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*Nuclear Command, Control, and Communications: A Primer on US Systems and Future Challenges* provides an overview of the history, current status, and future challenges of the United States’ nuclear command, control, and communications (NC3) architecture. James J. Wirtz and Jeffrey A. Larsen are the book's editors, with six other authors providing input for a total of eight contributors to the volume. *Nuclear Command, Control, and Communications* is divided into four parts. The first part describes the role of NC3 in shaping and maintaining strategic deterrence and provides a historical review of the US NC3 architecture from 1945 to 1991. The second part provides a high-level overview of the various components of NC3 and describes several space-based assets that directly support NC3, such as early warning and satellite communication systems. The third part compares the strategic and operational factors of nuclear weapons and offensive cyber operations and reviews several cyber and technological challenges to the NC3 enterprise. The fourth part closes out the book with a chapter on future NC3 modernization efforts that the US has begun to implement in recent years.

The book begins with a review of the basic concepts of strategy and deterrence. NC3 systems are a key contributor to nuclear deterrence as NC3 provides the link between the president of the United States and the nation’s nuclear weapons. These links ensure that the president always maintains continuous command and control of the nuclear forces, even in a post-attack nuclear environment. Wirtz also introduces the NC3 concepts of positive and negative controls here. Positive control means that only legitimate legal authority (the president) can transmit an order directing the employment of nuclear weapons, while negative control prevents the “unauthorized, inadvertent, or accidental” use of nuclear weapons from occurring at any time (p. 21).

The end of the Cold War brought about the reduction in the nuclear stockpiles of both the United States and Russia; however, this also resulted in the overall decline of focus on maintaining
the NC3 enterprise. This lack of focus was a contributing factor in an August 2007 incident where six nuclear-tipped cruise missiles were inadvertently flown from Minot Air Force Base (AFB), North Dakota, to Barksdale AFB, Louisiana. The aftermath of this incident led to the creation of Global Strike Command (AFGSC) in August 2009 to consolidate the Air Force’s nuclear bomber and intercontinental ballistic missile (ICBM) missions under a single four-star command. Additionally, the Air Force designated its portion of the NC3 architecture as a formal weapons system in 2013 and created the Air Force NC3 Center within AFGSC in 2017 to oversee the Air Force’s NC3 components. These administrative actions began the initial process to rebuild and “reinvigorate” NC3 after decades of neglect.

The NC3 architecture has evolved into a “system of systems” that integrates multiple components together to provide early warning data from ground-based radar and satellite systems, transmits data and messages from national command centers to the nuclear forces, and connects the nuclear “triad” (bombers, missiles, and submarines) to survivable communication links back to national command centers. The overall NC3 architecture is also known as the National Command and Control System (NMCS). Responsibility for the NMCS’s “missions, equipment, personnel, training, acquisition, and maintenance is dispersed across numerous Department of Defense (DoD), Navy, and Air Force agencies and commands” (p. 83). The NMCS had not seen significant upgrades since the end of the Cold War and the US recognized that the multiple organizations responsible for different portions of NC3 was quickly becoming a problem. In response to several other incidents involving nuclear weapons and increased pressure from Congress, efforts to modernize the United States’ NC3 systems began to take shape in the mid-2000s.

Larsen notes that the 2017 National Security Strategy of the United States highlighted the need for significant investment to modernize the NC3 architecture, and the 2018 Nuclear Posture Review (NPR) detailed requirements for a “next-generation” NC3 system (p. 87). The 2018 NPR also called on the DoD to reform “governance of the NC3 system” (p. 88). The DoD’s response was to designate the commander of US Strategic Command (USSTRATCOM) as the “NC3 enterprise lead,” and USSTRATCOM authored a NC3 Governance Improvement Implementation Plan, which was approved in October 2018 (p. 88).

Nuclear Command, Control, and Communications includes a review of current and emerging cyber and technology threats to the NC3 architecture, culminating in a fictional scenario authored by Wade L. Huntley set four years into the future (2027) where an “independent” (the scenario strongly suggests close ties to Russia) malign cyber actor causes the US to temporarily lose command and control of an entire Air Force ICBM wing by exploiting a vulnerability in the primary network used to communicate from national command centers to the nuclear forces. Russia exploits this loss of NC3 and uses it as leverage to deter the US from supporting an Article 5 declaration for a NATO ally (Latvia) during a Russian incursion into the Baltic country. In this fictional scenario, the malign actor used a supply chain intrusion technique to introduce a vulnerability into the NC3 communications network during a routine system upgrade several years prior. While Huntley admits that the fictional scenario could not happen as written, it highlights the potential effects if a similar real-world intrusion were to occur.

The book concludes with current efforts to modernize the NC3 system, including the 2019 and 2020 launches of two Advanced Extremely High Frequency (AEHF) communication satellites designed to replace the aging Military Strategic and Tactical Relay (MILSAR) constellation, as well as continuing efforts to implement the Family of Advanced Beyond Line-of-Sight Terminals (FAB-T) to
take advantage of the higher data rates offered by the new AEHF satellites.

Overall, *Nuclear Command, Control, and Communications* provides a great overview of the history, current status, and future challenges of the United States' NC3 architecture. Anyone who is interested in NC3 or the overall US nuclear enterprise should add it to his or her reading list.

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