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*Nuclear Command and Control: Current Programs and
Issues*

Robert D. Critchlow, Foreign Affairs, Defense, and Trade Division

May 3, 2006

Abstract. The Nuclear Command and Control System (NCCS) infrastructure supports the President and his combatant commanders when they direct nuclear forces. This report discusses the current role of the NCCS in light of the 2001 Nuclear Posture Review (NPR) and the 2006 Quadrennial Defense Review (QDR), examines current issues surrounding the NCCS, reviews modernization initiatives, summarizes NCCS functions and characteristics, and reviews NCCS platforms.

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Robert D. Critchlow
National Defense Fellow
Foreign Affairs, Defense, and Trade Division

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Nuclear Command and Control: Current Programs and Issues

Summary

The Nuclear Command and Control System (NCCS) infrastructure supports the President and his combatant commanders when they direct nuclear forces. This report discusses the current role of the NCCS in light of the 2001 Nuclear Posture Review (NPR) and the 2006 Quadrennial Defense Review (QDR), examines current issues surrounding the NCCS, reviews modernization initiatives, summarizes NCCS functions and characteristics, and reviews NCCS platforms.

Key NCCS platforms include fixed locations such as the National Military Command Center (NMCC), the U.S. Strategic Command (USSTRATCOM) Global Operations Center (GOC), and Site-R, and mobile platforms such as the E-4B National Airborne Operations Center (NAOC), the E-6B Airborne Command Post (ABNCP), and the Mobile Consolidated Command Center (MCCC). The NCCS must support situation monitoring, tactical warning and attack assessment of missile launches, senior leader decision making, dissemination of Presidential force-direction orders, and management of geographically dispersed forces.

The Department of Defense's (DOD's) 2001 NPR proposed a "new triad" of offensive nuclear and conventional forces, passive and active defenses, and a robust infrastructure, tied together by the command, control, computers, communication, intelligence, surveillance, reconnaissance, and planning architecture to confront the new, allegedly unpredictable post-Cold War environment. Adapting to non-nuclear responses and active defenses poses additional challenges for the current NCCS.

Some might question the continued relevancy of the legacy Cold War NCCS architecture. It was designed against a "decapitation" threat from the Soviet Union. This threat might not still exist. However, some believe China is investing in a nuclear capability to compete with the United States. Iran and North Korea might be developing nuclear capabilities that, if not used to strike directly at the United States or U.S. forces, might be used to generate an electromagnetic pulse (EMP) that could wreck U.S. infrastructure. In addition to confronting these potential catastrophic threats, the NCCS could direct conventional military operations, aid continuity of government in crises, and support civil authorities during natural disasters or emergencies.

The Defense Department has proposed several modernization and procurement initiatives in its 2007 budget. The DOD budget requests upgrades for the Minimum Essential Emergency Communications Network (MEECN) links to the intercontinental ballistic missiles (ICBMs), bombers, and tanker forces. It incorporates a redesign and consolidation of the NMCC, as part of ongoing Pentagon renovation efforts. It proposes several communications and aircraft upgrades to the E-4B NAOC and the E-6B ABNCP. It seeks funding for a sweeping upgrade to its satellite communications capability through the Advanced Extremely High Frequency (AEHF) program and its follow-on, the Transformational Communications Satellite (TSAT) program.

This report will be updated as needed.

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Nuclear Command and Control: Current Programs and Issues

Introduction

Directing the use of nuclear weapons is surely the gravest decision a President can make. The process established for the President to perform this function is “Nuclear Command and Control” (NC2). NC2 is defined as

the exercise of authority and direction by the President, as Commander in Chief, through established command lines, over nuclear weapon operations of military forces; as Chief Executive over all Government activities that support those operations; and, as Head of State over required multinational actions that support those operations.¹

The infrastructure that supports the President and his Unified Command Commanders in exercising this authority is the Nuclear Command and Control System (NCCS).² The NCCS is defined as:

The designated combination of flexible and enduring elements including facilities, equipment, communications, procedures, personnel, and the structure in which these elements are integrated, all of which are essential for planning, directing, and controlling nuclear weapon operations of military forces and the activities that support those operations. The purpose of the NCCS shall be to provide the President with all capabilities required to exercise his authority over nuclear weapons operations.³

The NCCS supports the President’s constitutional responsibilities as Commander in Chief and is part of Continuity of Government activities, and so may warrant Congressional oversight and interest. Congress, when authorizing and appropriating funds and in its oversight role, reviews Department of Defense’s (DOD’s) plans to sustain and modernize the NCCS. In the past, DOD has conducted reviews of nuclear posture and systems and communicated those findings to the

¹ Department of Defense, “Directive 3150.6: United States Nuclear Command and Control System Support Staff,” Jan. 19, 2001, p. 2.

² Unified Command commanders are the four-star generals or admirals who command the joint service combatant commands, directly answerable to the President. Examples include U.S. Central Command (USCENTCOM), which is responsible for operations in the Middle-East, and U.S. Strategic Command (USSTRATCOM), which among its many missions is nuclear deterrence.

³ “United States Nuclear Command and Control System Support Staff,” p. 2.

legislative branch.⁴ Increased momentum to implement the 2001 Nuclear Posture Review (NPR) findings, as well as the publication of DOD's 2006 Quadrennial Defense Review (QDR), could provide an opportunity for Congress to revisit the structure and future relevance of the NCCS.

Today's NCCS architecture still largely bears a shape that stems from its Cold War origins, despite the 14 years since the dissolution of the USSR. However, as the threat from Russia has waned, some analysts see the potential for nuclear challenges from China, North Korea, or Iran, which could drive a continued need for robust NC2, but possibly with a structure different from today. Other analysts note that the addition of non-nuclear responses and active defenses advocated by the 2001 NPR could drive additional complex requirements. Further, the individual platforms that make up the NCCS serve in secondary roles that give other user agencies equities in continued support for legacy systems. These equities will need to be reconciled with the recommendations from the 2006 QDR to retire some of these Cold War platforms.

Despite its strategic and budgetary implications, the NCCS is often not well understood and receives little attention from outside the military establishment. This report will describe NCCS platforms and functions, discuss the current role of the NCCS in light of the 2001 NPR and 2006 QDR, examine current issues related to the role of the NCCS from both process and technology perspectives, and review proposed modernization initiatives.

The Nuclear Command and Control System Infrastructure

Nuclear Command and Control Platforms

The lead elements of the NCCS form the National Military Command System (NMCS). The NMCS is "the priority component of the Global Command and Control System designed to support the Secretary of Defense and Joint Chiefs of Staff in the exercise of their responsibilities."⁵ It provides the National Command Authorities (NCA)⁶ and the Chairman of the Joint Chiefs of Staff (CJCS) with

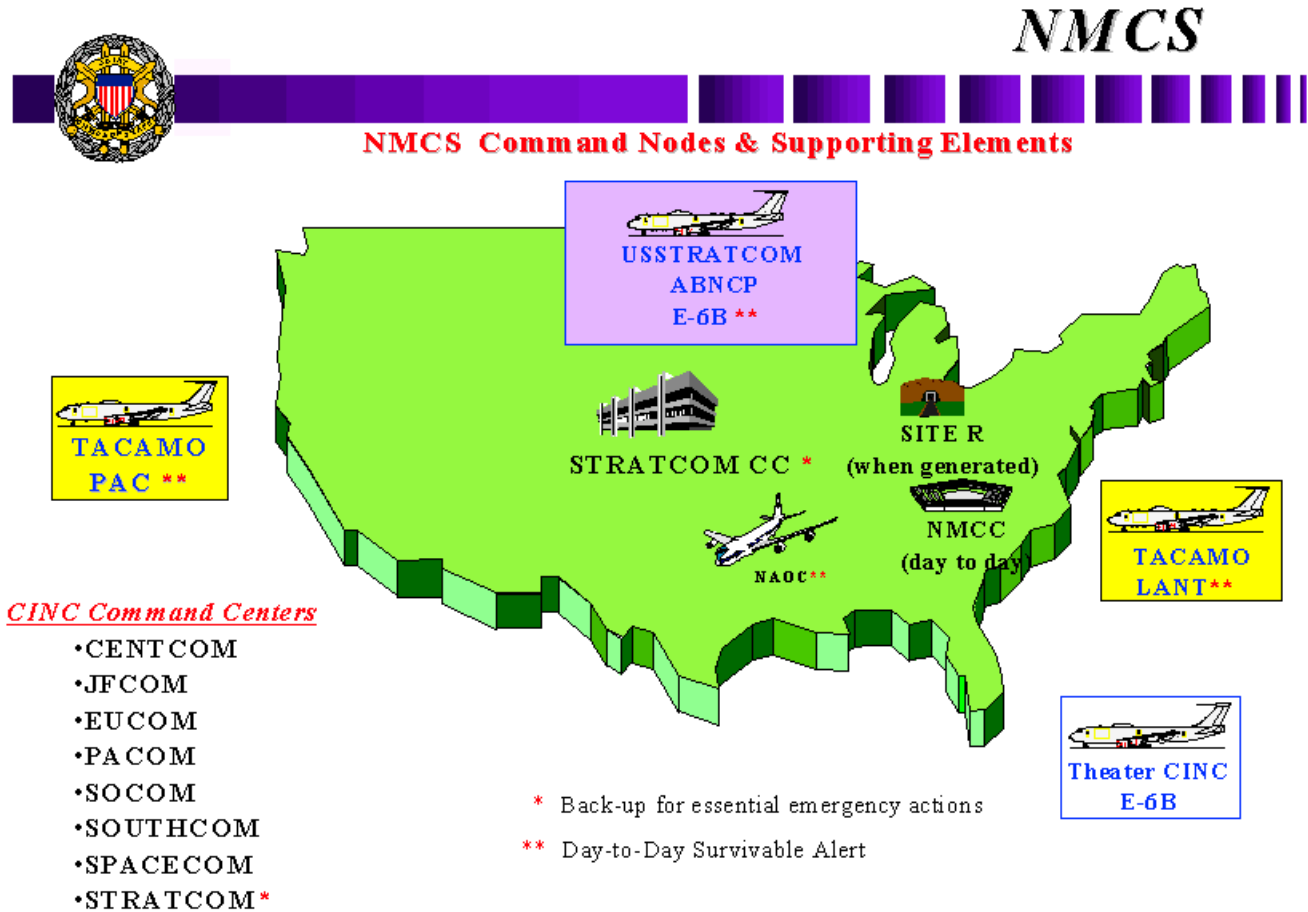
⁴ The 1998 Quadrennial Defense Review and the 1993 bottom-Up Review also addressed nuclear posture issues.

⁵ Joint Chiefs of Staff, "Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms," (Washington, DC: Joint Staff, Apr. 12, 2001, as amended through Aug. 31, 2005), p. 361.

⁶ National Command Authorities (or NCA) is a term that refers to the President and the Secretary of Defense. However, only the President has the authority to order the employment of nuclear weapons, and the term NCA is now used less frequently, although it still appears in the literature.

command and control of the armed forces, both nuclear and conventional.⁷ The NMCS includes the following command nodes and supporting components:

Figure 1. National Military Command System Nodes



Source: “National Command & Control: The National Military Command System (NMCS),” October 2001, at [http://www.afcea.org/education/briefs/lublinoct2001.ppt].

National Military Command Center (NMCC) . The NMCC is the primary location for national command and control on a day to day basis. This center is staffed around-the-clock, and each “watch team” is led by a General or Admiral, known as the “Deputy Director for Operations.” Located in a shielded room in the Pentagon, the NMCC is responsible for monitoring nuclear forces and ongoing conventional military operations, and can be augmented by additional response cells in the event of a crisis.⁸

⁷ “National Command & Control: The National Military Command System (NMCS),” October 2001, at [http://www.afcea.org/education/briefs/lublinoct2001.ppt].

⁸ Maj. Gen. Perry M. Smith, USAF (ret.), *Assignment: Pentagon, How to Excel in a Bureaucracy*, 3d ed., (Washington, DC: Brassey’s, 2002), 134-5; “National Command & Control: The National Military Command System (NMCS);” U.S. Strategic Command, (continued...)

National Airborne Operations Center (NAOC). If ground based command centers are destroyed, the NAOC can serve as a survivable airborne backup to the NMCC's command and control capabilities. A NAOC aircraft is always on alert, and the mobility of this airborne platform contributes to its survivability. The NAOCs are a fleet of modified Boeing 747-200B aircraft, each of which can include a crew of up to 114 people, and are based at Offutt AFB in Nebraska. Its communications, which include both Extremely High Frequency (EHF) and Very Low Frequency-Low Frequency (VLF/LF) links, are hardened against Electromagnetic Pulse (EMP). Although the Joint Staff tasks the aircraft, U.S. Strategic Command (USSTRATCOM)⁹ provides personnel and day-to-day administration, while the Air Force's Air Combat Command serves as the program's resource manager.¹⁰

Site-R . Located at Fort Ritchie, Maryland, Site-R can be activated from a "cold" status to serve as an alternate NMCC location.¹¹

USSTRATCOM Global Operations Center (GOC). Located underneath the USSTRATCOM Headquarters at Offutt AFB, Nebraska, the GOC can serve as a back up element to the NMCS for essential emergency actions. This center also serves as the command center for the USSTRATCOM Commander, one of the four-star-general Unified Combatant Commanders, for the day-to-day management of his forces and for providing situational awareness. The facility is protected against EMP, and has its own emergency power supply to enable extended operations. This facility is staffed 24 hours a day, 365 days a year, with each team led by a Senior Controller who is always a full Colonel (Air Force, Army, or Marine Corps) or Captain (Navy).¹²

USSTRATCOM Airborne Command Post (ABNCP). Should the USSTRATCOM GOC be unable to fulfill its role, the E-6B ABNCP can serve as a survivable airborne backup. The ABNCPs are a fleet of modified Boeing 707 aircraft, each of which carries a crew of 22, which includes aircrew, communications

⁸ (...continued)

"Welcome to the USSTRATCOM Command Center," Unpublished briefing slides, Dec. 11, 2001; Joint Chiefs of Staff, "J-3 Operations: Monitoring On-Going Operations," at [<http://www.jcs.mil/j3>].

⁹ United States Strategic Command is a joint (multi-service) combatant command, led by a four-star general or admiral, headquartered at Offutt AFB in Omaha Nebraska, with primary responsibility for nuclear deterrence forces.

¹⁰ U.S. Air Force, "U.S. Air Force Fact Sheet: E-4B," March 2005, at [<http://www.af.mil/factsheets>]; John Williamson, ed., *Jane's Military Communications*, 22d ed., 2001-2002, (Surrey, UK: Jane's Information Group, 2001), pp. 757-8.

¹¹ U.S. Army Military District of Washington, "Fort Ritchie Background," 2005, at [<http://www.mdw.army.mil/content>]; "National Command & Control: The National Military Command System (NMCS);" "Welcome to the USSTRATCOM Command Center."

¹² "Welcome to the USSTRATCOM Command Center;" U.S. Strategic Command, "U.S. Strategic Command Fact Sheet: USSTRATCOM Global Operations Center," December 2004, at [http://www.stratcom.mil/fact_sheets].

operators, and battlestaff personnel. Historically, each battle staff has been led by a General or Admiral, known as the Airborne Emergency Action Officer (AEAO). This aircraft fulfills two additional key missions. As the Airborne Launch Control System (ALCS), the aircraft has the ability to communicate launch codes directly to ICBM launch facilities to command launch, in the event that their launch control centers are unable to perform that function. Also, the E-6B can serve as the Take Charge And Move Out (TACAMO) relay for Navy ballistic missile submarines. The airplane can deploy a 2½-mile-long trailing wire antenna and communicate directives to the submarines over its VLF/LF system. In addition to the VLF/LF, the ABNCP can communicate using Ultra-High Frequency (UHF) or EHF satellite systems. While USSTRATCOM provides the battlestaff personnel, the aircraft, aircrew, and communications operators are from the Navy's Strategic Communications (STRATCOMM) Wing One, based at Tinker AFB, Oklahoma.¹³

USSTRATCOM Mobile Consolidated Command Center (MCCC). The MCCC is a convoy of trucks that can deploy during a crisis to serve as a survivable road-mobile backup to the USSTRATCOM GOC or ABNCP.¹⁴

What Are the Functions of Nuclear Command and Control Systems?

The fundamental premise underlying nuclear command and control is that only the President can direct the use of nuclear weapons.¹⁵ The Nuclear Command and Control System (NCCS) has evolved to serve the President's requirements for advice and decision making for the strategic nuclear forces. Some of the major functions that the NCCS must perform include:¹⁶

Situation Monitoring. The external military, political, or physical environment could signal upcoming events or shape the freedom of action of

¹³ United States Strategic Command, "U.S. Strategic Command Fact Sheet: E-6B Airborne Command Post (ABNCP)," at [http://www.stratcom.mil/fact_sheets]; United States Navy, "U.S. Navy Fact Sheet: E-6A Mercury Airborne Command Post," June 24, 2003, at [<http://www.navy.mil/navydata>]; "Welcome to the USSTRATCOM Command Center;" John Williamson, ed., *Jane's Military Communications*, 26th ed., 2005-2006, (Surrey, UK: Jane's Information Group, 2005), pp. 730-1.

¹⁴ "Welcome to the USSTRATCOM Command Center."

¹⁵ Joint Chiefs of Staff, "Joint Pub 3-12, Doctrine for Joint Nuclear Operations," (Washington, DC: Joint Staff, December 15, 1995), p. II-1.

¹⁶ For the following discussion, see Chairman of the Joint Chiefs of Staff, "CJCSI 5119.01B: Charter for the Centralized Direction, Management, Operation, and Technical Support of the Nuclear Command, Control, and Communication System," July 19, 2004, A-1; "National Command & Control: The National Military Command System (NMCS)," October 2001, at [<http://www.afcea.org/education/briefs/lublinoct2001.ppt>]; U.S. Strategic Command, "Welcome to the USSTRATCOM Command Center;" Albert E. Babbitt, "Command Centers," in *Managing Nuclear Operations*, Ashton B. Carter, John D. Steinbruner, Charles A. Zraket, eds., (Washington, DC: Brookings Institution, 1987), pp. 322-351; Paul Bracken, *The Command and Control of Nuclear Forces* (New Haven: Yale University Press, 1983), pp. 179-237.

deterrence forces. Thus, the command elements must monitor strategic intelligence, both from classified means and from open sources, for indicators. Most of the NCCS centers include an intelligence cell that is linked to classified national intelligence systems. This capability can help with anticipating crises, although sometimes 24-hour news services such as *CNN* are the first indicator. Situation monitoring can also include tracking the weather, which can affect aircraft operations.

Tactical Warning and Attack Assessment (TW/AA). Detecting and analyzing a potential attack is one of the most time-sensitive functions that contributes to the NCCS process. It is vital to verify quickly a missile launch and discern whether it is a false indication, a previously announced space launch, a potential attack, or some other event. Next, determining the origin, size, and potential targets of the attack should aid decision makers in shaping their response. To provide a high degree of certainty regarding this critical information, the TW/AA centers rely on a concept called “dual phenomenology.” Dual phenomenology means that two different systems, in this case satellites and radars, are used to verify an attack.

Decision Making. Doctrine recommends that the President consult with senior commanders in making a decision to employ nuclear weapons. By statute, the Chairman of the Joint Chiefs of Staff (CJCS) is the primary military advisor to the President (P.L. 99-433).¹⁷ The President may choose to consult with other advisors as well. The system must provide connectivity between the President, his advisors, and his nuclear commanders, as well as continuous situation updates, so that he has the best information possible on which to base a decision.

Force Management. Data on the readiness of the nuclear deterrent and supporting forces is important to decision makers both on a day-to-day basis and in a crisis. This data could include forces available, locations, or maintenance/supply status. This function could also include alerting forces during a crisis. The force management process collects this information and presents it in quickly understandable formats for key leadership.

Force Direction. This function includes two key aspects of nuclear command and control: nuclear surety (sometimes called “negative control”) and positive control. Nuclear surety comprises the controls designed to prevent unauthorized use of nuclear weapons. Positive control describes those elements that assure instructions to launch nuclear weapons reach the forces and will be carried out if given by the President.¹⁸ Force direction includes both employing forces and ending hostilities.

¹⁷ Title X, *United States Code*, Section 151.

¹⁸ John D. Steinbruner, “Choices and Trade Offs,” in *Managing Nuclear Operations*, Ashton B. Carter, John D. Steinbruner, Charles A. Zraket, eds., (Washington, DC: Brookings Institution, 1987), pp. 539-543.

Figure 2. National Military Command System Connectivity to the Forces

NMCS

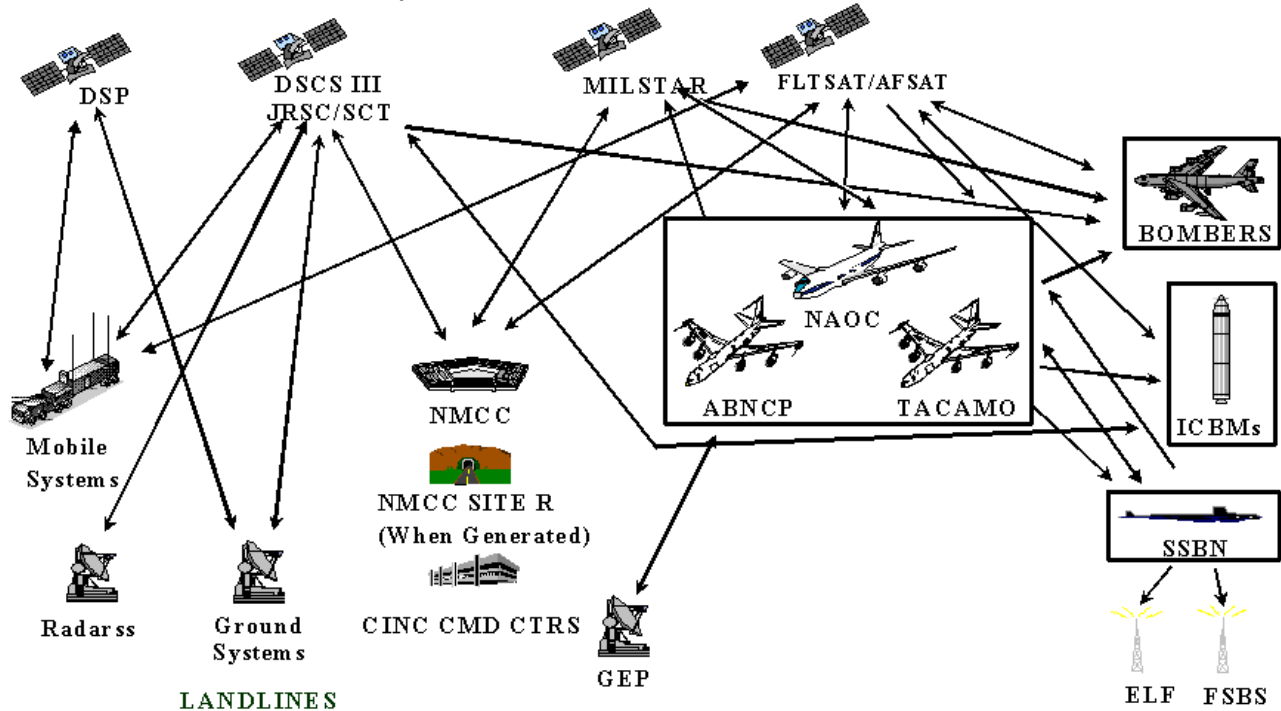


Warning

Notional Connectivity

Decision Making

Forces



Source: "National Command & Control: The National Military Command System (NMCS)," October 2001, at [http://www.afcea.org/education/briefs/lublinoct2001.ppt].

In order to accomplish these expectations in the potentially confusing and demanding environment of nuclear employment, the NCCS must fulfill several key attributes. Primarily, it must be survivable. The system may have to operate in extreme blast, heat, fallout, EMP, chemical, or biological environments. National leadership must be able to exercise control throughout any crisis. This survivability can be achieved by hardening, mobility, redundancy, or concealment.¹⁹

The NCCS must also be reliable. It should support rapid connectivity between decision makers and forces during time critical events. It should work properly when called upon. It should not generate false alarms or pass inaccurate information.²⁰

¹⁹ Chairman of the Joint Chiefs of Staff, "CJCSI 5119.01B," A-1; "National Command & Control: The National Military Command System (NMCS)," Bracken, pp. 179-237; Babbitt, pp. 322-351.

²⁰ Chairman of the Joint Chiefs of Staff, "CJCSI 5119.01B," A-1; "National Command & Control: The National Military Command System (NMCS)," Bracken, pp. 179-237; Ashton (continued...)

Last, the NCCS needs to be a secure system. Security limits access to these sensitive processes to those who are authorized, and it ensures the authenticity of communications. These systems should have protection against jamming or interference with the links between the leadership and the forces. It is also vital to prevent hostile listening or intercept of these communications.²¹ Security may be even more challenged as potential adversaries adopt asymmetric capabilities such as computer attack.²²

The Current Role of Nuclear Command and Control

The 2001 Nuclear Posture Review

Nuclear command and control was highlighted as the center of the deterrence construct in the DOD's 2001 Nuclear Posture Review.²³ Congress directed this review in the FY2001 National Defense Appropriations Act (P.L. 106-398, sect. 1041). The legislation required the review to include:

- (1) The role of nuclear forces in United States military strategy, planning, and programming.
- (2) The policy requirements and objectives for the United States to maintain a safe, reliable, and credible nuclear deterrence posture.
- (3) The relationship among United States nuclear deterrence policy, targeting strategy, and arms control objectives.
- (4) The levels and composition of the nuclear delivery systems that will be required for implementing the United States national and military strategy, including any plans for replacing or modifying existing systems.
- (5) The nuclear weapons complex that will be required for implementing the United States national and military strategy, including any plans to modernize or modify the complex.

²⁰ (...continued)

B. Carter, "Communications Technologies," in *Managing Nuclear Operations*, Ashton B. Carter, John D. Steinbruner, Charles A. Zraket, eds., (Washington, DC: Brookings Institution, 1987), pp. 217-281.

²¹ Chairman of the Joint Chiefs of Staff, "CJCSI 5119.01B," A-1; Babbitt, pp. 322-351; Carter, "Communications Technologies," pp. 217-281.

²² For a further discussion of computer or cyber attacks, see CRS Report RL32114, *Computer Attack and Cyberterrorism: Vulnerabilities and Policy Issues for Congress*, by Clay Wilson.

²³ For further detailed discussion of the Nuclear Posture Review, see CRS Report RL31623, *U.S. Nuclear Weapons: Changes in Policy and Force Structure*, by Amy F. Woolf.

(6) The active and inactive nuclear weapons stockpile that will be required for implementing the United States national and military strategy, including any plans for replacing or modifying warheads.²⁴

On January 9, 2002, J.D. Crouch, the Assistant Secretary of Defense for International Security Policy, briefed the public on the unclassified aspects of the NPR report. Assistant Secretary Crouch proposed that changes in the multinational environment drove the need for the NPR. He stated that since the Cold War was over, there was a new relationship with Russia. The Administration wanted to encourage a positive evolution in that relationship and move away from mutual assured destruction.²⁵ He claimed that this evolution would entail a reduced dependence on offensive nuclear forces for deterrence. Meanwhile, he also highlighted the NPR contention that the U.S. may face multiple political opponents posing newly emerging threats, particularly from the proliferation of weapons of mass destruction (WMD) and ballistic missiles to deliver them.²⁶

DOD held that these potential new threats were difficult to anticipate, so a “capabilities based approach” was needed. The “capabilities based” concept strove to provide the President with a wide range of options to better tailor the national response to potential adversaries and defeat any aggressor. The NPR embodied this approach in the architecture of a “new triad” of capabilities.²⁷ The first leg of the NPR’s new triad includes nuclear and non-nuclear offensive forces. Active defenses (such as interceptor technologies) and passive defensive forces (identification and warning capabilities) constitute the second leg of the new triad, to increase the range of options and reduce the reliance on offensive systems. A responsive weapons infrastructure for supporting deployed forces and developing new systems completes the NPR’s new triad construct.

The Administration places command, control, intelligence, and planning figuratively and literally at the center of the NPR’s new triad, linking its components.

²⁴ “Floyd D. Spence National Defense Authorization for Fiscal Year 2001,” H.R. 4205, (P.L. 106-945) Oct. 30, 2000, 114 STAT. 1654A-262.

²⁵ During the Cold War, the doctrine of “mutual assured destruction” contended that given the arsenals of thousands of nuclear weapons held by both the U.S. and the USSR, each side was deterred from initiating a nuclear strike by their fear that the homeland of the aggressor would in turn be destroyed by the response of the country attacked, thus eliminating the incentive to strike first.

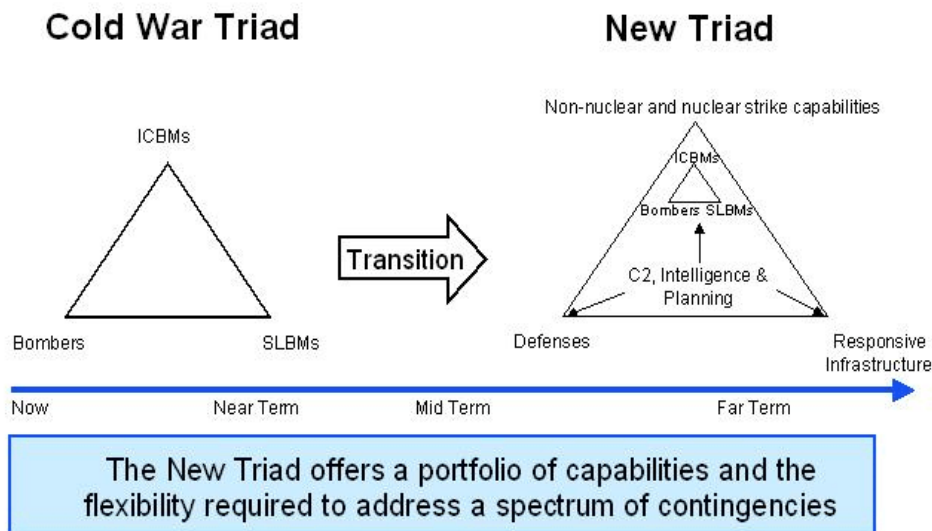
²⁶ Department of Defense, “Statement on Nuclear Posture Review,” and “Nuclear Posture Review Report Forward,” Mar. 9, 2002, at [http://www.defenselink.mil/releases/2002/b03092002_bt113-02.html]; Department of Defense, “Special Briefing on the Nuclear Posture Review,” Jan. 2, 2002, at [http://www.defenselink.mil/transcripts/2002/t01092002_t0109npr.html].

²⁷ The old or “classic” nuclear deterrence triad consisted of a mix of nuclear-capable long range bombers, submarine launched ballistic missiles (SLBMs) and land based intercontinental ballistic missiles (ICBMs). In the classic triad, the mix of forces complicated the problem for an adversary attempting to destroy U.S. capability in a preemptive strike and hedged against a breakthrough against, or failure of, one of the triad capabilities (such as an ability to easily find and destroy submerged submarines).

It envisions enhanced command and control to improve the precision of strike and defense forces. It also seeks a capability to plan adaptively, rapidly enabling the military to confront emerging threats, thus enhancing deterrence during crises and improving the conduct of operations. The Administration hopes command and control advances will better integrate nuclear and non-nuclear forces to increase their ability to quickly respond and increase the forces' flexibility in changing situations.²⁸ This increased emphasis on NC2 capabilities in the NPR could translate into new systems initiatives.

Figure 3: The NPR Depiction of the “New Triad”

***A Capabilities Based Concept:
The New Triad***



Source: Department of Defense, “Special Briefing on the Nuclear Posture Review,” January 2, 2002. [http://www.defenselink.mil/transcripts/2002/t01092002_t0109npr.html].

Recent Nuclear Doctrine Developments

The Bush Administration and the Department of Defense have begun implementing the framework embodied in the 2001 NPR. USSTRATCOM assumed responsibility for additional missions in the latest revision of the Unified Command Plan, implemented shortly after the NPR’s publication. These functions include global strike, space operations, missile defense, information operations, and

²⁸ James J. Wirtz and James A. Russell, “A Quiet Revolution: Nuclear Strategy for the 21st Century,” *Joint Forces Quarterly* 33 (Winter 2002-2003): pp. 9-15.

command, control, communications, computers, intelligence surveillance, and reconnaissance (C4ISR).²⁹ Organizational changes continued moving forward in January 2005, when Secretary of Defense Donald Rumsfeld designated USSTRATCOM as the focal point for combating weapons of mass destruction. By September 2005, General James Cartwright, the Commander of USSTRATCOM, had established a Center for Combating Weapons of Mass Destruction, in partnership with the Defense Threat Reduction Agency, to execute this function.³⁰ These additions to the USSTRATCOM mission portfolio institutionalized the view of the post-Cold War environment articulated in the 2001 NPR.

DOD has begun to incorporate the NPR thinking into its doctrinal guidance to military commanders. Press reports in 2005 noted that the Joint Staff was preparing an update to its “Doctrine for Joint Nuclear Operations,” last published in 1995. These reports suggested that a specific area of emphasis in the new doctrine is deterring the use of weapons of mass destruction and acting to prevent or retaliate against their use if required. Of interest with respect to nuclear command and control are the doctrine’s discussion of crisis action planning and emphasis on integrating nuclear and non-nuclear offensive forces with defensive forces.³¹ However, other press reports indicate that this draft update may have been cancelled.³²

Reports suggest that the new joint doctrine would emphasize rapid crisis action planning to respond to unanticipated WMD threats. This concept is also a carry-over from the 2001 NPR. Crisis action planning is defined as “...the time sensitive development of joint operations plans and orders in response to an imminent crisis.”³³ The need for rapid planning has been recognized in the conventional combatant commands for many years, while the nuclear plan has often been viewed as the product of a long term deliberate planning effort. Compressing the time required to develop and disseminate plans to nuclear forces during a crisis could require further growth in computer workstation capability and availability at the nuclear command centers. These centers must build these plans under time pressure and integrate these products with other military operations. It could also require increases in

²⁹ James O. Ellis, Jr., “U.S. Strategic Command: Meeting Global Challenges,” *Joint Forces Quarterly* 35 (n.d.): 28-33; Elaine M. Grossman, “DOD to Create Multiservice Components Under Strategic Command,” *Inside the Pentagon*, Sep. 16, 2004; U.S. Strategic Command, “Functional Components,” at [<http://www.stratcom.mil>].

³⁰ Jason Sherman, “Rumsfeld Assigns Strategic Command Responsibility for WMD Elimination Work,” *Inside the Pentagon*, Feb. 3, 2005; Sebastian Sprenger, “STRATCOM Sets Up Center for Combating Weapons of Mass Destruction,” *Inside the Pentagon*, Sep. 1, 2005.

³¹ Hans M. Kristensen, “The Role of U.S. Nuclear Weapons: New Doctrine Falls Short of Bush Pledge,” *Arms Control Today* 35, no. 7 (September 2005): 13-19; William Arkin, “Not Just a Last Resort?” *Washington Post*, May 15, 2005; Walter Pincus, “Pentagon Revises Nuclear Strike Plan,” *Washington Post*, Sep. 11, 2005; Walter Pincus, “Pentagon May Have Doubts on Preemptive Nuclear Moves,” *Washington Post*, Sep. 19, 2005.

³² Hans M. Kristensen, “Pentagon Cancels Controversial Nuclear Doctrine,” *The Nuclear Information Project*, Feb. 2, 2006 at [<http://www.nukestrat.com/us/jcs/canceled.htm>].

³³ “Department of Defense Dictionary,” p. 133.

communications capacity, similar to what conventional air forces have seen with the need to disseminate the daily Air Tasking Order in combat theaters. Networked collaborative planning systems are gradually becoming the norm in conventional military operations, and planners accustomed to these capabilities may desire to rely on them for nuclear planning as well. Senior leaders are increasingly expecting bandwidth-hungry video-teleconferencing links for their long distance deliberations and analysis regarding proposed courses of action. Robust communications would be key to coordination with intelligence providers, who would need to forward frequent updates and imagery on the latest data for WMD targets.

Congress recently directed the Secretary of Defense to appoint a 12-member commission to review implementation of the 2001 NPR. Specifically, the FY2006 Defense Authorization Act chartered this commission to study the programmatic requirements needed to achieve the NPR goals. This study would presumably include an examination of the NC2 requirements. This commission is required to submit its report to Congress by June 30, 2007.³⁴ As some might argue that there has been only limited movement to implement the NPR's findings, this commission might move that debate forward.

A vital aspect that the NPR does not address is the policy for the role and uses of nuclear weapons, although it does suggest that precision non-nuclear or even "non-kinetic" weapons might fulfill missions previously allocated to nuclear weapons and so permit a smaller arsenal. However, the continued presence of these weapons in the U.S. arsenal for the foreseeable future seems likely. An overarching approach to nuclear weapons policy could in turn determine the shape of the required command and control architecture. Assumptions, such as whether a small deterrent or large counterforce capability would remain or whether the NC2 system would be expected to "ride out" an exchange, shape the requirements for the degree of robustness, redundancy, or survivability required.

Nuclear Command and Control Issues

Is the Cold War Architecture Still Relevant?

Today's nuclear command and control systems originated and acquired most of their present configuration during the Cold War. The NORAD-Cheyenne Mountain Complex achieved initial operational capability in 1966.³⁵ The first version of the E-4 National Airborne Operations Center was delivered in 1974.³⁶ The current

³⁴ United States Congress, House of Representatives, "Conference Report to Accompany H.R. 1815, National Defense Authorization Act for Fiscal Year 2006," (H.Rept. 109-360), Dec. 18, 2005, pp. 300-302.

³⁵ North American Aerospace Defense Command, "NORAD Trivia: Cheyenne Mountain Operations Center," at [<http://www.norad.mil/>].

³⁶ Air Combat Command Public Affairs Office, "U.S. Air Force Fact Sheet: E-4B," Mar. 2005, at [<http://www.af.mil/factsheets/>].

USSTRATCOM underground command post was built between 1986 and 1989.³⁷ The focus of these systems was to manage a massive nuclear confrontation with the Soviet Union. In certain aspects, these systems have changed little since the end of the Cold War and subsequent reviews of nuclear posture. As the Defense Department examines difficult resources tradeoffs, it is relevant to ask, is this infrastructure still appropriate today? The post-Cold War environment could impose new requirements on the NCCS, that these Cold War systems might not best fulfill, and that might necessitate spending on new programs.

The nature of the threat can shape the challenges to the NC2 infrastructure. A particular problem with respect to assuring nuclear command and control during the Cold War was the threat of a “decapitation attack.” A decapitation attack would specifically target national and military leadership with the intent of disrupting the lines of authority required to direct a retaliation attack. This concern over decapitation was especially pervasive during the 1980s. While such an attack could prevent a response from the deterrent force or at least blunt the cohesion of a retaliation effort, the greatest concern centered on the potential loss of political control of a conflict’s escalation or termination. Analysts argued that the nuclear command and control architecture needed to be able to continue functioning through an attack in order to ensure government control of the weapons.³⁸ This outlook shaped upgrades to nuclear command and control that were implemented in the 1980s, such as increased redundancy and survivability of communication links.

The threat of such a strike from Russia today is considerably diminished compared to the Cold War. Indeed, U.S. policy considers the relationship with Russia to be no longer adversarial.³⁹ The Strategic Offensive Reductions Treaty (also known as the Moscow Treaty), agreed to by Presidents Bush and Putin in 2002, committed each side to reduce deployed nuclear weapons to levels between 1,700 and 2,200. Such arms levels represent a significant decrease from the tens of thousands deployed during the height of the Cold War.⁴⁰ Therefore, in the current strategic and fiscally constrained environment, is the overlapping redundancy and expense of a command and control architecture designed to function during a major nuclear exchange still justified?

Despite the demise of the Soviet Union, most analysts agree that the United States could face a wide range of challenges in the future. For example, there is

³⁷ John Pike, “U.S. Strategic Command Command Center,” Sep. 20, 2000, at [<http://www.fas.org/nuke/guide/usa/c3i/cmdctr.htm>].

³⁸ Bracken, 232-237; Ashton B. Carter, “Assessing Command System Vulnerability,” in *Managing Nuclear Operations*, Ashton B. Carter, John D. Steinbruner, Charles A. Zraket, eds., (Washington, DC: Brookings Institution, 1987), pp. 555-610.

³⁹ President of the United States, “National Security Strategy of the United States,” (Washington, DC: The White House, September 2005), pp. 13, 26-27.

⁴⁰ For a detailed discussion of the Moscow Treaty, see CRS Report RL31448, *Nuclear Arms Control: The Strategic Offensive Reduction Treaty*, by Amy F. Woolf.

debate regarding a potential nuclear threat from China.⁴¹ DOD analysts claim that overall military expenditures from the People's Republic may amount to as much as \$90 billion in 2005, and could triple by 2025. Specifically, the Chinese are acquiring more survivable systems, such as the mobile DF-31A ICBM, and currently have other ICBM systems that can target nearly all of the United States. Comments from General Zhu Chenghu, the dean of China's National Defense University, threatening that the Chinese would attack U.S. cities with nuclear weapons if the United States were to come to Taiwan's aid against China, were widely reported in the U.S. media.⁴² Peter Brooks, from the Heritage Foundation, suggested in testimony before the House Armed Services Committee that China may be striving for preeminence in the Pacific Rim and East Asia.⁴³

However, other analysts, even in DOD circles, counter with a "get real" school that argues that the China threat is overstated. Kurt Campbell, from the Center for Strategic and International Studies, suggested in testimony that the relationship with China is not the clear confrontation that shaped the Cold War competition with the Soviet Union. Indeed, there are many areas where cooperation characterizes the U.S. and European relationships with China.⁴⁴ Some might even argue that highlighting a "China threat" represents the latest effort in the search for a great power peer competitor--one that the defense establishment has not found since the end of the Cold War era, similar to the warnings about a "coming war with Japan" prevalent in the 1990s. Such a threat might be viewed as justifying the development of major weapons systems to satisfy the military's "comfort zone" (unlike the threat from non-state actors such as al Qaeda). Yet an increasing Chinese nuclear capability, if accompanied by hostile relations or diplomatic crisis, could pose a renewed survivability threat to the nuclear command and control system.

Others analysts argue that rogue states such as Iran or North Korea, emboldened by their pursuit of nuclear weapons and ballistic missile technology, pose threats that reinforce the need to preserve a viable NC2 architecture. North Korea has been actively seeking a nuclear weapons capability since the 1960s. Pakistani nuclear scientist and black marketeer A.Q. Khan traveled to North Korea several times in the 1990s and may have provided a source of information for Kim Jong Il's efforts. In February 2005, North Korea publicly announced it had nuclear weapons. However, without indications of a nuclear test, it is difficult to verify this claim. Based on

⁴¹ For a more extensive review of current U.S.-China relations, see CRS Report RL32804, *China-U.S. Relations: Current Issues and Implications for U.S. Policy*, by Kerry Dumbaugh.

⁴² Office of the Secretary of Defense, "Annual Report to Congress: The Military Power of the People's Republic of China, 2005," (Washington, DC: Department of Defense, 2005), pp. 21-22, 28-29; Robert Marquand, "Chinese Build a High-Tech Army Within an Army," *Christian Science Monitor*, Nov. 17, 2005; Bill Gertz, "China Stocks Nukes as Anti-U.S. Tactic," *Washington Times*, July 29, 2005.

⁴³ House of Representatives, Armed Services Committee, "Threats in Asia: Hearing of the Defense Threat Review Panel," Sep. 27, 2005.

⁴⁴ House of Representatives, Armed Services Committee, "Threats in Asia: Hearing of the Defense Threat Review Panel," Sep. 27, 2005; David Shambaugh, "The New Strategic Triangle: U.S. and European Reactions to China's Rise," *Washington Quarterly* 28, no. 3 (Summer 2005): pp. 7-25.

estimates of the amount of bomb grade fissile material that may have been diverted from North Korean nuclear reactors, Robert Norris and Hans Kristensen of the Natural Resources Defense Council place the number of North Korean bombs as possibly ten. It is also known that North Korea manufactures multiple variants of SCUD type missiles, the longer range NoDong missile, and the potentially intercontinental range TaepoDong missiles. However, it is unclear if the North Koreans have the capability to mate a nuclear weapon to these delivery systems.⁴⁵ Also, reliable information from inside the country is nearly non-existent. In addition, post-Iraq criticisms of U.S. intelligence community assessments have made government experts reluctant to publicly commit to estimates regarding the North Korean programs. Some analysts go so far as to suggest that North Korean claims to possess nuclear weapons are themselves deception efforts to bluff the United States.⁴⁶

The Iranian nuclear program also poses dilemmas for threat analysts. The current administration asserts that Iran is pursuing nuclear weapons, and intelligence analysts project that the Islamic Republic is roughly ten years away from having an atomic bomb capability.⁴⁷ Other commentators predict that Iran might have nuclear weapons significantly earlier. Some in Israel predict an Iranian bomb within two years, while the Institute for Science and International Security says they could have the capability by 2009.⁴⁸ However, other analysts emphasize that engaging in nuclear fuel cycle research and development falls within the scope of work permitted Iran within Nuclear Non-Proliferation Treaty obligations.⁴⁹ The secrecy and concealment in which Iran has enveloped the activities at Natanz and other nuclear sites has served to elevate suspicions. Iran also may be attempting to develop nuclear capable long range delivery systems, as evidenced by the recent testing of its 1,500 km range Shahab-3 missile and the alleged discovery of plans for a nose-cone optimized for a

⁴⁵ Robert S. Norris, Hans M. Kristensen, "North Korea's Nuclear Program 2005," *Bulletin of the Atomic Scientists* (May/June 2005): pp. 64-67.

⁴⁶ William J. Broad, Douglas Jehl, David E. Sanger, and Thom Shanker, "North Korea Nuclear Goals: A Case of Mixed Signals," *New York Times*, July 25, 2005; Joseph Cirincione and Jon B. Wolfsthal, "No Good Choices: The Implications of a Nuclear North Korea," *Brown Journal of World Affairs* XII, no. 1 (Summer/Fall 2005): pp. 269-277. For more complete analyses of the North Korea nuclear weapons and missile programs, see CRS Report RS21391, *North Korea's Nuclear Weapons: How Soon an Arsenal?*, by Sharon A. Squassoni, and CRS Issue Brief IB91141, *North Korea's Nuclear Weapons Program*, by Larry A. Niksch.

⁴⁷ Dafna Linzer, "Iran Is Judged 10 Years from Nuclear Bomb," *Washington Post*, Aug. 2, 2005. For more through discussions of the Iranian nuclear program, see CRS Report RS21592, *Iran's Nuclear Program: Recent Developments*, by Sharon Squassoni, and CRS Report RL32048, *Iran: U.S. Concerns and Policy Responses*, by Kenneth Katzman.

⁴⁸ Peter Grier, "Why the U.S. Doesn't Trust Iran on Nukes," *Christian Science Monitor*, Jan. 24, 2006.

⁴⁹ Jean du Preez and Melissa Kessler, "Iran's Game of Nuclear Poker: Knowing When to Fold," *Center for Non-Proliferation Studies Research Story*, Aug. 26, 2005, at [http://www.cns.miis.edu].

nuclear weapon.⁵⁰ Indeed, press reports have referenced an International Atomic Energy Agency (IAEA) study that links the Iranian military's study of high explosives, an essential element to constructing a nuclear weapon, to the Iranian civilian nuclear program.⁵¹ Iran's increasingly strident rhetoric regarding the destruction of Israel and the United States exacerbates concerns about hostile Iranian intentions.⁵²

Nations that have small nuclear arsenals could threaten disproportionate effects on U.S. infrastructure, including command and control systems, through an electromagnetic pulse (EMP).⁵³ A high altitude nuclear explosion generates an electrical field, with coverage depending on the height of the burst, that causes a voltage surge in power lines and communications cables. This voltage surge would immediately damage unprotected electronic components, such as computers or electrical transformers, leading to the failure of air traffic control, medical care, food preservation and distribution, or heating as the primary control computers or power systems fail. The potential result would be a cascading series of failures of interrelated critical infrastructure elements, similar to what was seen after Hurricane Katrina hit the Louisiana coast. Some argue that such a catastrophe could lead to the deaths of thousands if not millions of people.⁵⁴ Congress chartered the Commission to Assess the Threat to the United States from Electromagnetic Pulse Attack (or EMP Commission) to analyze and report on the scope of the EMP threat.⁵⁵

Some analysts argue that detonating a high altitude nuclear burst to generate EMP against the U.S. critical infrastructure might be one way that China could use its nuclear capability against the US, rather than launching a massive strike. William Graham, who chaired the EMP Commission, noted the great interest reflected in

⁵⁰ William J. Broad and David E. Sanger, "Relying on Computer, U.S. Seeks to Prove Iran's Nuclear Aims," *New York Times*, Nov. 13, 2005; David Albright and Corey Hinderstein, "Iran: Player or Rogue," *Bulletin of the Atomic Scientists* 59, no. 5 (September/October 2003): pp. 52-58.

⁵¹ Elaine Sciolino and William J. Broad, "Atomic Agency Sees Possible Link of Military to Iran Nuclear Work," *New York Times*, Feb. 1, 2006.

⁵² Karl Vick, "Iran's President Sparks Fears of New Isolation," *Washington Post*, November 5, 2005; Michael Slackman, "A New Face in Iran Resurrects an Old Defiance," *New York Times*, Jan. 30, 2006.

⁵³ For a more comprehensive discussion of EMP weapons, see CRS Report RL32544, *High Altitude Electromagnetic Pulse (HEMP) and High Power Microwave (HPM) Devices: Threat Assessments*, by Clay Wilson.

⁵⁴ Dee Ann Divis, "Protection Not in Place for Electric WMD," *UPI*, Mar. 9, 2005; Department of Defense, "Electromagnetic Pulse Attack: The Fatal Attack on America's Infrastructure," *Federal News Service*, Oct. 24, 2005.

⁵⁵ The Commission to Assess the Threat to the United States from Electromagnetic Pulse Attack (or EMP Commission) was chartered by Congress in the FY 2001 National Defense Authorization Act (P.L. 106-398, Title XIV, sect. 1401-1409) to review the EMP threat and to recommend actions the government should take to protect military and civilian systems.

Chinese military literature regarding EMP attack.⁵⁶ Experts also suggest that this could be the purpose of the nuclear and ballistic missile programs in North Korea and Iran. It is suggested that the profile of recent North Korean and Iranian missile tests, which detonated at high altitude and were viewed at first as failures, could indicate preparation for such a strategy. One scenario involves launching a short range missile, such as Iran's Shahab-3, from a freighter off the U.S. coast.⁵⁷ Technology may also be emerging that enables generation of an EMP burst with more localized effects without detonating a nuclear weapon.⁵⁸

Some scepticism may be warranted, however, regarding the scope of the EMP threat. Some analysts claim that military and some commercial systems may withstand an EMP burst with only few adverse effects, and that most key infrastructure would continue to function. Many key military systems, particularly in the area of command and control, include EMP protection. Other commercial systems can inexpensively add EMP protection. The threat from a single weapon attack from a freighter off the U.S. coast, in this view, would not cause the catastrophic failures envisioned by some.⁵⁹ It might also be noted that the motivation for China to use EMP against the continental United States would be unclear, given potential retaliatory consequences, although use against U.S. forces aiding Taiwan might be more conceivable. Further, some analysts contend that the North Korean long range ballistic missile program has stalled, because Russia and China have become less willing to share key advanced technologies with Kim Jong Il's regime.⁶⁰ Still others note that it would be extremely difficult for rogue states such as North Korea or Iran, let alone a terrorist group, to develop a nuclear weapon that would effectively generate the large area EMP effects postulated by some.⁶¹ However, the EMP Commission has found that maintenance of EMP hardening and practice of

⁵⁶ Zachary M. Peterson, "Expert Argues EMP Threat Greater Now Than During Cold War," *Inside Missile Defense*, Dec. 21, 2005; Kathy Gambrell, "Threat From EMPs Needs More Attention, Weldon Says," *Aerospace Daily and Defense Report*, July 22, 2004.

⁵⁷ United States Senate, Committee on the Judiciary, Subcommittee on Terrorism, Technology, and Homeland Security, "Terrorism and the EMP Threat to Homeland Security," (S. Hrg. 109-30), Mar. 8, 2005; Rep. Roscoe G. Bartlett, "Outside View: The EMP Threat is Real," *UPI*, Oct. 28, 2004; John S. Foster, Jr., et al., "Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack," vol. 1, 2004, at [<http://armed.services.house.gov/openingstatementsandpressreleases/108thCongress/04-07-22emp.pdf>]; Newt Gingrich, "The Threat of the Current Regime in Iran: Testimony to the Senate Committee on Homeland Security and Governmental Affairs, Subcommittee on Federal Financial Management, Government Information, and International Security" Nov. 15, 2005 at [<http://www.aei.org>].

⁵⁸ "Come Fry With Me," *Economist*, Feb. 1, 2003.

⁵⁹ United States House of Representatives, Armed Services Committee, Military Research and Development Subcommittee, "Electromagnetic Pulse Threats to the U.S. Military and Civilian Infrastructure," Oct. 7, 1999.

⁶⁰ "The Truth About North Korea's Missile Program," Mar. 5, 2001, at [<http://www.orbireport.com/Columns/01-03-05.html>].

⁶¹ Nick Schwellenbach, "The EMPTy Threat," *Washington Times*, Nov. 27, 2005.

EMP procedures in the military may have declined since the 1990s.⁶² Indeed, Congress recently directed reestablishment of the EMP Commission, with an assignment to deliver a report by June 30, 2007. It was specifically tasked to look at the vulnerability of military systems and progress on protecting these systems from EMP.⁶³ Some might view the EMP threat as supporting a continued requirement for the capabilities to be able to operate in an EMP environment instilled in the nuclear command and control infrastructure during the Cold War.

Command and Control Issues from the 2001 NPR

Some of the new missions addressed in the 2001 Nuclear Posture Review, specifically the inclusion of non-nuclear responses and of active defenses, will add to the challenges for the nuclear command and control system. These challenges are both systematic and technical. To integrate nuclear offensive forces, non-nuclear offensive forces, and defensive forces, the current command and control system may need to be improved to take on new challenges. It may need to expand its reach to include additional participants, such as those responsible for the non-nuclear forces or defensive forces, in the decision making process or at least as recipients of orders. Implementation of the NPR recommendations could also drive a demand for additional capacity, in the event that these additional parties must participate simultaneously in key conferences. It might also force a need for additional speed and responsiveness, as the time lines for a missile defense response may be more compressed than for an offensive response during the Cold War.

The process for directing release of non-nuclear strikes presents one area that requires further development. Such responses are presumed to include conventional attacks against strategic targets using precision weapons or conventional ballistic missiles, and “non-kinetic options,” which are taken to include information operations, electronic warfare, energy weapons, and even special operations forces strikes.⁶⁴ One question that including these additional choices might pose is the determination of “release authority.” As previously mentioned, only the President can direct the release of nuclear weapons. Should the President also be required to direct the release of these “non-nuclear” or “non-kinetic options” as well? As Commander-in-Chief, the President is free to determine the level of detail of his involvement in the direction of military operations. However, other than historic aberrations such as Lyndon Johnson’s personal selection of targets during the Vietnam War, Presidents have typically not become

⁶² “Report of the Commission to Assess the Threat to the United States from Electromagnetic Pulse (EMP) Attack,” vol. 1, 2004, at [<http://armedservices.house.gov/openingstatementsandpressreleases/108thCongress/04-07-22emp.pdf>].

⁶³ United States Congress, House of Representatives, “Conference Report to Accompany H.R. 1815, National Defense Authorization Act for Fiscal Year 2006,” (H.Rept. 109-360), Dec. 18, 2005, pp. 302-303.

⁶⁴ Both General Cartwright, the USSTRATCOM Commander, and Mr. Brian Green, the Deputy Assistant Secretary of Defense for Forces Policy and International Security Policy, specifically employed the term “non-kinetic” among the range of non-nuclear responses during their remarks at “Implementing the New Triad: Nuclear and Non-nuclear forces in Twenty-First-Century Deterrence,” *36th IFPA-Fletcher Conference on National Security Policy*, Dec. 14-15, 2005 (author’s notes).

involved in the details of planning specific conventional missions, particularly during the course of existing hostilities.⁶⁵ The President was not involved in the building of daily Air Tasking Orders for recent campaigns against Iraq in 1991 or 2003, or Kosovo. On the other hand, the targets against which USSTRATCOM might respond could well be presumed to have such strategic importance or criticality that they might warrant personal Presidential involvement. These strikes might also be tied to the opening rounds in the commencement of hostilities, which could invite closer Presidential participation. If one desired to require Presidential authorization to release these strikes, enforcement of that requirement could pose difficult technical and operational problems. While nuclear weapons are designed with permissive action link codes to prevent use without Presidential authorization, conventional weapons are not so designed.⁶⁶ The process becomes even more complex, when conventional weapons are mixed with nuclear weapons on the same platform, such as in the DOD's recent proposal to include some conventional Trident missiles on nuclear armed ballistic missile submarines. It will be essential to ensure a process on the weapons platform that ensures only conventional weapons are launched if only conventional weapons are ordered to launch.⁶⁷

The non-kinetic strikes, particularly information operations or cyber-attacks, may pose an even graver problem. Some claim that these attacks can not only strike strategically important targets, but could produce effects that are strategic in scope, such as shutting down a nation's electrical power network. Indeed, some have expressed concern that such attacks could be the equivalent of a WMD strike and should be treated as such.⁶⁸ Some might argue that as a consequence, the level of Presidential involvement and control should therefore be more detailed. However, like the case with conventional weapons, technical solutions for enforcing such control have not been discussed.

Adding these non-nuclear and non-kinetic responses will also add additional participants to the command and control process. These participants from other communities may not have the same ingrained disciplines or be trained in the same protocols as those from the nuclear community. As command and control lines of authority cross additional organizational boundaries, approval processes may need

⁶⁵ For detailed discussions of the depth of Presidential involvement in the Vietnam air campaigns, see Mark Clodfelter, *The Limits of Airpower: The American Bombing of North Vietnam* (New York: Free Press, 1989); also see Earl H. Tilford, Jr., *Setup: What the Air Force Did in Vietnam and Why* (Maxwell AFB, AL: Air University Press, 1991).

⁶⁶ Permissive Action Links (PALs) are designed to prevent an unauthorized nuclear launch or release. PALs employ coded combination locking systems, usually requiring two people to enter separate codes, which are also typically retained at higher command levels physically separate from nuclear weapons and only disseminated when the order to launch is given. See Donald R. Cotter, "Peacetime Operations Safety and Security," in *Managing Nuclear Operations*, Ashton B. Carter, John D. Steinbruner, Charles A. Zraket, eds., (Washington, DC: Brookings Institution, 1987), pp. 46-51.

⁶⁷ Department of Defense, "Quadrennial Defense Review Report," Feb. 6, 2006, pp. 32, 35, 50 at [<http://www.defenselink.mil/pubs>]; Jason Sherman, "2005 Quadrennial Defense Review the First to Adjust Strategic Forces," *Inside the Pentagon*, Jan. 26, 2006.

⁶⁸ Matthew Campbell, "'Logic Bomb' Arms Race Panics Russia," *Sunday Times (London)*, Nov. 29, 1998.

to be revised so that the cycle time for decision making and implementation does not grow excessively. Otherwise, critical targets could be missed because it takes too much time to reach decisions or to grant execution authorities.⁶⁹

The merging of active defenses, particularly missile defenses, into the NC2 architecture also will force further adaptation. As with offensive responses, it will be necessary to agree on the release authority. Given what is, at this time, a limited defensive capability,⁷⁰ in some scenarios a decision could be needed on what locations to defend and what not to defend.⁷¹ Such a grave decision might be viewed as requiring Presidential involvement. However, given what may be fleeting opportunities to respond within a defense system's operational "envelope," taking time to consult with the President could lead to missing the chance to stop incoming missiles. Therefore, some analysts recommend that missile defense release authority be delegated to the unified combatant commander, perhaps supported with standing Presidential guidance.⁷² In some cases, choosing whether a defensive launch or an offensive strike will form the national response, and selecting among the tradeoffs between the two, could also require Presidential consideration. It will be vital to choreograph both the offensive and the defensive conversations, so as to accommodate decision making in the limited time frames available. A successful defensive response may alter the range of offensive responses under consideration. Alternatively, an attack with the potential to overwhelm the defensive system may place a higher premium on an earlier offensive response for damage limitation.⁷³

As with the inclusion of non-nuclear offensive strikes, including consideration of defensive responses in the decision making process after the detection of a potential attack will add participants, with inputs that must also be considered in the short time frame preceding impact. As currently envisioned, regional combatant commanders will have responsibility for defense in their area of responsibility, so multiple command centers will be involved.⁷⁴ Although USSTRATCOM is tasked by DOD to take the lead on missile defense, any program will have to be linked to the systems resident in the regional combatant commands, such as USCENTCOM, or USNORTHCOM, who will have theater missile defense responsibilities and

⁶⁹ Dennis M. Gormley, "Conventional Force Integration in Global Strike," in *Nuclear Transformation: The New US Nuclear Doctrine*, James J. Wirtz and Jeffrey A. Larsen, eds., (New York: Palgrave MacMillan, 2005), pp. 59-60.

⁷⁰ The ground-based midcourse defense segment of the Pacific Missile Defense Testbed will initially have 16 interceptor missiles based at Ft. Greeley, Alaska, and 4 more at Vandenberg Air Force Base, California. The midcourse system also is planned to include up to 20 interceptors based on Aegis ships. For more detail on the missile defense program, see CRS Report RL31111, *Missile Defense: The Current Debate*, by Steven A. Hildreth.

⁷¹ M. Elaine Bunn, "Deploying Missile Defense: Major Operational Challenges," *Strategic Forum* no. 209, (August 2004): pp. 2-3

⁷² Ibid.

⁷³ Bunn, pp. 3-4.

⁷⁴ Bunn, p. 2.

equities in receiving warning data.⁷⁵ General Cartwright, the USSTRATCOM commander, reportedly has given direction already to his personnel to ensure that the missile defense command and control systems are interoperable, with common technical standards and protocols.⁷⁶ As participants are added to decision conferences for missile defense or non-nuclear offensive responses, the bandwidth demands on already strained networks will only increase further.

As is true today for nuclear operations, the ultimate customer of any command and control system that includes “non-nuclear” and defensive choices is the President. Ms. M. Elaine Bunn, a researcher at the National Defense University’s Institute for National Security Studies, points out that this system must be able to present these choices for Presidential decision, along with their ramifications and tradeoffs, in a manner in which they are easily understandable. It must facilitate the Commander-in-Chief’s ability to smoothly interact with all of his advisers, even aid him in knowing whom to contact for a specific question. It must aid his decisions within the tight time line of nuclear decision making, but at the same time not overwhelm him. It will be essential to maintain today’s tight Presidential control of nuclear weapons, as well as to ensure that the orders that reach the weapons operators are clear and actionable.⁷⁷

Are There Secondary Uses for Nuclear Command and Control Assets?

Beyond supporting the civilian and military leadership in the conduct of nuclear operations, nuclear command and control systems may be useful for other military and government functions, which could contribute to their continuing value. In fact, some of these systems already serve multiple missions in non-nuclear roles. The tight security, robust decision making and communications capabilities inherent in these platforms could make them versatile national assets.

One type of mission these systems can support is non-nuclear military forces direction and status monitoring. For example, the National Military Command Center (NMCC) provides 24-hour monitoring of all worldwide military operations. In addition to support during crises and conflicts, the NMCC aids management of peacetime contingencies, such as natural disasters. A response cell or crisis action team (CAT) may be formed from members from the Joint Staff, Office of the Secretary of Defense, or other agencies to prepare orders, monitor forces, conduct staff actions, and deliver briefings needed to respond to a developing situation.⁷⁸

⁷⁵ Nathan Busch, “Command, Control, and the Nuclear Posture Review,” in ” in *Nuclear Transformation: The New US Nuclear Doctrine*, James J. Wirtz and Jeffrey A. Larsen, eds., (New York: Palgrave MacMillan, 2005), pp. 111-112.

⁷⁶ Jason Sherman, “STRATCOM Chief Seeks to Streamline Missile Defense C2, Sensors,” *Inside the Pentagon*, Dec. 22, 2005.

⁷⁷ Interview with Ms. M. Elaine Bunn, Distinguished Research Fellow, Institute of National Security Studies, National Defense University on Mar. 3, 2006.

⁷⁸ Joint Chiefs of Staff, “J-3 Operations: Monitoring On-Going Operations,” at (continued...)

Command and control assets also supported mitigation and recovery activity after the September 11, 2001 terrorist attacks. For example, the North American Aerospace Defense Command (NORAD) command center at Cheyenne Mountain, in Colorado, and the NMCC were closely involved in coordinating the restoration of normal air traffic after the attacks, when all aircraft were ordered grounded.⁷⁹

These assets could be key tools for continuity of operations (COOP) and continuity of government (COG) during domestic contingencies or natural disasters. For example, the press has reported that on September 11, 2001, after stopping in Louisiana to give a brief statement, President Bush traveled to USSTRATCOM in Omaha, Nebraska. From that secure facility, he was able to receive updates on the evolving situation and communicate with his national security staff.⁸⁰ The press also widely reported the President's use of the command and control assets at U.S. Northern Command to monitor the government response to Hurricane Rita, which struck the Gulf coast in September 2005.⁸¹

Nuclear command and control assets can serve more directly to support civil authorities for consequence mitigation after disasters or other domestic events. In one case, the Federal Emergency Management Agency (FEMA) and the Chairman of the Joint Chiefs of Staff have signed a memorandum of agreement to make the National Airborne Operations Center (NAOC), a modified Boeing 747-200 command and control aircraft, available for FEMA support during disasters and emergencies. While FEMA did not call on NAOC during Hurricanes Katrina or Rita, it was used during Hurricane Opal in 1995.⁸²

Finally, senior government leadership values these systems for day-to-day support because of their versatile situation monitoring, communications, and teleconferencing capabilities. The NMCC is co-located in the Pentagon, easily accessible to the Secretary of Defense and other DOD leadership. Secretary Rumsfeld is also reported to have relied on the NAOC for support during official travel, such as his recent trips to Iraq and Central Asia.⁸³

Using NC2 assets for missions beyond those tied to nuclear forces requires balancing tradeoffs. The high value and small numbers of these assets could lead to fierce competition to share access in the event of a crisis, potentially creating

⁷⁸ (...continued)

[<http://www.jcs.mil/j3>]; Smith, *Assignment: Pentagon*, pp. 134-5.

⁷⁹ William B. Scott, "Command Cells Speed Airspace Reactivation," *Aviation Week & Space Technology* 156, no. 23 (June 10, 2002): p. 52.

⁸⁰ Bob Woodward, *Bush At War* (New York: Simon & Schuster, 2002), pp. 19, 26-27; Nancy Gibbs, "If You Want to Humble an Empire," *Time Magazine*, Sep. 14, 2001.

⁸¹ Jim VandeHei and Dan Balz, "Storm and Bush on the Move," *Washington Post*, Sep. 25, 2005; Evan Thomas, et al., "Rita's Lessons," *Newsweek*, Oct. 3, 2005.

⁸² "National Airborne Operations Center," Oct. 23, 2004, at [<http://www.fema.gov>]; Joint Chiefs of Staff, "J3 Operations: Functional Perspectives," at [<http://www.jcs.mil/j3>].

⁸³ Gerry J. Gilmore, "Secretary Rumsfeld Uses 'Flying Pentagon' to Communicate During Trips," *US Fed News*, Aug. 1, 2005.

shortfalls in response plans that count on system availability. Tying these systems to other agency functions, such as for FEMA, adds to the organizations that have equities in the continued viability of a given system, perhaps even after a new system has superseded the older system's military utility, or after the military deems the capability no longer to be required. This could force costs upon the military to sustain systems that are no longer desired. Employing these platforms in secondary roles also places added burdens on their military operators. Training for, or performing secondary roles decreases the time available to ensure readiness for primary missions. This burden increases if manpower pools shrink.

Nuclear Command and Control System Modernization

What Are Potential Nuclear Command and Control System Requirements?

Given the combination of demands on the nuclear command and control system from the changing nature of the threat and the recommendations of the Nuclear Posture Review, what requirements might be considered for today's systems? In 2001, the DOD chartered a committee to conduct an "End-to-End Review of the U.S. Nuclear Command and Control System." Former National Security Advisor Brent Scowcroft chaired the commission, which was tasked with examining the architecture from "national command authority to individual weapons," balancing "facilitating authorized use and preventing unauthorized use," and considering new technology and potential threats.⁸⁴ Although the findings of this commission have been closely held, it is possible to discuss some general issues.

One of the review's findings regards survivability. Many of the NC2 systems designed during the Cold War incorporate varying degrees of hardening against weapon effects. However, that hardening can degrade without periodic maintenance and operators' strict adherence to hardness procedures. The End-to-End Review claimed that the maintenance and procedural discipline for system hardness may have eroded since the fall of the Berlin Wall.⁸⁵

A second report finding is related to the first. The DOD report advocated shifting NC2 systems life cycle management to operators from the acquisition community. For example, in the case of Air Force aircraft, a single office oversees an aircraft program through request for proposals, acquisition, fielding, periodic upgrades, and final retirement. That office includes operators who work with logistics and acquisitions experts. The End-to-End Review proposed the same model

⁸⁴ "Establishment of the Federal Advisory Committee for the End-to-End Review of the U.S. Nuclear command and Control System (NCCS)," *Federal Register* 66, no., 44, (Mar. 6, 2001), p. 13508. "News Briefs: Nuclear Command and Control Review Initiated," *Arms Control Today*, (April 2004) at [http://www.amrscontrol.org/act/2001_04].

⁸⁵ Interview with Air Force Officer on the Nuclear Command and Control System Support Staff, conducted Dec. 7, 2005.

for NC2 systems. Operator requirements for new capabilities are often not supported in the new systems or modifications purchased by the acquisition community. This problem is compounded by the multiple agencies with interest or involvement in NC2 systems.⁸⁶

However, relying solely on operator-generated requirements to guide acquisition programs may also be problematic. Sometimes these requirements are unrealistic. They can exceed the state of the art that is achievable within a specific program budget or time line. As a corollary, these requirements may be achievable, but not at a cost congruent with other competing military needs. Additionally, the focus on technical capability sometimes ignores total costs of sustainment and operation over a system's lifetime.⁸⁷ The debate regarding the interaction between meeting operator needs and managing acquisition programs economically is ongoing.

A third concern is the decline in the number of people with NC2 expertise. Since the end of the Cold War, as nuclear forces have drawn down, the number of people in these skill sets has declined. Further, the prestige of being associated with the nuclear mission has also decreased. As the military services reduced manpower, many people with nuclear operations expertise were required to master multiple additional specialties, so positions associated with nuclear operations became a "revolving door." As a consequence, the services have experienced a "brain drain" of people with expertise in these "zero defects" disciplines. This results in "on-the-job" learning in key NC2 positions that require a "person-in-the-loop." Such a lack of depth could hinder desired responses during crises.⁸⁸

In addition to threats from potential adversaries, the legacy NC2 architecture may be challenged by the Defense Department's drive toward military transformation. U.S. Strategic Command is moving with the rest of the defense community toward more network oriented, distributed operations. In 2004, USSTRATCOM established several subordinate functional component commands dedicated to specific mission aspects. Global strike, space operations, missile defense, and information operations were the first functional components activated, recently followed by a command for combating WMD. These multi-service organizations are also geographically separated. They are the basis for decentralization of activity away from USSTRATCOM headquarters. These

⁸⁶ Ibid.

⁸⁷ United States General Accounting Office, "Best Practices: Better Matching of Needs and Resources Will Lead to Better Weapon System Outcomes," Mar. 2001; United States General Accounting Office, "Best Practices: Setting Requirements Differently Could Reduce Weapon Systems' Total Ownership Costs," Feb. 2003; Catherine MacRae, "Coyle Attributes Program Test Failures to Services' Lack of Realism," *Inside the Pentagon*, Apr. 5, 2001.

⁸⁸ Interview with Air Force Officer on the Nuclear Command and Control System Support Staff, conducted Dec. 7, 2005.

organizations are part of a command move to a more horizontal and collaborative process and away from the strict vertical and hierarchical methods of the past.⁸⁹

The 2006 Quadrennial Defense Review proposes some significant changes in NC2 programs that facilitate USSTRATCOM's move to distributed command and control capabilities as embodied in the Joint Functional Component Commands. The QDR recommends retiring expensive, legacy mobile platforms. One proposal would retire all of the E-4B NAOC aircraft and procure C-32 aircraft (a modified Boeing 757 aircraft) as replacements. The NAOC capability to support FEMA would apparently move to the E-6B aircraft, which would require additional communications upgrades. The USSTRATCOM MCCC would also be retired in FY2007, with the view that the new distributed architecture fulfills the survivability requirements that the MCCC helped to fulfill. The QDR emphasizes that these new command and control capabilities must be survivable in the event of WMD, electronic, or cyber-warfare attacks. DOD also proposes that these systems be tailored more specifically to include the mission of WMD elimination.⁹⁰

It will likely take a robust communications infrastructure to integrate the activities of these new organizations. USSTRATCOM is studying implementation of an internet protocol (IP)-based communications architecture to link these distributed locations.⁹¹ However, using an IP network in this type of application has not yet been proven to provide the high degree of assurance of rapid message transmission needed for nuclear command and control.⁹² In particular, high priority nuclear force direction messages must have priority over other traffic, and the nature of IP routing may not support this requirement.

Notably, the communications bandwidth which would be required for this expanded infrastructure is already at a premium across the military. During the previous ten years, DOD experienced a 500% growth in communications capacity

⁸⁹ Elaine M. Grossman, "DOD to Create Multiservice Components Under Strategic Command," *Inside the Pentagon*, September 16, 2004; "Functional Components," at [<http://www.stratcom.mil>]; Jeremy Singer, "Coordinating Strategic Command," *Space News*, Jan. 23, 2006.

⁹⁰ Department of Defense, "Quadrennial Defense Review Report," Feb. 6, 2006, pp. 32, 35, 50 at [<http://www.defenselink.mil/pubs>]; Jason Sherman, "Draft Quadrennial Defense Review Report Focuses on 'Long War,' New Capabilities," *Inside Defense*, Jan. 22, 2006; Jason Sherman, "2005 Quadrennial Defense Review the First to Adjust Strategic Forces," *Inside the Pentagon*, Jan. 26, 2006.

⁹¹ Transmission Control Protocol/Internet Protocol (TCP/IP) communications (voice or data) uses router equipment to divide messages up into "packets" which then independently travel multiple or varying routes through the redundant and cross connected network, to be reassembled by the router at the receiving end. Major advantages include the built in redundancy of the system, which when combined with error checking and correction protocols ensures the messages arrive at their destination. For more information, see CRS Report RL30987, *Spinning the Web: The Internet's History and Structure*, by Rita Tehan.

⁹² Interview with Air Force Officer on the Nuclear Command and Control System Support Staff, conducted Dec. 7, 2005.

requirements. The need for satellite communications links has grown 1000% since September 11, 2001. Within the next 10 years, that need may grow another 2500%.⁹³ The nuclear community will be competing with the rest of the high operations tempo military for these command and control links, for which a dispersed operations concept increases demand.

It will also be necessary to coordinate the integration of new centers and systems, such as those for missile defense or conventional strike, into the NC2 network. It is yet to be determined what level of certification and configuration management will be required. Should it be equal to that for existing NC2 systems, or is it sufficient to apply a standard that is less demanding but that fosters more flexibility to modernize? Who will ensure compatibility? Reconciliation of procedures and protocols in a distributed architecture also will be key to avoiding chaos. As more agencies gain access to equivalent data, the chain of command and identification of the level empowered to direct action or forces must be clearly defined and enforced.⁹⁴

What Procurement Programs Are in Progress?

Procurement programs tied to the nuclear command and control system affecting nearly every major element of the NC2 architecture appeared in DOD's FY2006 and FY2007 budget requests. Most of these are upgrades and enhancements of existing systems, rather than the procurement of new systems.

Minimum Essential Emergency Communications Network (MEECN).

The MEECN comprises the physical communication links between the President and fielded nuclear forces. DOD sought \$20.5 million for procurement and \$57.3 million in research and development (R&D) funds for FY2006 to upgrade various aspects of this network.⁹⁵ Congress fully authorized these amounts in the FY2006 Defense Authorization Act (PL 109-163). The FY2006 Defense Appropriations Act (PL 109-148) funded \$49 million for R&D but did not provide any money for

⁹³ James Schultz, "Communications Face-Off: Boeing, Lockheed Martin Vie for Major Satellite Program to Deliver Broadband to the Front Lines," *Washington Technology*, Nov. 22, 2004.

⁹⁴ Interview with Air Force Officer on the Nuclear Command and Control System Support Staff, conducted Dec. 7, 2005.

⁹⁵ "Exhibit R-2, RDT&E Budget Item Justification, PE0303131F, Minimum Essential Emergency Communications Network (MEECN)," February 2005, at [<http://www.dtic.mil/descriptivesum>]; Office of the Under Secretary of Defense (Comptroller), "Procurement Programs (P-1), Department of Defense Budget, Fiscal Year 2006," February 2005, at [<http://www.dtic.mil/comptroller/defbudget/fy2006>]; Office of the Under Secretary of Defense (Comptroller), "RDT&E Programs (R-1), Department of Defense Budget, Fiscal Year 2006," February 2005, at [<http://www.dtic.mil/comptroller/defbudget/fy2006>]. "Rockwell Collins Awarded Phase 2 of U.S. Air Force Gems Program," *Space Daily*, July 13, 2005; John Keller, "Rockwell Collins to Tackle Survivable Battle Management Communications for U.S. Nuclear Forces," *Military & Aerospace Electronics*, Aug. 1, 2005.

procurement.⁹⁶ For the FY2007 budget request, DOD is seeking \$3.4 million for procurement and \$64.1 million for R&D.⁹⁷ Modernization efforts within MEECN include:

- High data rate terminals (the Modified Miniature Receive Terminal or MMRT) for the E-4B and E-6B command and control aircraft, replacing legacy 1960s systems.
- Upgrades of the secure computer terminals (the Defense Injection Reception Emergency Action Message Command and Control Terminal or DIRECT) that nuclear command centers use to transmit Presidential emergency action messages (EAMs) to the forces.
- Improvements of the Very Low Frequency/Low Frequency (VLF/LF) and Extremely High Frequency (EHF) satellite communications (MILSTAR) to the Minuteman ICBM Launch Control Centers (LCCs) across the upper Midwest United States (the Minuteman MEECN Program or MMP).
- Installation of VLF and EHF communications for bomber and tanker forces (the Ground Element MEECN System or GEMS), replacing legacy systems that DOD contends have become unsustainable.

National Military Command System (NMCS). Press reports hint that Secretary of Defense Donald Rumsfeld has become personally involved in directing upgrades to the NMCC and its alternate at Site-R. Secretary Rumsfeld has directed that the uniformed services consolidate their separate command centers as part of this effort. This move would culminate in two new centers in the Pentagon: a Unified Command Center and a Resources and Situation Awareness Center, which between them would combine the functions of the NMCC and the military services' operations centers. These new centers would be focused on tracking crises around the world and on facilitating the Secretary's and Chairman's requirements to provide military advice to the President. These new facilities would be more survivable against nuclear, chemical, biological, and radiological threats and more secure against intelligence gathering. This effort would be timed to coincide with ongoing Pentagon renovation work, and would free up space in that crowded facility. The Defense Department claims the consolidation of functions will create efficiencies that

⁹⁶ United States Congress, House of Representatives, "Conference Report to Accompany H.R. 1815, National Defense Authorization Act for Fiscal Year 2006," (H.Rept. 109-360), Dec. 18, 2005, pp. 512, 586; United States Congress, House of Representatives, "Conference Report to Accompany H.R. 2863, Making Appropriations for the Department of Defense for the Fiscal Year Ending Sep. 30, 2006, and for Other Purposes," (H.Rept. 109-359), Dec. 18, 2005, p. 407.

⁹⁷ Office of the Under Secretary of Defense (Comptroller), "Procurement Programs (P-1), Department of Defense Budget, Fiscal Year 2007," February 2007 at [<http://www.dtic.mil/comptroller/defbudget/fy2007>]; Office of the Under Secretary of Defense (Comptroller), "RDT&E Programs (R-1), Department of Defense Budget, Fiscal Year 2007," February 2007, at [<http://www.dtic.mil/comptroller/defbudget/fy2007>].

allow a manpower reduction as well. The Defense Department requested just over \$0.6 million to fund planning, system engineering, and configuration management for this effort in FY2006, with roughly \$0.5 million needed each year through 2011.⁹⁸ Congress authorized the full amount of DOD's request for FY2006. The FY2006 appropriation supported the full amount of the DOD request.⁹⁹ DOD is seeking \$0.7 million for FY2007.¹⁰⁰

Additionally, DOD requested \$85.2 million in FY2006 to develop a future system for missile warning and attack assessment (TW/AA) that would upgrade capabilities at NORAD in Cheyenne Mountain and at the USSTRATCOM Global Operations Center in Omaha.¹⁰¹ These systems feed information to decision makers at the NMCC. Congress funded the full DOD request in the FY2006 Authorization. Congress provided \$74.2 million of the DOD budget request in the FY2006 appropriations legislation language.¹⁰² For FY2007, DOD is asking for \$50.9 million for further TW/AA research and development.¹⁰³

Airborne Command and Control. The Defense Department is also requesting funds to enhance both of its airborne nuclear command and control platforms, the E-4B NAOC and the E-6B ABNCP (Airborne Command Post). The Air Force requested \$85.3 million in procurement funds and \$18.9 million in research, development, test, and evaluation (RDT&E) funds for the NAOC modifications in FY2006.¹⁰⁴ Congress authorized these full amounts in the FY2006 National Defense Authorization Act. The FY2006 appropriations bill funded the full amount of the DOD request as well.¹⁰⁵ DOD's FY2007 budget request is asking for \$5.6 million for E-4B modifications procurement and only \$283 thousand for

⁹⁸ "Exhibit R-2, RDT&E Budget Item Justification, PE0302016K, National Military Command System (NMCS)," February 2005, at [<http://www.dtic.mil/descriptivesum>]; Amy Butler, "Rumsfeld's New War Rooms: Overhauling Command and Control at Pentagon," *C4I News*, Dec. 11, 2003; Amy Butler, "Rumsfeld Merges Service Command Centers Into Joint Nerve Center at Pentagon," *Defense Daily*, Oct. 23, 2003.

⁹⁹ H.Rept. 109-360, p. 604; H.Rept. 109-359, p. 430.

¹⁰⁰ Office of the Under Secretary of Defense (Comptroller), "RDT&E Programs (R-1), Department of Defense Budget, Fiscal Year 2007," February 2007 at [<http://www.dtic.mil/comptroller/defbudget/fy2007>].

¹⁰¹ "Exhibit R-2, RDT&E Budget Item Justification, PE0305906F, NCMC-TW/AA System," February 2005, at [<http://www.dtic.mil/descriptivesum>]; "US DOD: Contracts, Air Force," *M2 Presswire*, Oct. 10, 2005.

¹⁰² H.Rept. 109-360, p. 587; H.Rept. 109-359, p. 408.

¹⁰³ Office of the Under Secretary of Defense (Comptroller), "RDT&E Programs (R-1), Department of Defense Budget, Fiscal Year 2007," February 2007, at [<http://www.dtic.mil/comptroller/defbudget/fy2007>].

¹⁰⁴ Office of the Under Secretary of Defense (Comptroller), "Procurement Programs (P-1): Department of Defense Budget, Fiscal Year 2006," February 2005, at [<http://www.dtic.mil/comptroller/defbudget/fy2006>]; "Exhibit R-2, RDT&E Budget Item Justification, PE0302015F, E-4B National Airborne Operations Center," February 2005, at [<http://www.dtic.mil/descriptivesum>].

¹⁰⁵ H.Rept. 109-360, pp. 500, 586; H.Rept. 109-359, pp. 310, 407.

R&D.¹⁰⁶ These requests cover improvements to aircraft structures, propulsion, fuel systems, environmental controls, electrical generation, and flight safety. Specific aspects include:

- Updates to replace the outdated analog audio distribution and recording equipment with digital equipment.
- Development of an “office in the sky” for senior leaders that will include secure and non-secure voice, video, and data services.
- Improvements to the aircraft’s on-board local area network (LAN).
- Transition from analog to digital of the Ultra High Frequency (UHF) radio link between the aircraft and the ground entry points for telephone communication.
- Upgrades of the aircraft’s precision navigation capability and integration with Global Air Traffic systems.

Proposed upgrades for the E-6B, a fleet of modified Boeing 707s operated by the Navy for USSTRATCOM, would also affect both aircraft systems and mission systems for that platform. These modifications, as requested for FY2006, would cost \$11.2 million for procurement and \$31.4 million for RDT&E. The aircraft systems modifications include improved cockpit displays, enhanced navigation and air traffic control integration systems, and a service life assessment of the airframe, which the Navy maintains has exceeded its service life based on weight and usage. Mission system improvements would replace legacy computers, communication switches, and UHF communications equipment that the Navy argues will be unsupportable after 2010.¹⁰⁷ Congress fully supported the Navy’s request for the E-6 in the FY2006 Defense Authorization Act. Congress matched the DOD request for procurement and funded R & D at \$35.5 million, higher than the DOD budget figure, in the FY2006 appropriation.¹⁰⁸ For FY2007, the Defense Department is requesting \$99.2 million for E-6 modifications procurement and \$37.4 million for research and development.¹⁰⁹

¹⁰⁶ Office of the Under Secretary of Defense (Comptroller), “Procurement Programs (P-1), Department of Defense Budget, Fiscal Year 2007,” February 2007 at [<http://www.dtic.mil/comptroller/defbudget/fy2007>]; Office of the Under Secretary of Defense (Comptroller), “RDT&E Programs (R-1), Department of Defense Budget, Fiscal Year 2007,” February 2007, at [<http://www.dtic.mil/comptroller/defbudget/fy2007>].

¹⁰⁷ Office of the Under Secretary of Defense (Comptroller), “Procurement Programs (P-1): Department of Defense Budget, Fiscal Year 2006,” February 2005, at [<http://www.dtic.mil/comptroller/defbudget/fy2006>]; “Exhibit R-2, RDT&E Budget Item Justification, PE0101402N, Navy Strategic Communications,” February 2005, at [<http://www.dtic.mil/descriptivesum>]; Kenneth B. Sherman, “US Navy E-6B Mercury Upgraded,” *Journal of Electronic Defense* 27, no. 6 (June 2004): p. 17.

¹⁰⁸ H.Rept. 109-360, pp. 468, 571; H.Rept. 109-359, pp. 276, 381.

¹⁰⁹ Office of the Under Secretary of Defense (Comptroller), “Procurement Programs (P-1), Department of Defense Budget, Fiscal Year 2007,” February 2007 at (continued...)

Satellite Communications. The most visible and perhaps most controversial aspect of nuclear command and control modernization programs is acquisition of the Advanced EHF (AEHF) communications satellite. AEHF will replenish the aging MILSTAR EHF satellite constellation as those spacecraft reach the end of their service life. The MILSTAR satellite constellation, used both for strategic nuclear command and control and for tactical warfighters, currently has five satellites, with the first having been launched in 1994. The AEHF system would provide survivable, secure, anti-jam communications capabilities at higher data rates and capacities than the existing MILSTAR constellation. Lockheed Martin and Northrop-Grumman are the satellite integration and communications payload contractors for the AEHF program. The Air Force requested \$665.3 million in RDT&E and \$529 million for procurement in the FY2006 budget.¹¹⁰ In the FY2006 Defense Authorization, Congress fully funded the Air Force budget request for AEHF. In the FY2006 Defense appropriations legislation, Congress also matched the DOD budget request for AEHF.¹¹¹ In its FY2007 budget proposal, DOD is not requesting any procurement funds, as it has already purchased the three satellites proposed for the AEHF constellation. However, the Air Force is still seeking \$633 million for FY2007 for AEHF R&D.¹¹²

Unfortunately, like many Air Force satellite acquisition programs, AEHF has suffered from schedule delays and cost overruns.¹¹³ Technical shortfalls in the development of the communications encryption equipment, which the National Security Agency (NSA) must deliver as Government Furnished Equipment (GFE) to the satellite contractor, are a major cause of the schedule slips. The first AEHF launch is now targeted for 2008, a substantial delay from an originally planned late 2004 launch. Overall, the entire AEHF program is now estimated to cost over \$7

¹⁰⁹ (...continued)

[<http://www.dtic.mil/comptroller/defbudget/fy2007>]; Office of the Under Secretary of Defense (Comptroller), "RDT&E Programs (R-1), Department of Defense Budget, Fiscal Year 2007," February 2007, at [<http://www.dtic.mil/comptroller/defbudget/fy2007>].

¹¹⁰ Office of the Under Secretary of Defense (Comptroller), "Procurement Programs (P-1): Department of Defense Budget, Fiscal Year 2006," February 2005, at [<http://www.dtic.mil/comptroller/defbudget/fy2006>]; "Exhibit R-2, RDT&E Budget Item Justification, PE0603430F, Advanced EHF MILSATCOM (Space)," February 2005, at [<http://www.dtic.mil/descriptivesum>]; "U.S. Air Force Fact Sheet: MILSTAR Satellite Communications System," October 2005, at [<http://www.af.mil/factsheets>].

¹¹¹ H.Rept. 109-360, pp. 508, 580; H.Rept. 109-359, pp. 316, 403.

¹¹² Office of the Under Secretary of Defense (Comptroller), "RDT&E Programs (R-1), Department of Defense Budget, Fiscal Year 2007," February 2007, at [<http://www.dtic.mil/comptroller/defbudget/fy2007>].

¹¹³ For an overview that includes acquisition issues across DOD space programs, see CRS Issue Brief IB92011, *U.S. Space Programs: Civilian, Military, and Commercial*, by Marcia S. Smith.

billion, a 20% cost growth that forced a Nunn-McCurdy notification¹¹⁴ from the Air Force to Congress.¹¹⁵

AEHF is hoped to serve as a bridge between MILSTAR and the Transformational Satellite (TSAT) program, which is expected to incorporate laser communication cross-links between satellites and Internet routing capability. This program would first launch in 2013, which represents a two year slip from Air Force plans due to budget cuts and immature technologies underlying its advanced capabilities. Some are proposing that some of these technologies be tested on AEHF satellites first, to reduce risk on the TSAT program.¹¹⁶ For FY2006, Congress considered, but did not direct the Air Force to buy an additional AEHF satellite to hedge against further TSAT program delays. Congress did direct the Air Force to prepare an “analysis of alternatives” report examining the possibility of acquiring additional AEHF satellites and modifying the Wideband Gapfiller satellites to bridge the gap in the event of further TSAT delays.¹¹⁷ In the FY2006 Defense Appropriations Act, Congress reduced the funding for TSAT by \$400 million and directed the Air Force to focus on technology development, rather than transitioning to an acquisition program. Congress approved \$436-plus million, but reserved \$120 million for either purchase of a fourth AEHF satellite or continued systems development for TSAT, based on the outcome of the analysis of alternatives study.¹¹⁸

Issues for Congress

The increased demands on the nuclear command and control system driven by the 2001 NPR and subsequent DOD policy will pose challenges for the NCCS in the future. The system’s legacy Cold War architecture will compete for budgetary priority against conventional systems that may seem to some to be more immediately relevant to today’s threat environment and the war on terror. Whether the threat that should shape the NCCS comes from China (or some other nuclear armed peer competitor), rogue states, or terrorism, some suggest there is continued value in this robust system. Others may argue that the system’s continued value lies in its ability to fulfill missions often viewed as subsidiary or even beyond the traditional DOD purview. However, the key functions performed by the NCCS will likely remain requirements as long as the United States maintains a nuclear deterrent.

The DOD continues to pursue modernization initiatives across the system, but in a budget constrained environment these activities will come under competing

¹¹⁴ The Nunn-McCurdy Amendment to the Department of Defense Authorization Act for FY 1982 (PL 97-86) requires the military service secretaries to notify Congress if a program experiences more than 15% cost growth.

¹¹⁵ Amy Butler, “Tug of War,” *Aviation Week & Space Technology*, Mar. 21, 2005; Jeremy Singer, “Advance EHF Woes Prompt Changes to Air Force,” *C4ISR*, Oct. 14, 2005.

¹¹⁶ Libby John, “Senate Committee Slashed Funds for Major Air Force Space Programs,” *Inside the Air Force*, Sep. 30, 2005.

¹¹⁷ H.Rept. 109-360, pp. 275-276, 590-591.

¹¹⁸ H.Rept. 109-359, pp. 422.

pressure from more conventional missions. Through the FY2007 budget request, the Defense Department has continued to focus on evolutionary upgrades of the Cold War NCCS architecture. However, USSTRATCOM's activation of functional component commands, and some recommendations in the 2006 QDR could signal a change in direction. Questions Congress may confront include:

What is the nature of the threat? Some schools of thought contend that China is rising to be the US's next military peer competitor, while others contend that China is growing to be a partner in the world community. The extent of the threat from North Korea, Iran, or terrorist organizations, whether from a nuclear strike or from an EMP attack are also subject to debate. The capabilities posed by these potential threats may present a "worst case" against which to configure the nuclear command and control system.

What is the role of nuclear weapons in U.S. strategy and how might that role affect command and control? There is competition between those who believe the role of nuclear weapons should be reduced to give non-proliferation efforts credibility, and those who want to increase their utility to confront proliferators. The role of the weapons will shape the command and control system to support them.

What is the appropriate architecture for the NCCS? Is the current, centralized, linear system developed during the Cold War still the right approach to ensuring Presidential positive control and minimizing command and control confusion? Revisions to the NCCS architecture may need to incorporate the additional 2001 NPR-driven command and control requirements for non-nuclear offensive responses and active missile defense. A debate and possibly legislation regarding release authorities may need to precede such architectural decisions. Perhaps a more dispersed approach, such as USSTRATCOM now proposes, may be a better fit for the current threat environment. That approach might also convey manpower and budget economies in the long run. However, applying a distributed, network style approach to nuclear command and control has not yet been tested or proven.

What level of investment in modernization or new procurement is needed or justified? All of the NCCS modernization or procurement initiatives discussed above are projected to continue for years into the future. The continued implementation of the 2001 NPR and the findings of the 2006 QDR may adjust or add to those requirements. The retirement of the E-4B NAOC and MCCC may offer some opportunities for short term savings. As all of the services look to recapitalize equipment after the wear and tear from duty in Iraq, the NCCS will be competing against immediate day-to-day services' needs. Are the existing NCCS platforms adequate to requirements? Are they still needed?

What value are the secondary uses of the NCCS? The NCCS represents a national asset built up over decades. Can the taxpayer get added value by employing these capabilities for ancillary functions? As homeland security missions and domestic disaster response receive greater government attention, some platforms that already provide support in these areas have the potential for even greater utility. Do those functions justify continued investment if their primary

mission requirements are superseded? If so, should the procurement and operation of these systems be transferred to civilian agencies?

Appendix A: Nuclear Command and Control Platforms and Programs

Fixed Locations	Mobile Systems	Link Capabilities
National Military Command Center (NMCC) – Pentagon	E-4B National Airborne Operations Center (NAOC)	Minuteman Minimum Essential Emergency Communications Network Program (MMP)
Site-R – Fort Ritche, MD	E-6B Airborne Command Post (ABNCP)	Ground Element Minimum Essential Emergency Communications Network System (GEMS)
USSTRATCOM Global Operations Center (GOC) – Offutt AFB, NE	Mobile Consolidated Command Centers (MCCC)	Military Strategic and Tactical Relay (MILSTAR) Satellite Communications System
North American Aerospace Defense Command (NORAD) Cheyenne Mountain Complex – Colorado Springs, CO		Advanced Extremely High Frequency Satellite (AEHF)
		Transformational Communications Satellite (TSAT)

Appendix B: Acronyms

ABNCP	Airborne Command Post
AEAO	Airborne Emergency Actions Officer
AEHF	Advanced Extremely High Frequency satellite
AFSAT	Air Force Satellite communications payload
ALCS	Airborne Launch and Control System
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CAT	Crisis Action Team
CJCS	Chairman of the Joint Chiefs of Staff
COG	Continuity of Government
COOP	Continuity of Operations
DIRECT	Defense Injection Reception Emergency action message Command and control Terminal
DSCS	Defense Satellite Communications System
DSP	Defense Support Program satellite
EAM	Emergency Action Message
EHF	Extremely High Frequency
EMP	Electromagnetic Pulse
FLTSAT	Fleet Satellite communications
GEMS	Ground Element MEECN System
GEP	communications Ground Entry Point
GOC	Global Operations Center
IAEA	International Atomic Energy Agency
ICBM	Intercontinental Ballistic Missile
LCC	Launch Control Center
MCCC	Mobile Consolidated Command Center
MEECN	Minimum Essential Emergency Communications Network

MILSTAR	Military Strategic and Tactical Relay satellite
MMP	Minuteman MEECN Program
MMRT	Modified Miniature Receive Terminal
NAOC	National Airborne Operations Center
NC2	Nuclear Command and Control
NCCS	Nuclear Command and Control System
NMCC	National Military Command Center
NMCS	National Military Command System
NORAD	North American Aerospace Defense Command
NPR	Nuclear Posture Review
QDR	Quadrennial Defense Review
SCT	Single Channel Transponder
SLBM	Submarine Launched Ballistic Missile
TACAMO	Take Charge and Move Out aircraft
TSAT	Transformational communications Satellite
TW/AA	Tactical Warning and Attack Assessment
UHF	Ultra High Frequency
USSTRATCOM	United States Strategic Command
VLF/LF	Very Low Frequency/Low Frequency
WMD	Weapons of Mass Destruction