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Abstract

This paper provides a foundation for a number of related issues regarding present and future Nuclear Command, Control and Communications (NC3) capabilities. Specifically, it addresses the continuing decline in the current nuclear command and control capability and the need for sustainment of current capabilities as we study how the Nuclear Command and Control System (NCCS) will migrate into the evolving net-centric environment. Other issues include the evolution of command, warning and transport, i.e., emergency action message dissemination, and capabilities to support new concepts of operation such as distributed operations, and finally, ensuring that evolving NC3 capabilities provide the core protected, high assurance, robust strategic C2 capability for the New Triad and a national command capability.

Nuclear C3 and Migration to a New “Strategic” C3 Architecture

The United States Nuclear Command and Control System (NCCS) and the traditional “nuclear triad” of land-based ballistic missiles, long-range bombers and ballistic missile submarines has been a key element of the U.S. defense posture for decades. Today’s strategic environment, however, is far different than the Cold War environment that our nuclear C3 system and the traditional nuclear triad were built to address. In response to this new strategic environment, the U.S. has envisioned a “New Triad” comprised of offensive strike systems (both nuclear and non-nuclear; both kinetic and non-kinetic), active and passive defenses, and a revitalized defense infrastructure to meet emerging threats. The New Triad concept seeks the twin aims of creating a more efficient nuclear force by reducing the total number of nuclear weapons, while also lessening U.S. reliance on nuclear weapons to provide strategic deterrence by bringing non-nuclear strike systems into the range of options for rapid military responses. This broader range of strike options enables the Department of Defense to fulfill its stated goals of using military power to assure our allies and dissuade, deter, and defeat our enemies.¹

The New Triad concept requires that the three elements of the New Triad be supported by enhanced Command and Control capabilities and intelligence systems. New Triad options require Command and Control capabilities that support more complex and collaborative planning, targeting, and decision-making than required by the traditional nuclear employment options. The New Triad concept, therefore, is driving a new vision of how we think about strategic C2. To fully support this New Triad, the U.S. must ensure that the current nuclear C3 system transforms into a broader, more flexible, and more robust Strategic C3 system which will ensure our ability to operate in today’s more complex and uncertain strategic environment. Finally, it is vital that the migration of nuclear C3 capabilities to meet the demands of the New Triad is planned in the context of future nuclear/New Triad strategic C3 capabilities becoming an essential component of a broader national command capability.

This paper provides a foundation for a number of related issues regarding present and future U.S. nuclear C3 capabilities. Specifically, it addresses the need to ensure that evolving U.S. strategic C3 capabilities can support a broader range of C2 requirements while also providing the high assurance, robust, and enduring C2 capability required by U.S. national

policy; the need to study how this system will migrate into the evolving net-centric environment; the evolution of command, warning and transport (emergency action message dissemination); and new concepts of operation such as distributed operations. Finally, this paper proposes a strategy for migrating our existing nuclear C3 capabilities into a new “Strategic” C3 architecture.

Underlying any discussion of the current nuclear C3 architecture are several assumptions and factors that must be addressed to form an approach to evolving the current capability into a future nuclear C3 capability. First, U.S. national policy regarding strict assurances for nuclear command and control is unlikely to change. Assured control over nuclear weapons and the ability to order measured and appropriate responses to any threat – to include non-nuclear responses to strategic problems – is a basic requirement. Second, we assume that national leadership is unlikely to accept the lack of a “hedge” against all ranges of nuclear attack against the U.S., to include a large scale or surprise nuclear attack. Current U.S. policies require an ability to respond quickly to a major strike on the U.S.² Our current nuclear C3 capability is a direct result of these strict policies and requirements.

Today’s U.S. Nuclear C3 Architecture

The present U.S. nuclear C3 architecture can be described in three layers. The first layer is the current day-to-day/crisis architecture, which can also be described as the “thick-line” system. This architecture supports current U.S. national policy in that it: a) responds under all conditions in both peacetime and war to provide the means to exercise positive control and direction by the President and the SECDEF; b) provides secure, reliable, immediate and continuous access to the President; and c) provides robust C2 over nuclear and supporting government operations. The second and third layers of the NCCS architecture provide the survivable and enduring architectures known as the “thin-line.” The “thin-line” responds to policy that requires assured, unbroken, redundant, survivable, and enduring connectivity to and among the President, SECDEF, Chairman of the Joint Chiefs of Staff (CJCS) and designated Combatant Commanders (COCOMs) through all threat environments to perform all necessary command and control functions. Recently, the report of the Congressionally mandated “Commission to Assess the Threat to the U.S. from Electromagnetic Pulse Attack” (the EMP

Commission) noted that the Department of Defense (DoD) “must continue to pursue the strategy for strategic systems to ensure that weapons delivery systems of the New Triad are EMP survivable, and that there is, at a minimum, a survivable ‘thin-line’ of command and control capability to detect threats and direct the delivery systems.”³ This underscores the need to ensure the survivable “thin-line” C3 architecture is sustained and supported during any migration effort to ensure it can provide its intended capability.

Migration to a Future “Strategic” C3 Architecture

The ability to meet future challenges is based on “decision superiority”: the ability to detect, understand, decide, and act faster, and with better information, than any adversary in any situation. Decision superiority requires possessing the right information at the right time to create a superior understanding and visualization of the “battlespace.” The result of this activity is effects-based operations appropriate to the situation, which can best be achieved by adaptive organizations that employ tailored, capabilities-based force packages. These force packages are as important in responding to strategic (including nuclear) operations as they are to tactical operations.

As stated above, the Nuclear Posture Review (NPR) and the New Triad concept require the availability of a broad range of offensive strike options (both nuclear and non-nuclear; both kinetic and non-kinetic) to national level decision makers. However, nuclear strike options and non-nuclear strike options (known today as “Global Strike” options) currently are served by different command and control systems. In order to realize the vision of the NPR and the New Triad, the lines between what we now know of as Global C2 and Nuclear C2 must largely disappear, until the terms New Triad C2, Global C2, Strategic C2, and Nuclear C2 begin to mean the same thing and describe the same scope of activity. This coupling of capabilities will also require shifts and realignments in major areas of responsibility within the DoD. For example, responsibility for Global C2 is now assigned to USSTRATCOM in the Unified Command Plan (UCP), while responsibility for Nuclear C2 resides in the Office of the Secretary of Defense (OSD).

Predominately network-centric, or net-centric solutions, such as those already identified by the larger C2 community, appear to be the most operationally effective means to satisfy most of the needs. The network-enabled force enables accurate and timely information, which is the key element of decision superiority. The networked force is better able to integrate intelligence, surveillance, and reconnaissance (ISR) information and total asset visibility, which allows commanders to employ the right capabilities at the right time in a distributed operations environment.⁴

The migration of the critical nuclear C3 capabilities into the future Global Information Grid (GIG) net-centric enterprise environment is expected to provide equal or better nuclear command and control capabilities under virtually all conditions. In light of the foregoing discussion, the steps that determine how to migrate nuclear C3 capabilities into the future net-centric GIG are the most critical elements of building a future C3 capability that meets the full range of strategic requirements. An important first step is to develop clear performance standards for the new strategic environment described by the Nuclear Posture Review as it relates to the New Triad. These performance standards and the accompanying architecture must address the following capabilities:

- Integrated attack warning and effects assessment against all forms of attack (terrorist, conventional, nuclear, cyber, etc.).
- Collaboration/conferencing between senior leaders (military and civilian) necessary for decision-making during any crisis.
- Timely emergency action message transmission and processing.
- Assured connectivity and availability for the President and senior leaders to perform essential C2 functions in any crisis. The President must always have the option for an appropriate and deliberate response without being forced into a decision based on shortcomings in C3.
- Timely access, to include content discovery and delivery, by strategic C2 users to protected information and services.
- A user-definable interface.

- Redundant and distributed C2 functionality for assured reliability under any level of attack.
- An essential point is that our C2 capability must ensure that no attack can jeopardize the U.S. ability to deter or respond to an attack of any type or scale.

The migration of nuclear C3 capabilities to a future strategic C3 architecture is best addressed within three contexts/constructs: command, warning and assessment, and assured message delivery. We must recognize that our current nuclear command and control capability does not sufficiently support the requirements for robust planning, collaboration, and execution options that the broader range of New Triad employment demands. However, it is critical that we sustain our legacy nuclear command and control system, as these legacy networks will remain necessary in the near to mid-term to meet certification requirements and to provide assured and accurate message delivery during stressed conditions or to connect to distant users not connected to the common-user network, particularly for the nuclear scenario. Therefore, one approach in the migration to a future strategic C3 net-centric architecture will be to route data simultaneously to both the developing common-user net-centric environment and into the current point-to-point legacy networks. Once the net-centric environment can demonstrate the capability to meet the stated performance requirements for strategic operations (reliability, robustness, quality of service, survivability and durability) the need for “parallel paths” can be phased out.

In order to assess and predict the survivability and assured communications of nuclear C3 capabilities in a distributed net-centric environment, comprehensive modeling and simulation tools are required that will effectively predict overall performance under the most stressed conditions, as required by current nuclear command and control policy. This would be similar to the validation process that is done for today’s point-to-point communications architecture. Also required is a robust process to verify and validate those predictions.

Geographically Distributed Command Operations

One concept currently being studied for achieving the required command performance is a move from “Dispersal on Warning” to continuously available and functional “Geographically Distributed Operations” which becomes a transformed theory of strategic C3 operations. The

idea behind “Geographically Distributed Operations” is that survivability and endurance can be attained through multiple geographically distributed locations as opposed to today’s approach of mobility based on warning and generation. This concept can include a mix of combatant command centers, alternate locations, and possibly command ships/carriers, etc., linked within the net-centric operational environment. Also required may be mobile platforms within the net-centric environment that can support a decision-maker centric concept of operations by providing the capability for key decision-makers/leaders to remain flexible such that they can perform all necessary roles (political, diplomatic, and military) in a dynamic situation.

Truly distributed operations exist when the functions that contribute to a commander’s situational awareness, decision making and ability to execute occur in a virtual command center, where operators and decision makers are linked via a network instead of being physically collocated, as opposed to replicating complete command centers geographically. This approach is enabled by a networked environment that allows applications, services and data to be distributed throughout the network and accessed from any point by anyone with the proper permissions. A key tenet of this approach is that the distributed functions are performed day-to-day, rather than just during crisis or exercise conditions. This aspect provides the additional benefit of an intrinsic continuity of operations (COOP) capability in that these functions are more likely to be performed well if done daily.

Integrated Tactical Warning and Attack Assessment (ITW/AA)

Future ITW/AA capabilities must support a broad range of strategic operations. An expansion of air and space warning, and theater ballistic and cruise missile warning is required to meet New Triad requirements. In addition, offensive and defensive integration, electronic warfare and information operations (IO)/cyber-attack detection capabilities must be integrated with current ITW/AA systems to produce a complete threat picture. Major issues for the future networked ITW/AA capabilities include: 1) the fusion of warning and attack assessment data while preserving the integrity of the current system that provides highly assured, accurate, time critical data to our decision makers, 2) the integration and sharing of warning and attack assessment data from/with non-DoD agencies, 3) authority over DoD and other government C3

resources within legal and constitutional constraints, and 4) assurance to other countries that our actions do not precipitate unintended consequences.

Possible options for meeting future ITW/AA needs include using the GIG to augment interconnectivity; distributing sensor data processing nodes for survivability; mirroring network services at unhardened and hardened locations for endurability; maintaining diverse communications paths as mitigation against a single type of attack being successful; implementing message quality of service and prioritization across IP networks; maintaining system integrity through a dedicated network for high confidence data; fusing other New Triad warning data at a common location, then pushing data to forward users; and establishing a virtual warning center as a means for users to pull data.

Emergency Action Message (EAM) Delivery

The new strategic C3 architecture must support the dissemination of messages to New Triad forces in the same manner the nuclear EAM delivery system must be capable of satisfying the nuclear C3 requirements in the midst of a range of attacks. “Parallel Path” EAM delivery methodologies are being explored to meet performance requirements under all environments. Under these initiatives, collateral/parallel systems may be required to meet nuclear C3 assurance if net-centric concepts cannot initially meet nuclear requirements. EAM delivery to distant users (e.g. SSBNs) under the proposed geographically distributed command concept may likely present difficult command and control challenges, and may require the sustainment of certain ‘legacy’ communications paths until a viable alternative is available.

The Path Forward

The emergence of the Department’s Global Information Grid (GIG) offers the opportunity for a radical restructuring of our approach to nuclear C3. Dispersed network-centric operations can provide the assurance of the traditional C3 architecture, while increasing reliability, efficiency, and speed of command. The following paragraphs outline a proactive and aggressive approach toward ensuring our present and future nuclear and strategic C3 capabilities

will evolve to support national security strategy and policy in the most effective and efficient manner possible.

The Joint C4ISR Decision Support Center (DSC) is developing a long-range Strategic C2 Capabilities Analysis that will determine future (2012-2015) C3 capabilities needed for the New Triad, to include nuclear C3.⁵ Integral to this effort, the DSC study team is developing an integrated set of technical performance criteria for strategic C3 supporting the New Triad. The DSC study will define an objective systems architecture for strategic C3 segments leveraging GIG enterprise capabilities and will recommend an integrated investment strategy for selected strategic command, control, and communications (C3) capabilities. A key goal of this effort is to provide a starting point for next Strategic Capability Assessment and the FY2008-2013 Program Objective Memorandum (POM) development. The results of this study are expected to be available in early 2006.

The first steps on the path forward are to tie ongoing efforts, starting with the DSC study, into a coherent strategy and concept definition for future strategic C3 capabilities. Essential to this approach is that we explore concepts for how nuclear C3 functions can/should be migrated into the net-centric environment based on the GIG architecture. A key approach to doing this will be to establish a Strategic C3 Community of Interest (COI) to address the establishment of a shared vocabulary and a shared information space for Strategic C3. The Strategic C3 COI will also identify the sources and owners of the authoritative data that needs to be shared. The Strategic C3 COI needs to approach these tasks in three phases; look at what is required to support the geographically distributed command concept discussed earlier, ITW/AA and the transmission of emergency action messages. The COI concept will help define how to build the future strategic C3 capabilities according to net-centric criteria, but may also have to consider the need to retain some of the current nuclear C3 stovepipe transport capability to achieve the required survivability and endurability. Most important is that throughout the migration process, high confidence in our current nuclear C3 capabilities has to be assured.

A strategy to overcome today's issues and the associated recommended actions is as follows:

1. Review as necessary and implement policy directing migration of tactical, strategic, and nuclear C3 to a New Triad C3 construct by 2012-2015.
2. Expedite DSC's study results and associated first-step strategic C3 architecture into actionable programmatic changes and funding allocation changes to facilitate a faster migration towards net-centric strategic C3.
3. Provide funding and resources/personnel for analysis and recommended approach for implementation of a pilot "Minimum Essential Command Network" for select threads of the nuclear C3 processes.
4. Leverage GIG developments and planned/on-going demonstrations as proofs-of concept for a part of the nuclear thread. Leverage and guide STRATCOM's investigations of geographically distributed, net-centric operations.
5. Assign and provide JFCOM, STRATCOM, and DISA, as appropriate, funding and dedicated personnel to perform or expand on coordinated planning, modeling and simulation, and experimentation efforts that promote migration of traditional nuclear C2 to strategic C3 and develop new, required capabilities for key areas lacking a current migration plan.
6. Develop a supported and funded long-range plan and companion migration strategy for disadvantaged operations and capabilities not feasible for net-centric operations.
7. Define and fund a migration plan that precludes further degradation of nuclear C3 and sets forth distinct performance and decision-points that must be achieved before deactivation/migration of key legacy nuclear C3 systems.
8. Assign within USD(AT&L), PA&E, and ASD(NII) and others as appropriate a monthly/quarterly board that oversees funding, programs, and policy towards New Triad migration.

Conclusion

The new national security environment will require new strategic C3 capabilities based on the New Triad architecture. To fully support this New Triad, the U.S. must ensure that the current nuclear C3 system transforms into a broader, more flexible, and more robust Strategic C3

system which will ensure our ability to operate in today's more complex and uncertain strategic environment. However, until these new capabilities are in place, current policies driving the nuclear C3 architecture will continue to present significant challenges to the capabilities that are in place today. It is critical that any further decline in this capability is arrested and the sustainment and correction of required capabilities into the future be assured as migration into the evolving net-centric environment is studied and changes are phased in. Finally, it is vital that the migration of nuclear C3 capabilities to meet the demands of the New Triad is planned in the context of future nuclear/New Triad strategic C3 capabilities becoming an essential component of a broader national command capability.

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