



Chapter 6

Nuclear Command and Control System

6.1 Overview

The U.S. Nuclear Command and Control System (NCCS) relies on a collection of activities, processes, and procedures performed by appropriate military commanders and support personnel that, through the chain of command, allow for senior-level decisions on nuclear weapons employment. Leadership decisions are communicated to the nuclear forces via an intricate NCCS.¹ The NCCS is an essential element to ensure crisis stability, deter attack against the United States and its allies, and maintain the safety, security, and effectiveness of the U.S. nuclear deterrent. The NCCS provides the President with the means to authorize the use of nuclear weapons in a crisis and to prevent unauthorized or accidental use. This is accomplished through nuclear command and control (NC2) and communications (NC3), managed by the Military Departments, nuclear force commanders, and the defense agencies. For information on the prevention of unauthorized or accidental use, see *Chapter 7: Nuclear Surety*.

¹ The NCCS is made possible through the cooperation of multiple departments and agencies within the U.S. Government; this chapter focuses on the DoD-related portion of the system.

6.2 Nuclear Command and Control System

The President's ability to exercise authorities is ensured by the elements of the NCCS (personnel, procedures, facilities, equipment, and communications) which are essential for supporting the President's NC2. The NCCS is an interagency system including stakeholders from the White House, DoD, Department of State (DOS), Department of Homeland Security (DHS), Department of Justice (DOJ), Federal Bureau of Investigation (FBI), DOE, and Office of the Director of National Intelligence (ODNI).

The DoD ensures the communications architecture for the nuclear deterrent can serve as the core component of a broader national command, control, communications, computers, and intelligence (C4I) system supporting the President.

6.2.1 DoD-Operational NCCS Elements

The five elements of the NCCS detailed below compose the infrastructure that supports the President, through his military commanders, in exercising presidential authority over U.S. nuclear weapons operations.

Personnel

Because of the policy implications, military importance, destructive power, and the political consequences of an accident or an unauthorized act, only those individuals who demonstrate reliability are authorized to perform NCCS duties. NCCS personnel include the operators, security personnel, and maintainers of the facilities, equipment, communications, weapons, and delivery systems.

Procedures

NCCS procedures support the President and the Secretary of Defense in the exercise of command authorities in the areas of situation monitoring, decision making, force direction, force management, and planning to direct the actions of the people who operate nuclear systems.

Facilities

NCCS facilities include the fixed National Military Command Center (NMCC), the Global Operation Center (GOC), the airborne E-4B National Airborne Operations Center (NAOC), and the E-6B Take Charge and Move Out (TACAMO)/Airborne Command Post.

The primary NC2 facility is the NMCC located within the Pentagon. The NMCC provides daily support to the President, the Secretary of Defense, and the Chairman

of the Joint Chiefs of Staff (CJCS), allowing for the monitoring of nuclear forces and ongoing conventional military operations.

Another NC2 command center resides with U.S. Strategic Command (USSTRATCOM) Headquarters at Offutt Air Force Base in Nebraska. The USSTRATCOM GOC enables the Commander of USSTRATCOM to conduct NC2 while also enabling the day-to-day management of forces and the monitoring of world events.

If fixed command centers are destroyed or incapacitated, several survivable alternatives exist to which NC2 operations can transfer, including the E-4B NAOC and the E-6B TACAMO/Airborne Command Post (Figures 6.1, 6.2, and 6.3). 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 E-6B serves as an airborne command post. In this capacity, the E-6B is an airborne backup of the GOC. As a result of this role, the E-6B performs two additional key missions. First, as the Airborne Launch Control System, the aircraft has the ability to launch Minuteman III intercontinental ballistic missiles as backup to the land-based launch control facilities. Second, in its TACAMO role, it can relay presidential nuclear control orders to Navy nuclear submarines and Air Force nuclear missiles and bombers.



Figure 6.1 E-4B NAOC



Figure 6.2 E-6B TACAMO/Airborne Command Post

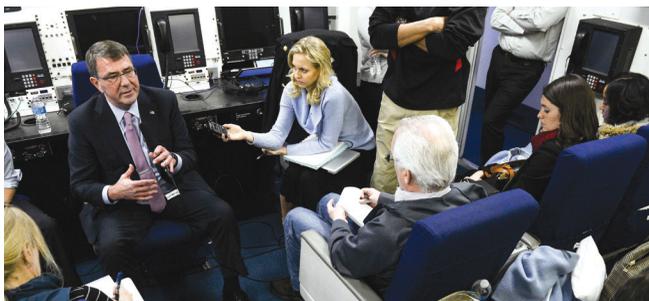


Figure 6.3 Secretary of Defense Ashton B. Carter onboard the E-4B NAOC

Equipment

NCCS equipment includes information protection (cryptological) devices, and the sensors (radars and infrared satellites, fixed, mobile and processing systems) of the Integrated Tactical Warning/Attack Assessment (ITW/AA) System.

The ITW/AA includes rigorously tested and certified systems that provide unambiguous, reliable, accurate, timely, survivable, and enduring warning information of ballistic missile, space, and air attacks on North America. In general, the ITW/AA process includes four steps to support the decision-making process: surveillance,² correlation,³ warning,⁴ and assessment.⁵

To assist in ITW/AA decisions, two independent information sources using different physical principles, such as radar and infrared satellite sensors associated with the same event, help clarify the operational situation and ensure the highest possible assessment credibility. Regardless of the type of event, assessments are passed over an emergency communications conference to the President, the Secretary of Defense, and the CJCS. The assessment details whether an attack is occurring against North America or U.S. assets.

Communications

The NCCS relies on terrestrial (e.g., land-based secure and non-secure phone lines and undersea cables), airborne relay (e.g., E-4B and E-6B), and satellite (military and commercial) sensors to transmit and receive voice, video, or data. The ability to move trusted data and advice from sensors to correlation centers, from presidential advisors to the President, from the President to the NMCC, and from the NMCC to the nuclear weapons delivery platforms depends on NC3 systems (**Figure 6.5**). These encompass a myriad of terrestrial, airborne, and satellite-based systems ranging in sophistication from the simple telephone, to radio frequency systems, to government and non-government

² Surveillance is the detection, collection, identification, processing, and reporting of ballistic missile, atmospheric, and space events by means of a worldwide network of ground- and space-based sensors.

³ Correlation is the collection, integration, analysis, and interpretation of surveillance data along with intelligence information on all potentially hostile events.

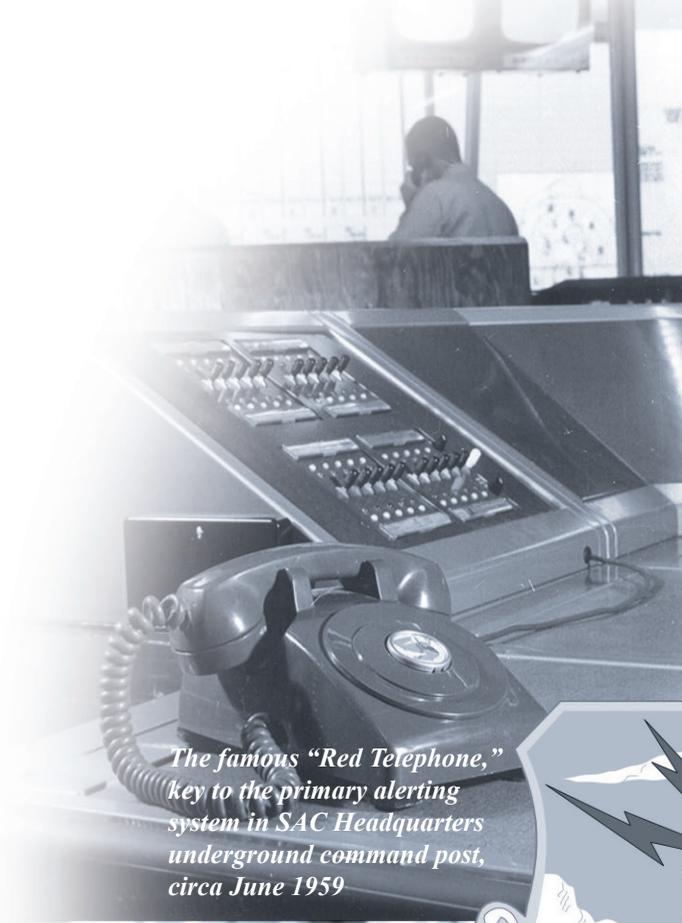
⁴ Warning is the process that uses automated displays of missile, atmospheric, and space events, confirmed by voice conferences to sensor sites, to assess the validity of warning information. Intelligence information can further corroborate sensor data.

⁵ Assessment evaluates the likelihood that an air, missile, and/or space attack is in progress against North America or an ally. Missile or air attack assessment is based on a combination of sensor information and the judgment of the Commander, North American Aerospace Defense Command (NORAD) of its validity. The Commander, USSTRATCOM validates missile and space warning information for areas outside North America and provides an assessment of potential attacks on U.S. and allied space assets.



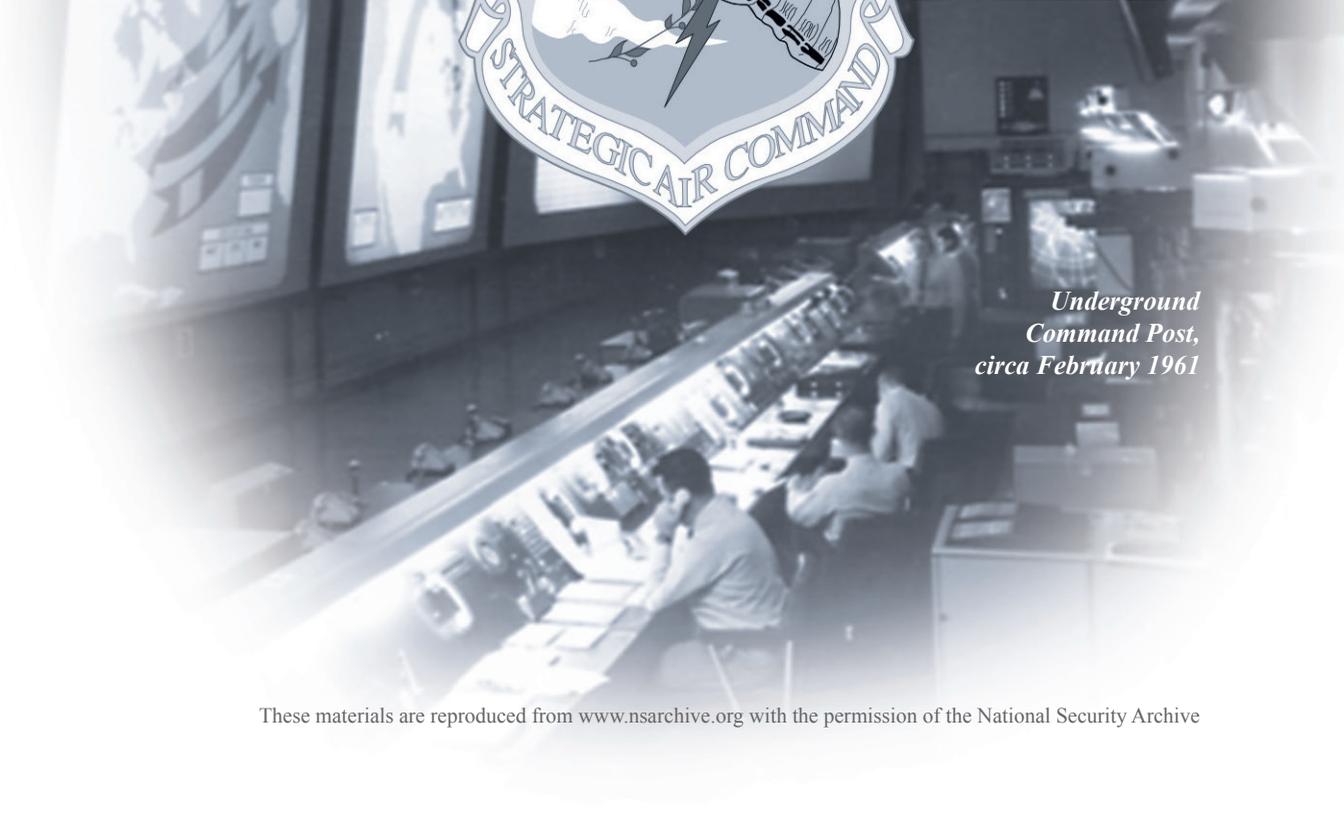
A black and white photograph showing the interior of an Airborne Command Post. Several crew members are seated at consoles, working with various electronic equipment and communication devices. The environment is cramped and filled with technical gear.

Airborne Command Post, circa early 1961



A black and white photograph of a rotary telephone, known as the "Red Telephone," sitting on a desk in a control room. The phone is a classic design with a coiled cord and a circular dial.

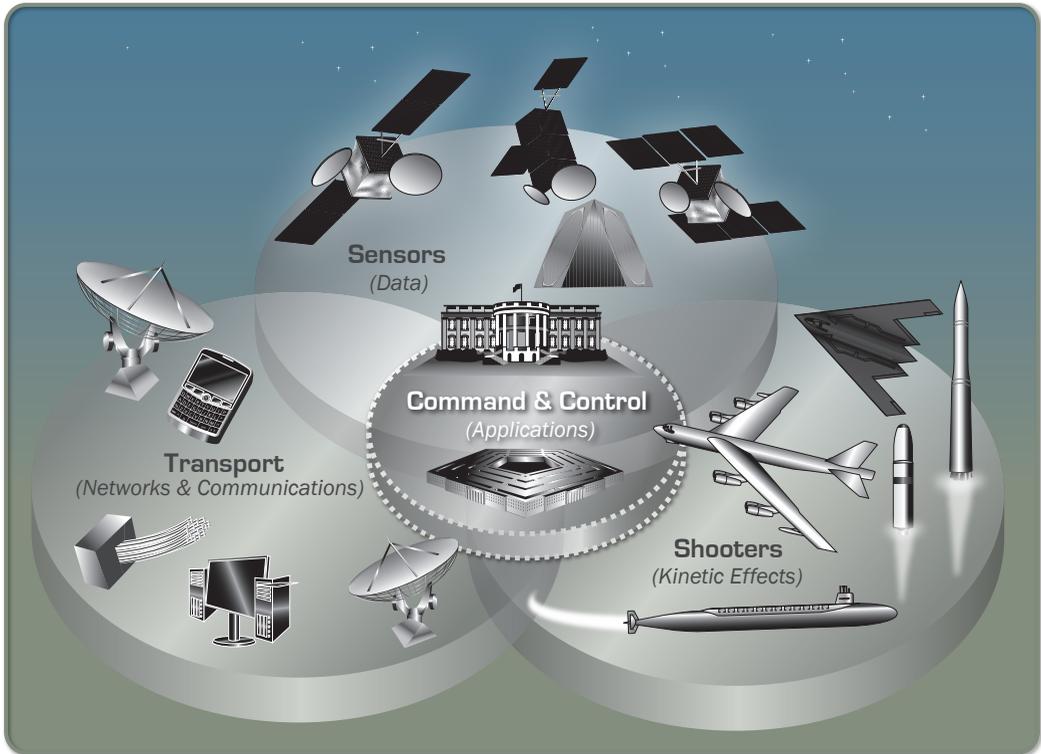
The famous "Red Telephone," key to the primary alerting system in SAC Headquarters underground command post, circa June 1959



A black and white photograph of an underground command post. The room is filled with rows of consoles and equipment. Several operators are visible, focused on their work. The lighting is dim, highlighting the technical nature of the environment.

Underground Command Post, circa February 1961

Figure 6.4 NC3 Systems



satellites. Some of these systems are expected to be able to operate through nuclear effects, while others are expected to be subject to nuclear effect disruption for periods ranging from minutes to hours.⁶

6.2.2 NCCS Requirements, Functions, and Elements

Presidential guidance, via presidential policy directives, is the authoritative source for NCCS requirements. The requirements have been translated into NC3 functions that support nuclear force planning, situation monitoring including an ITW/AA of bomber threats and missile launches, senior leader decision making, dissemination of presidential force-direction orders, and management of geographically dispersed forces. Many factors, including both current and future projections, can influence presidential

⁶ As with other critical elements of the NC3, even communications systems whose frequency spectrum is expected to be available in a nuclear-affected environment are susceptible to physical effects. This includes burnout or temporary disruption, due to the effects of a nuclear detonation on their electronic components if these components are not hardened against such effects.

decision making. Thus, the command elements of the NC2 system must maintain constant awareness of world events, both through classified means, usually through access to national intelligence systems and other sensors, and open sources such as news networks, weather forecasts, crowd sourcing data, and other reliable governmental or public media.

The elements of the supporting NCCS provide the means to perform the functions of NC3 for the President and his senior advisors in a nuclear crisis.

6.3 Nuclear Command and Control

NC2 is the exercise of authority and direction, through established command lines, over nuclear weapon operations by the President as the chief executive and head of state. NC2 is supported by a survivable network of communications and warning systems that ensure dedicated connectivity from the President to all nuclear-capable forces. The fundamental requirements of NC2 are paramount; it must be assured, timely, secure, survivable, and enduring in providing the information and communications for the President to make and communicate critical decisions without being constrained by limitations in the systems, the people, or the procedures that make up the systems used by the NCCS.

Five NC2 functions exist that encompass all of the nuclear-related activities performed by DoD personnel as they carry out their assigned military missions, including force management, planning, situation monitoring, decision making, and force direction.

Force Management

Force management includes the assignment, training, deployment, maintenance, and logistics support of nuclear forces and weapons before, during, and after any crisis. This understanding of force readiness status enables key leaders to quickly ascertain the ability to initiate or continue operations.

Planning

Planning involves the development and modification of plans for the employment of nuclear weapons and other operations in support of nuclear employment. Planning enables U.S. forces to survive and respond quickly to any contingency, a necessary condition given the short flight time of ballistic missiles.

Situation Monitoring

Situation monitoring comprises the collection, maintenance, assessment, and dissemination of information on friendly forces, adversary forces and possible targets,

emerging nuclear powers, and worldwide events of interest. Effective situation monitoring creates a comprehensive picture based on formal sources, such as warning data from system sensors and field commander assessments, classified intelligence sources, and unclassified or open sources.

Decision Making

Decision making refers to the assessment, review, and consultation that occur when the employment or movement of nuclear weapons is considered for the execution of nuclear control orders. This function relies on time-critical secure phone and video conferencing to enable the President to consult with his senior advisors, including the Secretary of Defense and other military commanders. Decision-support tools and rapid reliable connectivity are critical to this function.

Force Direction

Force direction entails the implementation of decisions regarding the execution, termination, destruction, and disablement of nuclear weapons. This function relates to nuclear surety, accomplished through procedures, physical security (e.g., gates, guns, and guards), and internal warhead locks and disabling mechanisms to prevent unauthorized use of nuclear weapons. Force direction also relies on positive control, accomplished through procedures, continuous training, equipment, and communications that ensure the President's nuclear control orders are received and properly implemented through the NC2 system.

6.4 Nuclear Command, Control, and Communications

NC3, managed by the Military Departments, nuclear force commanders, and the defense agencies, provides the President with the means to authorize the use of nuclear weapons in a crisis.⁷

6.4.1 NC3 Requirements

Many NC3 requirements are set forth in national and DoD policy; among these are the requirements that NC3 must be reliable, assured, enduring, redundant, unambiguous, survivable, secure, timely, flexible, and accurate. These requirements have been translated into specific, measurable, and testable criteria to evaluate the performance of the NC3 through exercise, testing, and analysis.

⁷ The NC3 system can also prove critical for U.S. response to other significant national events, such as a terrorist attack or natural disaster, where there is a need for continuity and the means to ensure the performance of essential government functions during a wide range of emergencies. Nuclear crisis is the worst-case scenario.

Mission-critical NCCS facilities and equipment must be built to resist the effects of a nuclear explosion, especially electromagnetic pulse (EMP), which can interrupt or destroy sensitive electronics. See *Appendix C: Basic Nuclear Physics and Weapons Effects* and *Appendix E: Nuclear Survivability* for more information about nuclear effects.

Additionally, modern systems must be capable of operating on internet-like networks to provide survivable, reliable support for senior U.S. Government officials, the U.S. military, and U.S. allies, as appropriate. While the implications and applicability of this policy can introduce increased vulnerability, it is still necessary to protect critical information and information systems against cyber-attack or network intrusion.



“The aging NC3 systems continue to meet their intended purpose, but risk to mission success is increasing as key elements of the system age. The unpredictable challenges posed by today’s complex security environment make it increasingly important to optimize our NC3 architecture...so that NC3 systems operate together as a core set of survivable and endurable capabilities that underpin a broader, national command and control system.”

Admiral Cecil D. Haney, Senate Armed Services Committee Testimony, March 19, 2015

6.4.2 Current NC3 Architecture

The present U.S. NC3 architecture is described in two layers. The first layer is the day-to-day and crisis architecture, which can also be described as a “thick-line.” This architecture supports current U.S. national policy in that it responds under all conditions in both peacetime and war to provide the means to exercise positive control and direction by the President, the Secretary of Defense, and Combatant Commanders; provides secure, reliable, immediate, and continuous access to the President; and provides robust command and control over nuclear and supporting government operations.

The second layer provides the survivable, secure, and enduring architecture known as the “thin-line.” The thin-line responds to policy that requires assured, unbroken, redundant, survivable, secure, and enduring connectivity to and among the President, the Secretary of Defense, the CJCS, and the designated commanders through all threat environments to perform all necessary NC2 functions. The thin-line NC3 architecture must be sustained and supported during any modernization effort to ensure presidential requirements can be met.

