pdf>.

131 “National Security Study Memorandum 169, February 13, 1973,” Richard Nixon Presidential Library and Museum, [https://www.nixonlibrary.gov/sites/default/files/virtuallibrary/documents/nssm/nssm\\_169.pdf](https://www.nixonlibrary.gov/sites/default/files/virtuallibrary/documents/nssm/nssm_169.pdf).

132 “National Security Decision Memorandum 242, January 17, 1974,” Richard Nixon Presidential Library and Museum, pp. 2–4, [https://www.nixonlibrary.gov/sites/default/files/virtuallibrary/documents/nsdm/nsdm\\_242.pdf](https://www.nixonlibrary.gov/sites/default/files/virtuallibrary/documents/nsdm/nsdm_242.pdf).

133 Burr, “Is This the Best They Can Do?,” pp. 37–40; and Desmond Ball, “The Development of the SIOP, 1960–1983,” in Desmond Ball and Jeffrey Richelson, eds., *Strategic Nuclear Targeting* (Ithaca, NY: Cornell University Press, 1986), pp. 71–75.

134 Historical Division, “A Historical Study of Strategic Connectivity,” p. 17.

capability to destroy 95 percent of U.S. ICBMs by uploading additional MIRVs to its SS-9 ICBM.<sup>135</sup> Although Ford attempted to resolve the MIRV issue in subsequent arms control efforts, Moscow was intransigent and ICBM vulnerability remained an issue.<sup>136</sup>

## Jimmy Carter's National Security Team Brings a New Level of Focus to NC3

When Carter assumed the presidency in January 1977, National Security Adviser Zbigniew Brzezinski and Secretary of Defense Harold Brown believed that the strategic balance was increasingly tipping in Moscow's favor. They attributed this to the "sustained [Soviet] effort to increase its strategic forces while the United States stood pat."<sup>137</sup> Worse still, an Office of Net Assessment (ONA) paper written for Rumsfeld and read by Brown had concluded that the Soviet Union was developing a suite of warfighting capabilities that might tempt Soviet leaders to "consider a first strike."<sup>138</sup>

After promulgating a presidential directive (PD) on high-level security strategy, Brzezinski turned his attention to nuclear policy and NC3. After he and Carter were briefed on the SIOP, Brzezinski wrote that the plan "in effect, left [Carter] with the option of initiating a response which, irrespective of the version, amounts to at least the first phase of a massive central war." Brzezinski was also concerned about whether U.S. NC3 capabilities were sufficient to enable a limited nuclear war.<sup>139</sup> He decided to test the COG system in February 1977. The test did not go well: The helicopter selected to evacuate Carter arrived late, and "most of the officials to be evacuated could not be located."<sup>140</sup> Carter and Brzezinski later exercised the system again, becoming the first administration to include the vice president in such drills.

Brzezinski continued to probe the U.S. NC3 system, directing a study of the links between the Pentagon and SAC and catalyzing Carter's increased interest in the issue. Brzezinski

135 Lynn Etheridge Davis and Warner R. Schilling, "All You Ever Wanted to Know About MIRV and ICBM Calculations but Were Not Cleared to Ask," *The Journal of Conflict Resolution* 17, no. 2, June 1973, pp. 207–242. The 95 percent figure appears on p. 240.

136 See, inter alia, Paul Nitze, "Assuring Strategic Stability in an Era of Détente," *Foreign Affairs* 54, no. 2, January 1976, pp. 207–232; Paul Nitze, "Deterring Our Deterrent," *Foreign Policy* 25, Winter 1976–1977, pp. 195–210, <https://doi.org/10.2307/1148029>. For a skeptical view, see Pavel Podvig, "The Window of Vulnerability that Wasn't: The Soviet Military Buildup in the 1970s—A Research Note," *International Security* 33, no. 1, Summer 2008, pp. 118–138.

137 Zbigniew Brzezinski, *Power and Principle: Memoirs of the National Security Adviser, 1977–1981* (New York: Farrar, Straus, Giroux, 1983), p. 332.

138 Edward C. Keefer, *Harold Brown: Offsetting the Soviet Military Challenge, 1977–1981* (Washington, DC: Office of the Secretary of Defense Historical Office, 2017), p. 133.

139 "Memorandum from the President's Assistant for National Security Affairs (Brzezinski) to President Carter, Undated," in James Graham Wilson, ed., *FRUS, 1977–1980, vol. IV, National Security Policy* (Washington, DC: Government Printing Office, 2024), Document 6, <https://history.state.gov/historicaldocuments/frus1977-80vo4/d6>.

140 William E. Odom, "The Origins of Presidential Directive 59: A Memoir," in Henry D. Sokolski, ed. *Getting MAD: Nuclear Mutual Assured Destruction, Its Origins and Practice* (Carlisle Barracks, PA: U.S. Army War College Press, 2004), p. 179; and Fred Kaplan, *The Bomb: Presidents, Generals, and the Secret History of Nuclear War* (New York: Simon and Schuster, 2020), p. 123.

tasked Brown to produce a “brief statement on the procedures for actually conducting a nuclear war; limited or total, beyond the initial phase,” including specific operational information and an assessment of NC3 system survivability.<sup>141</sup> Brzezinski found Brown’s answers, which took months to gather, underwhelming. The actions designed to enhance U.S. NC3 capabilities and develop limited nuclear options that had originally been promulgated by the Nixon administration in 1974’s NSDM-242 had “not been carried out effectively.” He urged Carter to reemphasize these actions and visit SAC headquarters personally.<sup>142</sup>

Carter’s interest in NC3 resulted in a series of exercises designed to test the Missile Attack Conference System, including one in which Carter participated directly. The series of exercises were codenamed IVORY ITEM, and they revealed the limitations of the extant NC3 system. During one IVORY ITEM, for example, Brown was unable to convene all the regional combatant commanders and Joint Chiefs on a secure call, and “several of the [combatant commanders] could not reach their secure phones in the time frame allotted.”<sup>143</sup> When Carter participated in a later IVORY ITEM, he was shocked to learn that he was the first president to take part in such an exercise, and he found the binder containing available nuclear options impenetrably complex.<sup>144</sup> Carter then visited the NMCC in January 1978, prompting him to express “a desire to do something about command and control as well as the vulnerability of our warning systems.”<sup>145</sup>

Presidential attention to NC3 catalyzed greater attention to the issue within DoD. William Odom, Brzezinski’s military assistant, called the impact of the IVORY ITEM exercises on thinking at SAC and North American Aerospace Defense Command “far-reaching” because they had forced generals at both commands to think more seriously about NC3. For Odom, this was a welcome change from what had been a “travesty of neglect,” but the United States would still have to grapple with “staggering” NC3 vulnerabilities.<sup>146</sup>

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141 Wilson, “Memorandum from the President’s Assistant for National Security Affairs (Brzezinski) to Secretary of Defense Brown, Mar. 31, 1977,” in Wilson, ed., FRUS, 1977–1980, vol. IV, National Security Policy, Document 10, <https://history.state.gov/historicaldocuments/frus1977-80v04/d10>.

142 “Memorandum from the President’s Assistant for National Security Affairs (Brzezinski) to President Carter, Undated,” in Wilson, ed., FRUS, 1977–1980, vol. IV, National Security Policy, Document 36, <https://history.state.gov/historicaldocuments/frus1977-80v04/d36>.

143 William E. Odom, “Memorandum: The IVORY ITEM That Never Was,” National Security Archive, September 28, 1977, <https://nsarchive.gwu.edu/document/32022-document-10-memorandum-william-e-odom-zbigniew-brzezinski-ivory-item-never-was-28>.

144 Jimmy Carter, *White House Diary* (New York: Farrar, Straus, and Giroux, 2010), p. 141; and Kaplan, *The Bomb*, p. 123.

145 William E. Odom, “Memorandum: Items of Interest from the NMCC Visit,” National Security Archive, January 28, 1978, <https://nsarchive.gwu.edu/document/27623-document-4-william-odom-zbigniew-brzezinski-items-interest-nmcc-visit-28-january>.

146 “Memorandum from the Military Assistant to the President’s Assistant for National Security Affairs (Odom) to the President’s Assistant for National Security Affairs (Brzezinski), Jun. 15, 1978,” in Wilson, ed., FRUS, 1977–1980, vol. IV, National Security Policy, Document 65, <https://history.state.gov/historicaldocuments/frus1977-80v04/d65>.

As Carter and Brzezinski were probing the challenges associated with survivable and flexible NC3, Brzezinski's staff was also studying nuclear targeting and limited options. Brown had selected Leon Sloss to lead the study under the guidance of Deputy Assistant Secretary of Defense Walter Slocombe and Director of Net Assessment Andrew Marshall earlier in Carter's tenure. Although the NSC staff were divided on what Soviet targets to prioritize, there was general agreement among all involved that "a high capability for Presidential flexibility and improvisation in a nuclear confrontation should be built into our command, administrative, and technical institutions."<sup>147</sup> Flexible targeting therefore depended upon survivable, capable NC3.

The targeting study, which Sloss completed in November 1978, established the requirements a true flexible response doctrine would create for NC3. The study was informed by the intelligence community's assessment that the Soviet Union was developing a nuclear warfighting posture that would enable its leadership to "survive and emerge victorious."<sup>148</sup> Given Soviet willingness to consider fighting a nuclear war to achieve political ends, deterrence depended upon "employment policies that would make a Soviet victory as seen through Soviet eyes, as improbable as we can make it."<sup>149</sup> The threat of escalation, the study concluded, could deter the Soviets if it was made credible by "employment operations and supporting capabilities which the Soviets might perceive to be advantageous to us."<sup>150</sup> Importantly for NC3, "Such options require greater flexibility and endurance than we now have in our nuclear posture."<sup>151</sup> The vulnerability of the U.S. NC3 system would impede effective escalation control and thus complicate the introduction of a more flexible employment policy.

The United States was at a disadvantage in NC3 survivability, relative to the Soviet Union. Between 1976 and 1978, ONA performed several assessments of the relative NC3 balance. They found that the Soviets had "designated C3 as a high-priority, separable warfare area with doctrine and methods to execute it in different scenarios. By contrast, the U.S. approach was fragmented and focused on technology and less on protecting assets."<sup>152</sup> Although the assessments supported the view that "the Soviets have sought and achieved a more robust and enduring C3 infrastructure at all levels of military operations" than

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147 "Memorandum from Samuel Huntington of the National Security Council Staff to the President's Assistant for National Security Affairs (Brzezinski), August 1, 1978," in Wilson, ed., FRUS, 1977–1980, vol. IV, National Security Policy, Document 71, <https://history.state.gov/historicaldocuments/frus1977-80v04/d71>.

148 Keefer, Harold Brown, p. 139.

149 "Memorandum from Secretary of Defense Brown to President Carter, Nov. 28, 1978," in Wilson, ed., FRUS, 1977–1980, vol. IV, National Security Policy, Document 105, <https://history.state.gov/historicaldocuments/frus1977-80v04/d105>

150 Ibid.

151 Ibid.

152 John A. Battilega, "Assessing Soviet Military Capabilities," in Thomas G. Mahnken, ed., *Net Assessment and Military Strategy: Retrospective and Prospective Essays* (Amherst, NY: Cambria Press, 2020), p. 129.

the United States, they also identified vulnerabilities in Soviet NC3 that Washington could exploit.<sup>153</sup>

Throughout late 1978 and 1979, the Carter administration worked feverishly to address the linked issues of NC3 vulnerability and flexible nuclear targeting. William Odom spearheaded emergency management planning for COG that resulted in PD-58 in June 1980.<sup>154</sup> Another NC3 staffer's work led to PD-57, promulgated in March 1980, which established policies for emergency mobilization planning.<sup>155</sup> Odom also produced PD-53, released in November 1979, which established national security requirements for telecommunications to strengthen the capabilities necessary for COG and COOP.<sup>156</sup> Odom's success in driving these major reforms required leveraging authorities across the federal bureaucracy, a challenging task.<sup>157</sup>

The debate over nuclear targeting was also complex. The Joint Chiefs, for example, were skeptical about the feasibility of flexible employment options and were wary of what was likely to be a time- and resource-intensive process.<sup>158</sup> Cyrus Vance, the secretary of state, and Spurgeon Keeny, Jr., the director of the Arms Control and Disarmament Agency, also evinced skepticism of the revisions to nuclear strategy that Brzezinski and Brown were advocating because they believed targeting Soviet leadership and weapons was excessive and deterrence could be achieved by targeting a smaller number of urban and industrial centers.<sup>159</sup> Such disagreements notwithstanding, Brzezinski decided to proceed with a new targeting PD in early 1980, and the NSC staff had prepared a draft by March.<sup>160</sup>

Carter signed PD-59 in July 1980. Recognizing that parity with the Soviet Union had made deterrence more difficult to achieve, PD-59 directed the implementation of a "countervailing

153 "Memorandum From Fritz Ermarth of the National Security Council Staff to the President's Assistant for National Security Affairs (Brzezinski) and the President's Deputy Assistant for National Security Affairs (Aaron), Dec. 4, 1978," in Wilson, ed., FRUS, 1977-1980, vol. IV, National Security Policy, Document 107, <https://history.state.gov/historicaldocuments/frus1977-80v04/d107>.

154 "Presidential Directive/NSC-58, Jun. 30, 1980," in Wilson, ed., FRUS, 1977-1980, vol. IV, National Security Policy, Document 201, <https://history.state.gov/historicaldocuments/frus1977-80v04/d201>.

155 "Presidential Directive/NSC-57," Federation of American Scientists Intelligence Resource Program, March 3, 1980, <https://irp.fas.org/offdocs/pd/pd57.pdf>

156 "Presidential Directive/NSC-53, Nov. 15, 1979," in Wilson, ed., FRUS, 1977-1980, vol. IV, National Security Policy, Document 165, <https://history.state.gov/historicaldocuments/frus1977-80v04/d165>.

157 Odom, "Origins of Presidential Directive 59," pp. 189-192.

158 Steven L. Rearden and Kenneth R. Foulks, Jr., *The Joint Chiefs of Staff and National Policy, 1977-1980* (Washington, DC: Office of Joint History, Office of the Chairman of the Joint Chiefs of Staff, 2015), p. 242.

159 "Minutes of a Special Coordination Committee meeting, Washington, April 9, 1979, 1:45-3 PM;" "Summary of Conclusions of a Meeting of a Special Coordination Committee Meeting, Washington, April 25, 1979, 3-5PM;" "Minutes of a Special Coordination Committee Meeting, Washington, April 26, 1979, 4-5:30PM;" and "Minutes of a NSC Meeting, June 4, 1979, 3-4:20PM" all in Wilson, ed., FRUS, 1977-1980, vol. IV, National Security Policy, Documents 118, 124, 125, and 141, <https://history.state.gov/historicaldocuments/frus1977-80v04>.

160 William E. Odom, "Memorandum: Draft PD on Nuclear Targeting," National Security Archive, March 22, 1980, <https://nsarchive2.gwu.edu/nukevault/ebb390/docs/3-22-80%20Odom%20memo.pdf>.

strategy” in nuclear targeting, which would “result in a capability to choose to put the major weight of the initial response on military and control targets.”<sup>161</sup> This policy was memorialized in a new DoD Policy Guidance for the Employment of Nuclear Weapons (NUWEP), which Brown approved in October 1980. The 1980 NUWEP emphasized flexibility, survivability, escalation, and reserve forces as essential elements of the employment strategy.<sup>162</sup> Improving the NC3 system, along with the survivability of the nuclear weapons themselves, was critical to making all this work.

Brzezinski and Brown succeeded in changing U.S. targeting policy, but more remained to be done. These policy changes demanded programmatic adjustments to U.S. defense policy to ensure NC3 was survivable and the nuclear force mix was fit for the purpose. In a memorandum to Carter recapitulating the “Carter Transformation of Our Strategic Doctrine,” Brzezinski wrote that this would “be a major task of your second-term defense policy.”<sup>163</sup> In November 1980, however, Carter lost his bid for reelection in a landslide to Reagan, who thus inherited the task of implementing these nuclear policy changes.

## The Reagan Buildup and Reagan’s Involvement in NC3

Targeting policy was an early priority for Reagan’s Secretary of Defense, Caspar Weinberger. General Richard Ellis, the dual-hatted commander of SAC and JSTPS, asked Weinberger for a one-year moratorium on the SIOP revisions required by Carter’s PD-59 so the new administration would have more time to review it and develop its own nuclear strategy.<sup>164</sup> Weinberger approved Ellis’s request. DoD completed its draft of the new policy in September 1981, and it was officially codified by Reagan in National Security Decision Directive (NSDD) 13 on October 19<sup>th</sup>. The strategy was largely a continuation of previous administrations’ efforts to inject more flexibility into U.S. targeting policy; NSDD-13 stated that to effectively deter Moscow, the United States needed a credible capability to successfully fight a nuclear war.<sup>165</sup> Acquiring such a capability required “substantial improvements in [U.S.] forces and their supporting command, control and intelligence systems (C3I) to ensure requisite flexibility, endurance, and effectiveness in a nuclear war of indefinite duration.”<sup>166</sup>

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161 “Presidential Directive/NSC-59, July 15, 1980,” in Wilson, ed., FRUS, 1977–1980, vol. IV, National Security Policy, Document 208, <https://history.state.gov/historicaldocuments/frus1977-80v04/d208>.

162 “Policy Guidance for the Employment of Nuclear Weapons (NUWEP),” Office of the Secretary of Defense, <https://nsarchive2.gwu.edu/nukevault/ebb390/docs/10-24-80%20nuclear%20weapons%20employment%20policy.pdf>.

163 “Memorandum from the President’s Assistant for National Security Affairs (Brzezinski) to President Carter, Aug. 26, 1980,” in Wilson, ed., FRUS, 1977–1980, vol. IV, National Security Policy, Document 211, <https://history.state.gov/historicaldocuments/frus1977-80v04/d211>.

164 Edward C. Keefer, Caspar Weinberger and the U.S. Military Buildup, 1981–1985 (Washington, DC: Office of the Secretary of Defense Historical Office, 2023), pp. 441–442.

165 “National Security Decision Directive 13: Nuclear Weapons Employment Policy, Oct. 13, 1981,” National Security Archive, <https://nsarchive.gwu.edu/document/20309-national-security-archive-doc-24-national>.

166 *Ibid.*, p. 1.

The Reagan administration maintained the emphasis on survivable, flexible nuclear forces. NSDD-32, which Reagan approved in the spring of 1982, delineated national strategic objectives for nuclear forces, including “developing a capability to sustain protracted nuclear conflict.”<sup>167</sup> It also directed an emphasis on nuclear force survivability, COG, and COOP, based on concerns like the ones that had animated Brzezinski and Odom in the previous administration.<sup>168</sup>

COG, COOP, and NC3 were another set of priorities for the Reagan administration. Thomas Reed, an NSC staffer, felt that Reagan needed to familiarize himself with these issues because Reed lacked confidence in the presidential communication system.<sup>169</sup> Reagan received briefings on nuclear operations, NC3, and COG from February 26–28, in advance of a five-day exercise, Operation IVY LEAGUE, scheduled for early March. On March 1, Reagan observed as notional Soviet targets, depicted by red dots on a screen in the White House Situation Room, “covered the map of the United States,” destroying “most U.S. forces” and killing “millions of Americans.”<sup>170</sup> According to Reed’s memoir, the exercises in early March helped convince Reagan that the United States needed “a system of procedures and hardware” to enable COG and COOP in the event of a decapitating strike.<sup>171</sup>

As in the Carter administration, the task of addressing COG and COOP planning fell to the NSC staff. With assistance from DoD, the NSC grouped cabinet secretaries with government officials, often including a retired high-ranking official, who would support the cabinet member if they had to succeed the president in a crisis. To maximize the chances a successor survived, multiple teams of cabinet secretaries and government officials would be evacuated to secret locations in a crisis.<sup>172</sup> Reagan approved this scheme as NSDD-55, which remains classified, in September 1982.<sup>173</sup> DoD provided support to this system through its National Program Office (NPO), the successor to the Joint Program Office Odom had created to support COG planning. NPO developed contingency plans that involved calling on former cabinet members “to advise a successor president after a decapitation attack.”<sup>174</sup>

Beyond supporting the NSC’s efforts to devise new plans for COG and COOP, Weinberger also worked to drive NC3 modernization within DoD. In his Fiscal Year (FY) 1985 Statement

167 “National Security Decision Directive 32: U.S. National Security Strategy, May 20, 1982,” National Security Archive, p. 5, <https://nsarchive.gwu.edu/document/20310-national-security-archive-doc-25-national>.

168 Keefer, Caspar Weinberger, p. 407.

169 Thomas C. Reed, *At the Abyss: An Insider’s History of the Cold War* (New York: Presidio Press, 2004), p. 242–243.

170 Keefer, Caspar Weinberger, p. 443.

171 Reed, *At the Abyss*, p. 245–246. See also William P. Clark, “National Defense/Security Briefings to Secretary of Defense Weinberger and Joint Chiefs of Staff Chairman David Jones,” National Security Archive, February 23, 1982, enclosing a detailed outline of the presidential briefing on nuclear operations, <https://nsarchive.gwu.edu/sites/default/files/documents/4502455/Document-12.pdf>.

172 Keefer, Caspar Weinberger, p. 436.

173 *Ibid.*

174 *Ibid.*, p. 437.

to Congress, Weinberger noted, “Forces alone are insufficient for deterrence,” and the United States needed “strategic command, control, and communications systems to ensure that we could employ our nuclear forces effectively.”<sup>175</sup> Weinberger planned to comprehensively upgrade U.S. NC3 capabilities during FY 1985–1989 period, “increasing their mobility, protecting essential equipment against nuclear effects, and providing alternative and redundant methods of communication.”<sup>176</sup>

The Reagan administration’s efforts on COG, COOP, and NC3 dovetailed with its emphasis on flexible counterforce targeting in nuclear strategy. Although the civilian Office of the Secretary of Defense (OSD) favored quickly changing the SIOP to emphasize targeting Soviet nuclear forces, NC3, and political leadership, the Joint Chiefs believed that changing the employment plans would take a long time because U.S. forces and NC3 were not up to the task of flexible targeting.<sup>177</sup>

According to Deputy Assistant Secretary of Defense for Nuclear Affairs Franklin Miller, the JSTPS and SAC were unwilling to share “detailed information about the SIOP target base” with OSD, leading some officials in OSD to suspect that the SIOP “was not reflecting the changes of the PDs of the past three administrations.”<sup>178</sup> Weinberger eventually broke the impasse when he committed to minimal OSD involvement in the SIOP revision process, entrusting the Joint Staff with that task.<sup>179</sup>

DoD approved a new NUWEP-84 in June 1984. The document required DoD to “improve our employment flexibility to provide the capability of responding effectively and appropriately to any situation in which nuclear weapons may need to be employed to achieve U.S. objectives.”<sup>180</sup> Broadly, NUWEP-84 called for enhancing U.S. NC3 capabilities to ensure it could prosecute a flexible, extended nuclear war, and it drew attention to the possibility that conventional attacks could degrade C3I capabilities.<sup>181</sup> According to an official OSD history, “[NUWEP-84] was a prescription for fighting different nuclear conflicts so that the United States could endure in all cases. It held out the possibility that the conflict could be limited

175 Caspar W. Weinberger, Report of the Secretary of Defense Caspar W. Weinberger to the Congress on the FY 1985 Budget, FY 1986 Authorization Request and FY 1985–89 Defense Programs (Washington, DC: Government Printing Office, Feb. 1, 1984), p. 195, [https://history.defense.gov/Portals/70/Documents/annual\\_reports/1985\\_DoD\\_AR.pdf?ver=2014-06-24-151140-670](https://history.defense.gov/Portals/70/Documents/annual_reports/1985_DoD_AR.pdf?ver=2014-06-24-151140-670).

176 Ibid.

177 Keefer, Caspar Weinberger, p. 443.

178 Ibid., p. 444.

179 Ibid., p. 444–445.

180 “Policy Guidance for the Employment of Nuclear Weapons (NUWEP-84),” June 29, 1984, Washington Headquarters Services, [https://www.esd.whs.mil/portals/54/documents/foid/reading%20room/mdr\\_releases/fy19/fy19\\_q4/talking\\_points\\_for\\_use\\_in\\_discussion\\_with\\_joint\\_committee\\_19dec1994.pdf](https://www.esd.whs.mil/portals/54/documents/foid/reading%20room/mdr_releases/fy19/fy19_q4/talking_points_for_use_in_discussion_with_joint_committee_19dec1994.pdf).

181 Ibid., p. 1.

and de-escalated. Far from revolutionary, it was an evolutionary plan that owed its inspirations to previous administrations' thinking on nuclear war."<sup>182</sup>

This achievement was the culmination of decades of work on modernizing U.S. nuclear forces and NC3, bringing them in line with strategic objectives. However, the end of the Cold War in 1989 and the subsequent collapse of the Soviet Union made NC3 a far less pressing concern for senior leaders.

## The Fear of Decapitation

Throughout the Cold War, senior leaders only episodically paid attention to NC3. When they focused on it, they tended to be surprised by the vulnerability of the NC3 system and its inability to perform the tasks they expected from it. Unfortunately, episodic attention to NC3 was not enough to ensure that it was modern and survivable. Each presidential administration that studied the issue found that previous improvements to the system were either inadequate or suffered from a lack of follow-through from the bureaucracy. Although the fear of decapitation was an animating concern throughout the Cold War, the lack of sustained, high-level attention to NC3 until Carter's presidency meant that it took decades to make U.S. nuclear posture more flexible and survivable.

Rapid technological change further challenged NC3. The development of the ICBM, MIRVing, and improvements in missile accuracy each complicated the problem of NC3 survivability. Senior decision makers had to adapt quickly to these changes, but the gradual pace of NC3 modernization made doing so a challenge. Bureaucratic inertia was another source of difficulty for NC3 modernization. As this chapter has discussed, the Joint Staff, the JSTPS, and SAC dragged their feet and resisted OSD efforts to spearhead the development of more flexible, controlled nuclear war plans. The targeting debate therefore took nearly a decade to resolve.

NC3 modernization presented a separate set of challenges. As Odom astutely observed in a letter to Brzezinski, funding for NC3 came from the Services' budgets, and the Services were not eager to sacrifice their own platforms for NC3.<sup>183</sup> Thus, "it [was] difficult to find a sustained and powerful military interest in C3I."<sup>184</sup> Only persistent attention and follow-through from senior leaders in the late Cold War succeeded in overcoming this challenge.

Although gallons of ink have been spilled on the study of U.S. nuclear force posture, the history of nuclear strategy, and the strategic balance between the United States and the Soviet Union, the study of NC3 has remained an afterthought. To reconstruct the history of

<sup>182</sup> Keefer, Caspar Weinberger, p. 445–446.

<sup>183</sup> "Memorandum from the Military Assistant to the President's Assistant for National Security Affairs (Odom) to the President's Assistant for National Security Affairs, Aug. 22, 1978," in Wilson, ed., FRUS, 1977–1980, vol. IV, National Security Policy, Document 81, <https://history.state.gov/historicaldocuments/frus1977-80v04/d81>.

<sup>184</sup> Ibid.

NC3 during the Cold War, one must revisit the key questions that policymakers faced during the nuclear confrontation with the Soviet Union during that “long, twilight struggle.”<sup>185</sup> Those questions include the nature of strategic deterrence, the requirements of nuclear strategy, and strategic targeting to meet the requirements civilian policymakers established for the employment of nuclear weapons. An accurate account requires not just the story of C3 systems themselves but also the nuclear strategy they were meant to support and the approaches to targeting they were meant to service.

This neglect of NC3 in Cold War histories is quite simply a reflection of the larger reality of the inattention to those issues by the nation’s most senior officials during their tenure in office. For the most part, with a few significant exceptions, NC3 was treated with benign neglect. At a few critical moments in the history of the Cold War’s central strategic antagonism between the United States and the Soviet Union, however, several American presidents, national security advisers, secretaries of defense and other senior leaders did devote significant attention, resources, and most importantly time, to the questions associated with NC3.

In general, those periods of attention coincided with technological developments in the strategic arms competition that threatened the survival of U.S. nuclear forces and called into question the ability of the national command authority to survive the threat of a decapitating nuclear strike. The first instance was triggered by the launch of Sputnik and the development of ICBMs and SLBMs. Eisenhower’s determination to unify the efforts of the military Services as new means of delivery were arriving to complement the existing strategic bomber force resulted in the elaboration of the SIOP. The so-called missile gap and studies of the how vulnerable U.S. Air Force bases were to preemption prompted McNamara to seriously consider whether the Soviet Union might be able to execute a nuclear strike that could knock out the U.S. national command authority and inhibit America’s ability to respond with a devastating retaliatory blow. He focused on the president’s ability to survive an attack and then maintain control of U.S. nuclear forces.

As McNamara’s attention was consumed by the war in Vietnam, and concerns over nuclear conflict receded in the wake of the Berlin and Cuban crises, senior leader focus on NC3 waned to the point that Johnson simply canceled plans that McNamara had promoted for a deep underground protective shelter for key government officials.<sup>186</sup>

The ever-changing technology of nuclear weaponry and delivery systems made it especially challenging for those charged with the C3 systems to keep pace with developments. In

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185 The phrase, of course, comes from Kennedy’s inaugural address in 1961.

186 Spurgeon M. Keeny, “Fingers on the Nuclear Trigger,” *Bulletin of Atomic Scientists* 36, no. 8, October 2006, pp. 47–51. Keeny reported that Johnson, after letting loose a string of expletives, made clear that he thought the plans for a deep underground facility in Washington was “the stupidest idea he had ever heard and that he had no intention of hiding in an expensive hole while the rest of Washington and probably the United States were burned to a crisp. That was the last I ever heard about DUCCS” (p. 48).

particular, the advent of more accurate ballistic missiles, MIRVs on warheads and the threat they presented to ICBMs, and the potential for a depressed trajectory SLBM that could execute a short-warning attack on the nation's capital, prompted Brzezinski, Odom, and eventually Brown to devote unprecedented senior leader attention to NC3.

They undertook a series of actions that created a strong starting point for improvements in NC3 systems and, equally important, in the ability for government to continue to function across and beyond a nuclear attack. Their hard work provided the successor Reagan administration a foundation on which to build, notwithstanding the partisan acrimony that accompanied the 1980 presidential election. The Carter and Reagan administrations shared the view that improvements to NC3 and transattack COG and government operations were critical to nuclear deterrence and required drastic improvements.

With the end of the Cold War and the dissolution of the Soviet Union, however, attention to NC3 waned until the terrorist attacks of 9/11 once again briefly engaged senior leaders' attention on COG issues (if not nuclear command and control, per se). This serves as an important reminder, if one were needed, that the national C3 system provides national leadership with the ability to provide direction to both conventional and nuclear forces in an international crisis.<sup>187</sup>

The improved technology of nuclear weapons was not the only thing that drove concern about NC3 issues. The persistent demand by policymakers from the Kennedy administration onward to have more flexible options than the SIOP made available was another significant factor driving attention to NC3 issues. The SIOP optimized for a single, large strike with virtually every weapon in the arsenal. During the Ford administration, Schlesinger sought to create more flexible options for the president, including the creation of a strategic reserve force that could be withheld from the U.S. retaliatory response to a Soviet attack. The ability to use a reserve force after riding out a nuclear strike required an enduring and survivable NC3 system. SAC target planners were reluctant to implement repeated guidance from Schlesinger that called for limited or more selective options because they lacked confidence that the existing NC3 systems could manage a strategic reserve force.

Because no one in the bureaucracy owned NC3 and because, as Odom pointed out to Brown, there was no connection between the guidance for employment of nuclear weapons and the system of defense acquisition, it should not be surprising that, without presidential-level attention, NC3 would suffer from neglect. Concerns about nuclear decapitation that arose from specific developments in nuclear weaponry could increase senior officials' attention to NC3, but ultimately it was direct observation and participation by senior officials, including the president, in rigorous NC3 exercises that were crucial to the small band

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187 Howard Kurtz, "'Armageddon' Plan Was Put into Action on 9/11, Clarke Says," *Washington Post*, April 6, 2004, <https://www.washingtonpost.com/archive/politics/2004/04/07/armageddon-plan-was-put-into-action-on-911-clarke-says/fce9af72-54e6-43d3-a177-7d29dcefb50b/#>; and James Mann, "The Armageddon Plan," *Atlantic Monthly*, March 2004, <https://www.theatlantic.com/magazine/archive/2004/03/the-armageddon-plan/302902/>.

of government officials who were determined to remedy ongoing U.S. vulnerabilities to nuclear decapitation.<sup>188</sup>

Today, the United States faces a daunting nuclear threat environment. The emergence of two nuclear peers, each of which is developing capabilities that could threaten the U.S. NC3 system, presents a generational challenge for U.S. defense policy.<sup>189</sup> This comes as DoD has only belatedly begun modernizing its nuclear forces and NC3 capabilities. Simultaneously deterring two nuclear peers will challenge U.S. nuclear strategy into the future, but NC3 cannot be an afterthought. Just as the Carter and Reagan administrations devoted attention to the durability, flexibility, and survivability of NC3 in the late Cold War, senior leaders today must work to ensure that the current system meets those standards, is fully funded, and is modernized in a timely manner.

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188 On Odom's observation about the gap between policy guidance and acquisition policy, see William Odom, "The Origins and Design of Presidential Decision-59: A Memoir," p. 193, Nonproliferation Policy Education Center, [https://npolicy.org/wp-content/uploads/2021/06/Getting\\_MAD-Ch6\\_Odom.pdf](https://npolicy.org/wp-content/uploads/2021/06/Getting_MAD-Ch6_Odom.pdf).

189 Eric S. Edelman, "America's Latest Problem: A Three-Way Nuclear Race," *Foreign Policy*, June 2, 2025, <https://foreignpolicy.com/2025/06/02/us-nuclear-weapons-deterrence-command-control-nc3-decapitation-strike-china-russia-strategy-geopolitics/>.

## CHAPTER 6

# Conclusion

The United States is facing a novel and even more challenging version of the problems that past cohorts of policymakers confronted during the Cold War. The United States must now simultaneously deter two nuclear peers—something it has never done. China and Russia are developing and deploying capabilities that could threaten the U.S. NC3 system. These capabilities include ASAT systems, cyberweapons, and hypersonic delivery vehicles that have been designed to evade U.S. missile defenses. As a result, U.S. government officials are facing an issue that last bedeviled their predecessors some 40 years ago—the prospect of nuclear decapitation.

A nuclear decapitation attack would seek to eliminate the U.S. president and their designated successors in the national command authority and to degrade the NC3 system enough to prevent a U.S. retaliatory strike. The possibility of such a decapitation attack, however slight, “is probably the only imaginable route to decisive victory in nuclear war,” Steinbruner wrote in *Foreign Policy* in 1981. As U.S. nuclear planners learned during the Cold War, nuclear deterrence must rely not only on assured means of delivering nuclear weapons but also on an NC3 system that can credibly manage retaliation. “Weapons and strategic doctrine are meaningless,” Ashton Carter observed in 1985, without “the means to know what is happening in the chaos of crisis or war, to provide for decisions by legitimate authorities, and to have orders carried out precisely and faithfully.”<sup>190</sup>

Although Russia and China have spent the past decade and a half modernizing and expanding their nuclear forces and associated capabilities, the United States has only belatedly begun its nuclear modernization. That effort includes the recapitalization of its aging nuclear forces and modernization of its early warning radars and satellites, its space-based

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190 Steinbruner, “Nuclear Decapitation,” p. 19; and Carter, “Command and Control of Nuclear War,” p. 32.

communications systems, and its mobile command posts including the E-4B NAOC and the Navy's TACAMO aircraft.<sup>191</sup>

But the record of waxing and waning attention to NC3 issues demonstrated by the history recounted above suggests that support for NC3 modernization can diminish over time. These elements of the warning and assessment system and key communications links must be fully modernized and, at a time when some are concerned about the sufficiency of national defense funding, not be subject to budget reductions or reallocation of resources. In addition, some elements of the NC3 system demand special attention to ensure the survivability of the national command authority in the face of a decapitating strike.

First and perhaps most important, COG and COOP programs need to be thoroughly refreshed. Although in recent months, some officials in the Department of Homeland Security have recommended eliminating the Federal Emergency Management Agency (FEMA) because of dissatisfaction with its disaster relief efforts, it is imperative to recall that important elements of the COG efforts, particularly with the states and localities, are vested in FEMA. Those capabilities should be refreshed and resourced adequately. If, however, FEMA is abolished for domestic political reasons, it would be important to ensure that the COG/COOP functions are clearly transferred to another government entity and adequately resourced for the novel and considerably more taxing nuclear security environment that is likely to confront policymakers in the years ahead.<sup>192</sup>

Providing adequate resources is a necessary but not sufficient condition for dealing with the challenges of COG in a nuclear attack or transattack environment. The principal officers of government need to be fully briefed on all aspects of these plans and need to exercise them regularly, as occurred during the Reagan administration. The pressing pace of business in a 24/7 all-news, all-the-time environment has eroded the notion of principals setting aside time to understand their responsibilities in the extraordinary circumstances of nuclear conflict. Exercising these capabilities (and making the fact of the exercise public) would reinforce deterrence by underscoring that the U.S. government will retain the ability to execute emergency action messages to its forces, come what may.

Finally, the survivability of the national command authority will rely in no small part on mobile alternative command posts, and their role will be critical to injecting doubt into Russian and Chinese calculations about the chances of a decapitating nuclear strike succeeding. The United States maintains a number of fixed sites as alternatives to the Pentagon's NMCC, including STRATCOM's Global Operations Center at Offutt Air Force

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191 CRS, "Defense Primer: Strategic Nuclear Forces."

192 Sean Michael Newhouse, "FEMA Set for Elimination, Noem Says, amid Bipartisan House Reform Proposal," Government Executive, March 24, 2025, <https://www.govexec.com/management/2025/03/fema-set-elimination-noem-says-amid-bipartisan-house-reform-proposal/404008/>; and Eric S. Edelman and Franklin C. Miller, "FEMA Prepares for Disasters Worse Than Hurricanes," Wall Street Journal, May 13, 2025, <https://www.wsj.com/opinion/fema-prepares-for-disasters-worse-than-hurricanes-national-security-government-continuity-adfb531a?>

Base in Omaha, Nebraska; the Raven Rock Mountain Complex in Pennsylvania; and the Cheyenne Mountain Complex in Colorado, near the headquarters of U.S. Northern Command and North American Aerospace Defense Command. These sites, however, are well known to America's adversaries and would likely be targeted and destroyed in any nuclear decapitation attempt. As McNamara pointed out during the Kennedy administration, destroying these known sites might require only a small missile force. Ever since the 1960s, the United States has invested in an airborne component of the NC3 architecture to provide a survivable command center. The U.S. Air Force is currently modernizing the E-4B NAOC through the SAOC program, a \$13 billion effort to replace, by 2036, legacy 1970s-era aircraft with a fleet of adapted civilian aircraft kitted out with modern communications, networks, and advanced command and control subsystems. Meanwhile, the Navy is upgrading the TACAMO aircraft to extend their service life until 2038 so they can provide strategic connectivity to the SSBN fleet and serve as an alternative airborne launch control system for American ICBMs. Both programs ought to be resourced as fully as possible to keep them on schedule.

The modernization of these mobile command posts is essential to convincing Russia and China that a nuclear decapitation strategy would fail. Israel's recent successes in decapitating the leadership of Hezbollah and Iranian military and paramilitary forces has underlined the urgency of this matter. The danger that Russia and China will learn the wrong lessons from this recent experience underscores how urgent it is that the United States takes visible steps to convey its ongoing ability to survive any effort at severing the connection between legitimate national leadership and the nation's nuclear forces and to retaliate with a devastating retaliatory strike.

The challenge of deterring two nuclear peers at the same time is a problem that will challenge U.S. strategic planners for many years. If history is any guide, it may take as much as a decade to sort out the changes to U.S. nuclear posture that may be necessary to sustain and reinforce the credibility of the nuclear deterrent. Ensuring that NC3 remains enduring and survivable and that programs to support it are fully funded so they can deliver upgraded capabilities on time should be regarded as low-hanging fruit and an easy first step for the nation's strategic planners and political leaders to take as they address the longer-term three-body problem of deterring two nuclear peers.

## LIST OF ACRONYMS

AEHF	advanced extremely high frequency
AI	artificial intelligence
ALBM	air-launched ballistic missile
ALCM	air-launched cruise missile
ANCC	Alternative National Command Center
ASAT	anti-satellite (weapon)
CASD	continuous at-sea deterrence
CIA	Central Intelligence Agency
C3	command, control, and communications
C3I	command, control, communications, and intelligence
COG	continuity of government
CONUS	continental United States
COOP	continuity of operations
DA-ASAT	direct-ascent anti-satellite (weapon)
DIA	Defense Intelligence Agency
DoD	U.S. Department of Defense
DoE	U.S. Department of Energy
ESS	Evolved Strategic SATCOM (satellite communications)
FEMA	U.S. Federal Emergency Management Agency
FOBS	fractional orbital bombardment system
GBSD	ground-based strategic deterrent
GEO	geosynchronous Earth orbit
HGV	hypersonic glide vehicle
HEO	highly elliptical orbit
ICBM	intercontinental ballistic missile
ITW/AA	Integrated Tactical Warning/Attack Assessment
JSTPS	Joint Strategic Target Planning Staff
LEO	low Earth orbit
LRSO	long-range stand off (weapon)
MAD	mutual assured destruction
MIRV	multiple independently targetable reentry vehicle
NAOC	National Airborne Operations Center
NC3	nuclear command, control, and communications
NEACP	National Emergency Airborne Command Post
NECPA	National Emergency Command Post, Afloat

NMCC	National Military Command Center
NMCS	National Military Command System
NNSA	U.S. National Nuclear Security Administration
NPO	National Program Office
NPR	Nuclear Posture Review
NSC	U.S. National Security Council
NSDD	National Security Decision Directive
NSDM	National Security Decision Memorandum
NSSM	National Security Study Memorandum
NUWEP	Policy Guidance for the Employment of Nuclear Weapons
ONA	U.S. Office of Net Assessment
OPIR	Overhead Persistent Infrared
OSD	U.S. Office of the Secretary of Defense
PARCS	Perimeter Acquisition Radar Attack Characterization System
PAVE PAWS	Precision Acquisition Vehicle Entry Phased Array Warning System
PD	Presidential Directive
PLAAF	People's Liberation Army Air Force
PRC	People's Republic of China
SAOC	Survivable Airborne Operations Center
SAC	U.S. Strategic Air Command
SALT	Strategic Arms Limitation Talks
SATCOM	satellite communications
SBIRS	Space-Based Infrared System
SIOP	Single Integrated Operational Plan
SIPRI	Stockholm International Peace Research Institute
SLBM	submarine-launched ballistic missile
SLEP	service life extension program
SRF	Russian Strategic Rocket Forces
SSBN	nuclear-powered ballistic missile submarine
START (I, II, New)	Strategic Arms Reduction Treaty
STRATCOM	U.S. Strategic Command
TACAMO	Take Charge and Move Out
USAF	U.S. Air Force
USSR	Union of Soviet Socialist Republics (Soviet Union)
WSEG	Weapons Systems Evaluation Group





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