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Global Title X Series '13: Game Report

Wargaming Department

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U.S. Naval War College Global 2013 Game Report

Navy Global War Game Series

Game Director: Professor Don Marrin
Lead Analyst: Professor Walter Berbrick

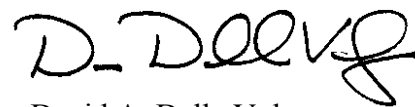


11 March, 2014

At the request of the Air-Sea Battle Office and Chief of Naval Operations, the War Gaming Department undertook a year-long effort to identify candidate command and control structures designed to execute cross-domain operations (XDO) in future high-intensity anti-access, area-denial (A2/AD) environments. This report was prepared by the War Gaming Department faculty and documents the findings of these efforts.

The War Gaming Department conducts high quality research, analysis, gaming, and education to support the Naval War College mission of preparing future maritime leaders and helping to shape key decisions on the future of the Navy. It strives to provide interested parties with intellectually honest analysis of complex problems using a wide range of research tools and analytical methodologies.

The War Gaming Department is located within the Center for Naval Warfare Studies at the U.S. Naval War College in Newport, Rhode Island. It was first established in 1887 by Lieutenant William McCarty-Little. The views expressed in this work are those of the War Gaming Department and do not represent the policy or position of the Department of the Navy, Department of the Defense, or the U.S. government. This work was cleared for public release; distribution is unlimited. Please direct any inquiries or comments on the substantive content of this document to the project director, Professor Don Marrin, at 401-841-2246 or don.marrin@usnwc.edu.



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Executive Summary

OVERVIEW

The Chief of Naval Operations' (CNO's) annual Title 10 War Game (also known as Global) conducted at the Naval War College (NWC) has become a primary venue for exploring emerging concepts. This year's effort is a continuation of the NWC War Gaming Department's examination of the Air-Sea Battle (ASB) concept. The 2012 Global War Game concluded that current command and control (C2) structures at the operational level of war may be inadequate to effectively execute cross-domain operations as envisioned by the concept. While the ASB concept outlines the need to command and control 'cross-domain operations' which are joint, networked and integrated, no organizational structure is proposed. The concept only suggests that any suitable structure must be capable of tight, real-time coordination.

At the direction of the CNO and the ASB Office, the 2013 Global War Game explored the C2 of combined forces while executing cross-domain operations in a high-intensity Anti-Access/Area Denial (A2/AD) environment. This event followed two workshops conducted earlier in the year: a C2 Requirements Workshop held in the spring and a C2 Options Workshop held in the early summer. The results of both events informed the design and development of the capstone event.

The 2013 Global War Game was conducted in September and brought together 72 players, 39 observers, and 19 flag officers and general officers from the joint and international community to examine and refine candidate C2 systems (consisting of both organizational structure and functional processes). Three candidate C2 systems were examined, consisting of a traditional model using functional component commanders, and two novel approaches developed during the C2 Options Workshop: one based on a "Domain Commander" and another based on a "Cross-Domain Commander."

In order to address the mutually agreed upon objectives established by the ASB Office and the Naval War College, the following central research questions guided the design and development of the game: Which of the three candidate C2 systems is best suited to command and control combined forces engaged in cross-domain operations in a high-intensity A2/AD environment, and why?

GAME DESIGN AND MECHANICS

This one-sided, seminar style, scenario-based game divided players into one of three combined operational planning teams formed to support the geographic combatant commander of a fictional region. Within this region, tensions between the antagonistic Red and their regional neighbors continued to escalate over a series of four notional vignettes. These vignettes were used to help critically examine and drive improvements to the candidate C2 systems. Each planning team was assigned one of the three candidate C2 structures at the beginning of the event: Player review of these structures was guided by a common set of criteria which were

derived from the *Joint Operational Access Concept (JOAC)* and Milan Vego's *Joint Operational Warfare Theory and Practice*, and subsequently refined through the C2 Requirements Workshop and a Flag and General Officer Survey. The resulting criteria consisted of the following:

- Unity of Effort
- Flexibility
- Simplicity
- Resiliency
- Operational Integration
- Cross-Domain Synergy

(See pages 30–31 of the full report for criteria definitions)

In addition to identifying command relationships and authorities, each planning team examined how their respective C2 systems facilitated four key processes of interest:

- Deliberate and dynamic targeting
- Intelligence tasking, collection, processing, exploitation, analysis, production, dissemination and integration
- Integrated air and missile defense
- Sustainment

Using the six criteria, players identified strengths and weaknesses of their C2 system. Based on the criteria-driven weaknesses identified, players then made initial changes to the structure (command nodes and authority links) and processes (roles and responsibilities) in order to mitigate weaknesses. Players then addressed a series of specific questions which highlighted particular challenges associated with each of the vignettes and incorporated additional changes, as needed. All participant-generated changes to the C2 system—along with the associated strengths and weaknesses—were captured in the game tool developed specifically for this event. At the end of each vignette, players completed individual surveys to assess the performance of their C2 system using the six criteria.

Following the fourth vignette, players prepared their final C2 system brief for the Peer Review Plenary, as well as a brief for the participating flag and general officers (FOGOs) who attended the last two days of the event to demonstrate how their system evolved over the course of the game. During the Peer Review Plenary, the players received feedback regarding their systems and used Analytical Hierarchical Process (AHP) software to collectively weight the six criteria for use during the final plenary session. The players then reviewed the feedback they received and revised their C2 system brief accordingly. Similarly, after receiving presentations on the Global '13 project and candidate C2 systems, the FOGO's collectively weighted the six criteria as well.

During the final plenary, each team presented their final C2 system brief, which was followed by a brief question and answer session to clarify the functionality of these systems. Using the AHP software, both the players and FOGO's conducted individual pair-wise comparisons of the candidate

C2 systems using the weighted criteria established the day before. These results were used to stimulate a facilitated discussion regarding the C2 systems and their attributes. Web-IQ threaded-discussion software and ethnographers were used to capture discussions during this session.

RESULTING CANDIDATE C2 OPTIONS

Option A: Domain Commanders

Option A uses domains (maritime, air, land, space, and cyber) as its organizing principle. Domain commanders are responsible for gaining, maintaining, and exploiting access within their assigned domain and denying the enemy from doing the same. They exercise operational control (OPCON) over joint and combined forces rather than relying on support relationships between functional components. Forces are allocated based on the anticipated need to project power through given domains, the threats to forces operating in those domains, and the need to disrupt, destroy, and defeat those same domain threats. Cross-Domain Operations Centers located within each domain commander's staff headquarters use Integrated Tasking Orders to provide direction to supporting Combined Joint Task Units (CJTU) and control/coordinating instructions for CJTUs from other domain commanders which are operating in the same physical domain (e.g., space deconfliction, water space management, fire control measures, etc.). The CJTU is a tailored, coalition force that includes multi-domain capabilities and has either a common mission or geographic focus. CJTUs provide the requisite C2 structure to enable assigned units to be effectively employed when adversary efforts degrade traditional reach-back communications paths.

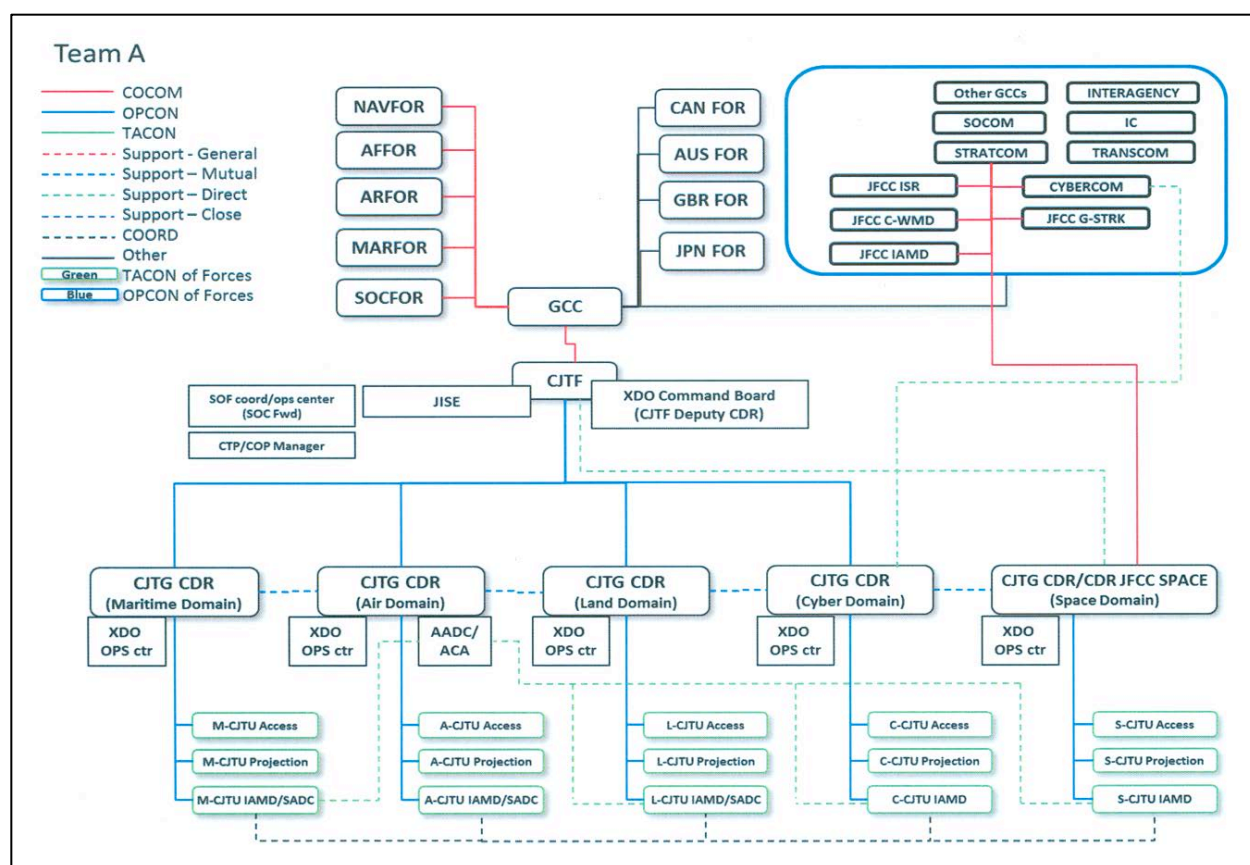


Figure 1: Option A Final C2 Structure

Option B: Cross-Domain Commanders

Option B focuses on organizing joint effects under cross-domain commands which are subordinate to the Combined Joint Task Force (CJTF) and are tailored to execute their assigned line of operation in a particular campaign plan. Known as “Cross-Domain Commanders,” each sub JTF-level headquarters controls an array of joint capabilities and operates much like a mini-CJTF. The independent nature of each Cross-Domain Commander allows them to operate autonomously, limited only by the extent of their authorities and the capabilities of their assigned forces. Individual Cross-Domain Commanders are empowered to task and organize their forces as required in response to changes in their assigned lines of operation and associated missions. All forces are either assigned OPCON to a Cross-Domain Commander or available for tasking directly by the CJTF. When additional theater assets or assets from outside the joint operating area are required by a Cross-Domain Commander, they are assigned under the tactical control (TACON) of the requesting commander. Shifting TACON of units among cross-domain Commanders as the situation dictates provides for flexibility as the campaign unfolds and operational requirements dictate. This system relies on functions and processes being delegated to the lowest level possible within the organization to enable their accomplishment when degraded communications inhibit guidance from above.

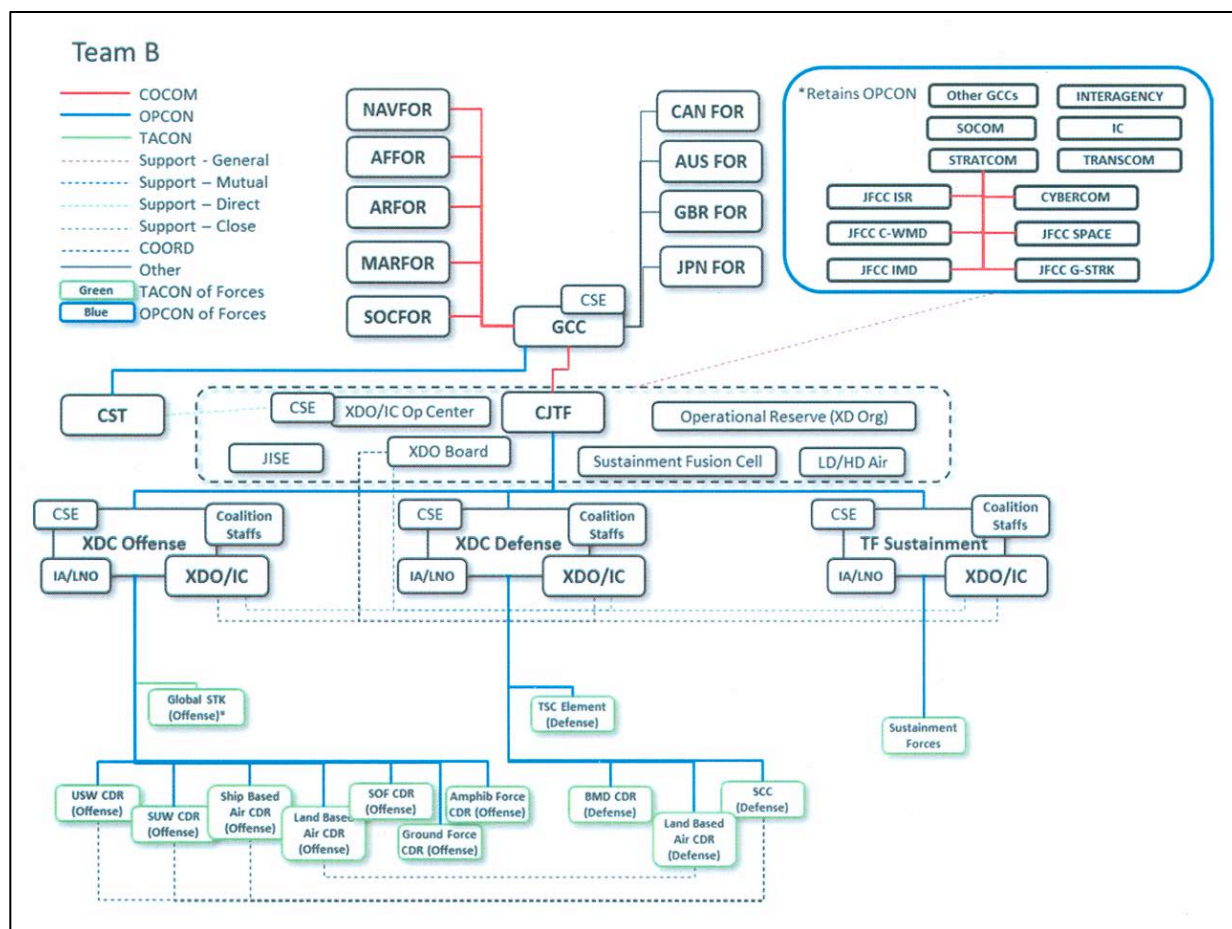


Figure 2: Option B Final C2 Structure

Option C: Functional Commanders

Option C evolved from a functional component commander approach, with changes incorporated to improve cross-domain operational effectiveness. Maritime, air, and land component headquarters were transformed into combined/joint organizations, and similar sub-CJTF component commanders for information warfare/dominance and logistics are incorporated to provide improved C2 in those areas. This model also incorporates the concept of utilizing CJTUs at the sub-functional component level to effectively leverage the capabilities of joint and combined forces in a specific area of operations, particularly when operating in a communications-challenged environment. Cross-domain effectiveness is further enhanced by implementing Cross-Domain Coordination Elements - sized and tailored appropriately - at the CJTF, functional component, and CJTU levels.

COMPARISON OF OPTIONS

The AHP results from the final plenary session indicate no clear consensus among either the players or the FOGOs for one of the three C2 options. As a group, the players demonstrated a slight preference for option B (Cross-Domain Commander Model), while the U.S. and coalition flag and general officer group indicated a slight preference for option A (Domain Commander Model). However, when separating their responses, it's interesting to note that the U.S. Navy

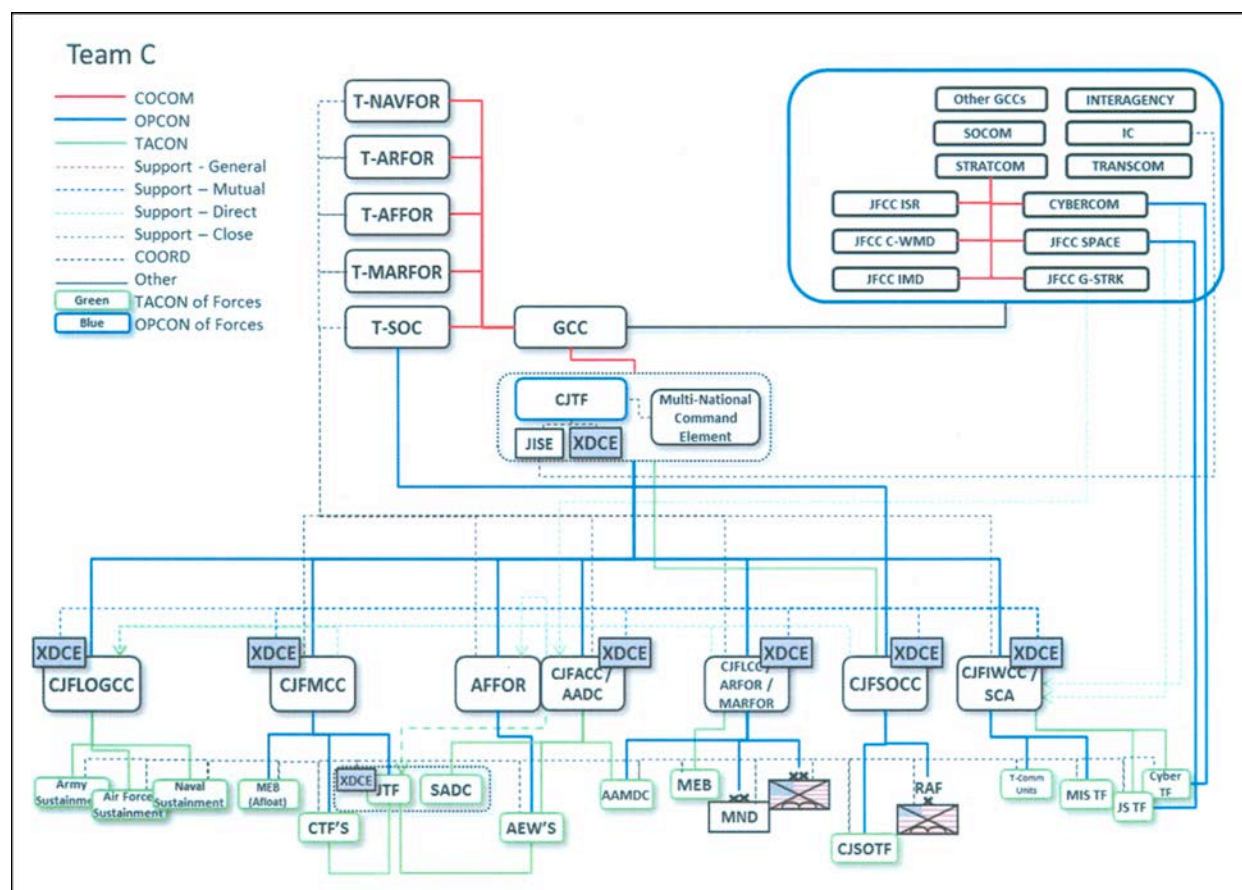


Figure 3: Option C Final C2 Structure

Flag Officer cohort preferred option C (Functional Commander Model), the Coalition FOGOs preferred option B, and the U.S. General Officer cohort preferred option A. Following analysis Based on the their feedback.

RESULTING THEMES

Post-game analysis of the various player and FOGO deliverables led to identification of the following six themes:

Enhancing Unity of Effort through Mission Command and Authorities

Global '13 described three distinct ways to command and control the joint force in a high intensity A2/AD environment. In all cases, the importance of Mission Command and pushing authorities and commander's intent to the lowest effective level was emphasized as a way of mitigating the effects of communications challenges. Because such challenges may force autonomous execution and decision making at lower levels, commanders will need the clarity of intent provided by mission orders. Mission orders must present a clear understanding of roles and missions among commanders at each level in the structure, prioritization among tasks and lines of effort, and clearly defined boundaries between domains. Poorly defined domains could create confusion for commanders issuing orders and tactical units attempting to operate from, create effects in, or even transit from one domain to another.

In order to ensure that all execution decisions and apportionment requests remain aligned with the operation's mission and commander's intent, the joint force must commit to a culture of leadership that relies on decentralization and trust. This will require senior commanders to develop and clearly articulate their intent and guidance, and to trust that their tactical commanders will appropriately interpret and act upon their guidance, especially when degraded or denied communications may prevent the issuing of amplifying guidance. Senior commanders must be comfortable with not being able to directly control the outcome of a mission, but rather indirectly influence outcomes through clear intent and authorities. This trust must be earned through persistent engagement between leaders at all levels and a commitment to changing the culture of joint command and control. To be effective, tactical commanders must be able to quickly identify the likelihood that an event or action may occur, the potential impact it would have on mission accomplishment, and how much risk the operational commander is willing to accept for tactical success. Pushing mission orders and authorities to the lowest levels succeeds in an environment where leaders at all levels appreciate, encourage, and expect creativity and initiative. Exercises—and real-world operations—provide the venues to develop this trust through practice and experience.

Improvements to Joint C2 Must Be Evolutionary, Vice Revolutionary

Participants appeared reluctant to commit to any change that was radically different than what is in place today. While realizing the benefits and strengths inherent in each of three models, the vast majority of U.S. and coalition participants indicated that changes to current C2 structures and processes would have to occur at a deliberate, moderate pace if they are to succeed. Many of the coalition representatives highlighted that clear commander's intent and guidance and pushing mission orders down to the lowest echelon would improve coalition integration, but that the pace and extent of change must be tempered and conducted in a way that enables coalition forces to

operationally integrate. As one coalition flag officer said, “If you go evolutionary, then we can follow; revolutionary, we can’t follow.” Players also recognized that integrating the characteristics of any XDO C2 system into today’s functional component-based model would require new ways of thinking about warfare, including the breaking down of service-specific cultural barriers.

Cross-Domain Coordination and Control Elements

All three C2 models incorporated some form of a cross-domain coordination or control cell to synchronize effects and mitigate resource shortfalls at the sub-CJTF/functional component commander level. This feature was developed to enhance cross-domain synergy and operational integration. Team A used their XDO Centers, which resided within each Domain Commander, to produce Integrated Tasking Orders to provide direction to subordinate Combined Joint Task Units (CJTU). They also provided control and coordinating instructions for CJTUs from other domain commanders that operate in the same physical domain (e.g. airspace deconfliction, water space management, fire control measures, etc.). Each XDO headquarters in Team B featured a Cross-Domain Operations and Intelligence Center (XDO/IC) to coordinate activities among XDO CDRs and synchronize with the XDO Board at the JTF level. Team C developed Cross-Domain Coordination Elements (XDCE) at the CJTF and functional component headquarters to create and exploit greater knowledge and understanding across all domains within the area of operations.

These elements would be manned with joint and coalition operators and planners from each domain and service that are educated and trained in planning and executing cross-domain operations. They would ultimately enhance knowledge and awareness of access and power projection requirements of each domain, and the associated capabilities required to do so. As one player noted, “Until we all do alternate tours as airmen, sailors, soldiers, marines, cyber and log specialists (and we would clearly never do it) we need to force together staffs—XDCEs—that truly co-join their staffs to achieve coordinated effects.”

Information Warfare/Dominance Commander

Establishing a commander solely responsible for information dominance was strongly supported by game participants. This standing organization would coordinate and integrate requirements and capabilities across the entire range of the information spectrum (cyber, space, EW, communications, intelligence, METOC, IO etc.) in order to support commanders’ domain access and power projection requirements, push appropriate authorities down to the lowest levels, and better affect the internal workings (processes, biases, etc.) of an adversary’s C2 system. One flag officer noted, “The integrated information command from Team C is an important and novel idea and the information environment will be a key feature in emerging forms of warfare.”

Sustainment Commander/Task Force Sustainment

The sustainment of forces will be a major challenge to gaining a competitive advantage over a highly capable adversary. Traveling from long distances, these forces will be highly vulnerable to advanced adversary A2/AD systems. Any C2 structure must be able to accommodate the flow of forces deployed from the United States and throughout the region. The C2 systems developed over the course of the game highlighted some potential ways to plan and execute sustainment

operations in an A2/AD environment. A commander responsible solely for sustaining forces during the conflict was an emerging C2 concept that warrants further consideration. Such an organization would direct all elements of the supply and maintenance system “to deliver the right things to the right place at the right time to support the joint force commander and component commanders.”

Combined Joint Task Units (CJTUs)

Participants in all three cells strongly supported the concept of projecting power through combined units below the sub-CJTF/functional component level with forces from different services and countries that operate in different domains. These units could be tailored to any type of commander (domain, cross-domain, functional) based on mission, line of effort, domain or geographic orientation. These forces would need to be pre-integrated and trained prior to the start of conflict, which would enable them to self-synchronize and directly coordinate with each other in a degraded, denied, or hostile communications environment. The make-up of these units drew similar comparisons to a Marine Air Ground Task Force, Army Battalion Task Force, a Navy Battle Group or a Joint Special Operations Task Force. However, the tailored combination of mission/task-organized capabilities envisioned for a CJTU could include forces from all domains, including cyber and space.

THE WAY AHEAD

Because an evolutionary approach was viewed as the preferred method for improving current C2 structures and processes, Global 2014 will explore how the four emerging C2 attributes (information warfare/dominance commander, sustainment commander, cross-domain coordination and control element, and combined joint task units) derived from Global 2013 could be integrated into the current functional component model of today. This effort will entail developing a hybrid C2 model which incorporates these attributes, along with a supporting XDO C2 Concept of Operations (CONOPS), and to then examine and refine the CONOPS in order to lay the foundation for future Tactics, Techniques, and Procedures (TTP) development.

Game Report

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I. Introduction

STATEMENT OF SPONSOR'S INTEREST IN THIS TOPIC

Based upon CNO's area of interest, the Global 2013 project was developed to explore how the U.S. and its international partners could command and control forces executing cross-domain operations in future Anti-Access/Area-Denial (A2/AD) environments. The results of this effort were designed to inform the development and refinement of a joint Cross- Domain Operations (XDO) Command and Control (C2) Concept of Operations (CONOPS).

The Global 2013 Project consisted of an online C2 Requirements Workshop (development of C2 criteria and conditions), a C2 Options Development Workshop (development of candidate C2 systems) and the Capstone Event (examination of the candidate C2 systems). Utilizing an inductive analytical methodology, the participants were able explore specific activities and environments in which future C2 systems would be required to perform.

Armed with this information, participants developed several candidate C2 systems, which were then narrowed down by the game design team to three options. A common set of criteria guided the development and refinement of these structures throughout the project and served as the basis for evaluation during the capstone event. The final three candidate C2 systems examined during the Capstone Event consisted of a traditional model using functional component commanders, and two novel approaches developed during the C2 Options Workshop: one based on a "Domain Commander" and another based on a "Cross-Domain Commander."

PROBLEM STATEMENT

The findings from the Global 2012 Project suggest that current service or component-centric command and control structures at the operational level of war may be inadequate for effectively executing cross-domain operations as envisioned by the Air Sea Battle (ASB) Concept. While this concept outlines the need to command and control 'cross-domain operations' which are joint, networked and integrated, no organizational structure is proposed, only the requirement that any suitable structure must be capable of tight, real-time coordination.

PURPOSE

This project will inform the development and refinement of a Joint XDO C2 CONOPS that describes how to command joint forces while executing cross-domain operations in future high intensity A2/AD environments.

OBJECTIVES

Calendar Year 2013: Possible C2 Structures are identified, analyzed, selected to support development of a Joint XDO C2 CONOPS

Calendar Year 2014: A draft CONOPS describing the selected C2 structure has been developed by the ASB C2 Working Group, examined in a NWC-run analytical event, and revised by the Working Group to support future tactics, techniques, and procedures (TTP) development.

CONSTRAINTS:

- Based on guidance from the ASB Office, the candidate C2 structure and processes should be capable of performing cross-domain operations in future high-intensity A2/AD environments.
- Based on guidance from the ASB Office, the candidate C2 structure and processes must account for coalition integration.
- Development and examination of the candidate C2 structure should adhere to governing joint doctrine wherever possible, such as the Capstone Concept for Joint Operations (CCJO), Joint Operational Access Concept (JOAC), and other Joint Operational Concepts (JOCs) as appropriate.

OVERARCHING RESEARCH QUESTIONS

Based upon CNO's area of interest, subsequent literature review by the Naval War College WGD faculty, and the two primary objectives for the project, the following research questions guided the design and development of the project:

- Which of the three candidate C2 systems is best suited to command and control combined forces engaged in cross-domain operations in a high-intensity A2/AD environment, and why?

DEFINITION OF KEY TERMS

While definitions are usually provided at the end of a document, the importance of the following terms to the Global '13 project, along with their potential unfamiliarity, warrants their inclusion at this stage of the report:

Anti-Access (A2): Those actions and capabilities, usually long-range, designed to prevent an opposing force from entering an operational area.

Area-Denial (AD): Those actions and capabilities, usually shorter-range, designed to keep an opposing force out, but to limit its freedom of action within the operational area.

Cross-Domain Operations (XDO): The use of capabilities in one or multiple domains to reduce risk and gain or maintain access in another domain.

Command and Control (C2): The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission.

Air-Sea Battle (ASB) Concept: A Department of Defense document that reflects new and creative ways of integrating the Services in order to reduce risk, maintain U.S. freedom of action, and project power in the global commons during peacetime and crises.

II. C2 Requirements Online Workshop

The C2 Requirements Workshop was the first event in the Global '13 Operational C2 Project. Conducted online via a web site designed and hosted by NWC, the purpose of the workshop was to better define the conditions, capabilities, criteria and challenges affecting future C2 structures intended to plan, direct, monitor and assess cross-domain operations at the operational level. After viewing briefs addressing the Air Sea Battle Concept, Domain Definitions, Cross-Domain Operations, and Command and Control (C2) in Cross-Domain Settings, participants responded to a questionnaire to solicit their input regarding time, space and force factors influencing XDO-C2, the internal functions of XDO-C2 organizations, the impact of coalition participation in XDO-C2, and the relevant criteria necessary to evaluate XDO-C2 structures. Participants were also able to ask questions and exchange ideas via the web site's discussion board.

The criteria introduced at the C2 Requirements Workshop consisted of the following, based on organizational theory and joint operational warfare:

Unity of Effort: The C2 construct ensures that all execution decisions and apportionment requests remain aligned with the operation's mission and commander's intent. The organizational structure fosters a sense of cohesion and unity of purpose throughout the planning/directing/monitoring/assessing process.

Resiliency: The positive ability of the C2 system or a specific organization to adapt and overcome setbacks and fill important positions quickly and satisfactorily. This robustness is also a function of the number of command layers, degree of centralization vs. decentralization, and reliability of supporting C4ISR systems.

Flexibility: The C2 construct is broadly adaptable to a wide range of regions and tasks. The organization can expand or contract with changing circumstances without serious loss of effectiveness. It is able to respond to changes in mission and resources. Information is acquired and passed quickly and reliably to help build the situational awareness of subordinate, superior and adjacent commands. It exercises decentralized execution, delegates specific defined functions, and rapidly deploys forces to meet specific situations.

Simplicity: Chain of command is clear and straightforward. Responsibilities and authorities are clearly delineated with no overlap. Subordinate commands are responsible to no more than one superior at any given time. Processes and procedures are straightforward and foster clear direct communication.

Continuity: The command organization smoothly transitions across the range of military operations. Once established, organization should only undergo small changes in dealing with pre-hostility, combat, and post hostility operations.

Span of Control: The area of activity or number of functions, people, or things for which an individual or organization is responsible. Span of control should not exceed the superior's ability to effectively oversee and employ the subordinate unit.

Stability: The stable organization is characterized by predictability and control. Structure, routine, policies, etc., have been established to remove uncertainty from the environment. Goals are clear and people understand who is responsible for what.

During the online workshop, participants identified three additional criteria, defined as follows:

Interoperability: The ability to interact with subordinate, adjacent, and higher organizations that have different missions and authorities.

Span of Understanding: The ability to make timely and relevant decisions and complete key tasks as a result of a complete understanding of all organizations' actions and capabilities that exist within the C2 system.

Mission Accomplishment: The stable organization is characterized by predictability and control. Structure, routine, policies, etc., have been established to remove uncertainty from the environment. Goals are clear and people understand who is responsible for what.

ANALYSIS AND RESULTS

C2 Criteria Assessment

Survey questions 19–25 from the online workshop asked respondents to indicate the level of importance of seven possible criteria that could be used to assess the performance of joint cross-domain C2 structures at the operational level of war. Response choices were based on a five-point Likert-scale (most important, very important, important, somewhat important, and not important). Results suggest unity of effort to be the most important criteria, followed by resiliency, flexibility, simplicity, span of control, continuity, and stability. See Table 1 for a summary of participant responses.

Time, Space, and Force Factors and Future A2/AD Environments

Survey question 17 asked respondents to describe the interrelated time, space, and force factors that characterize future environments in which XDO C2 will be performed. Time will most likely be set by the opposing force—with little indications and warning—thereby requiring a swift response from forward deployed forces in the region. The tyranny of distance by which U.S. forces will close on an adversary presents myriad challenges to operating in an A2/AD environment. For example, forces transiting great distances should expect communications denied, degraded, or hostile environments targeted by advanced adversary cyber and space capabilities. In addition, defending logistics assets over long transits will impact resources that could otherwise be employed for immediate offensive response operations.

Question	Criteria	Not Important (1)	Somewhat Important (2)	Important (3)	Very Important (4)	Most Important (5)	Mean
19	Unity of Effort	(0) 4%	3% (2) 18%	4% (3) 38%	46% (31) 34%	47% (32) 6%	4.37
20	Continuity	(3)	(12) 6%	(26) 13%	(23) 51%	(4) 29%	3.19
21	Flexibility	(0)	(4) 15%	(9) 26%	(35) 28%	(20) 16%	4.04
22	Simplicity	(0) 1%	(10) 9%	(18) 40%	(29) 43%	(11) 7%	3.61
23	Span of Control	(1) 1%	(6) 19%	(27) 44%	(29) 31%	(5) 4%	3.45
24	Stability	(1)	(13) 3%	(30) 16%	(21) 40%	(3) 41%	3.17
25	Resiliency	(0)	(2)	(11)	(27)	(28)	4.19

Table 1: Frequency Distribution and Mean Table for Survey Questions 19–25

The rapid and persistent pace by which an adversary employs multiple capabilities to achieve effects in specific domains, its use of interior lines of communication, and the employment of significant quantities of diverse weapons systems will present unique challenges to forces striving to gain and maintain access and project power in multiple domains. Forces should also anticipate non-state actors with irregular and distributed leadership structures to complicate the actions and decision-making of combined forces.

Participants also focused on the complexities associated with cross-domain operations. These discussions may be best characterized by the following participant response; “Forces can operate in one domain, deliver payloads through another domain (which can affect the success or outcome), that have an effect on a third domain, which can ultimately allow access for delivery of an effect in a fourth domain.” U.S. capabilities across domains will aggregate, reconfigure, and disaggregate more fluidly during campaigns, operations, missions and tasks. Forces will have to operate at varying operational tempos in different domains (for example forces moving faster in the air domain than in the subsurface). Distributed forces may not have a common operating picture in communication denied environments, while autonomous forces will likely operate alongside traditional forces in all domains, as well as in different domains and phases at the same time.

Another key element of time is the speed by which information travels to decision makers. Higher headquarters awareness of the changing battle space and generation of new orders to subordinates coupled with the battle rhythm of operations centers and fires (both kinetic and non-kinetic) processes are critical time elements for which future C2 systems must account. U.S. and allied forces must have an awareness of activities in all domains where they are operating, the advantages and disadvantages of operating in all domains, and the access requirements and capabilities that forces can offer to achieve effects in other domains. The different characteristics of the various domains and how information will travel across those domains will be very

important in synchronizing cross-domain effects. However, depending solely on technology to communicate in expected communications denied environments will increase the likelihood of mission failure.

Political affirmation of military coalition participation is effected by myriad factors causing vast uncertainty for leveraging coalition capabilities. Political retraction of military coalition participation can occur without warning causing high risk to coalition operational capability, especially if the coalition is heavily manned by any given nationality. The decision process for a coalition to accept new missions may not match the speed of other more efficient organizations, especially due to political factors. Moreover, many nations only allow their forces to deploy to a coalition for a short period of time, causing a very high rate of turnover and loss of corporate knowledge and organizational proficiency in specific tasks and functions.

Coalition AOR boundaries may not align with Unified Command Plan (UCP) Areas of Responsibility (AOR), causing singular coalition operations to exist across multiple Combatant Commander's (COCOMs) AORs. In addition, national caveats might preclude operations by certain coalition forces within specific Joint Operating Areas (JOAs). Future C2 systems comprised of coalition forces will have to account for relationships of other "friendly" forces and the ability to leverage each other's forces and resources without violating mandates, treaties, or the political will of a coalition partner. Within a coalition, the agreements and authorizations reached with a nation's navy often do not imply that the agreement is valid with a nation's coast guard, thereby negating the use of coast guard forces, which in some cases are more capable than their naval counterparts. Developing coalition partnerships may be more prominent when collective national interests are at stake in specific geographic areas, thereby causing the coalition AOR to be vastly smaller than the COCOM AOR; but still requiring full integration of operations across multiple domains.

PDMA Activities and C2 Systems

Survey question 18 asked participants to describe the internal actions or activities that XDO C2 structures will have to perform. Responses were binned into four pre-determined categories: planning, directing, monitoring, and assessing.

Planning Activities

Command and control infrastructure and processes must be adapted to properly plan for cross-domain operations. Future C2 systems must synchronize operational planning across combined, joint, and service component headquarters. Forces must be capable of planning both single and cross-domain operations, which will require the associated planning groups to possess adequate representation from all domains in order to maximize effectiveness and efficiency across the force. This integrated planning group should also include information dominance planners from across the services in order to quickly synchronize effects. Planners should identify the required capabilities and capacities of the forces to disrupt, destroy, and defeat adversary kill chains, as well as identify, plan, and acquire the logistics to sustain those forces. Forces should plan for operations in challenging communications environments and account for primary, backup, and tertiary communications pathways in their plans. Planning in conditions where communications are degraded or denied is problematic and should be practiced by service and joint headquarters.

Planning should also include ways to counter degradation, denial, and data manipulation throughout all phases of the campaign.

Coalitions often assume that forces will arrive with tactical proficiency, though a foundational level of operational training should be conducted to ensure awareness of and ability to conduct various contingency plans, and to ensure that forces and headquarters remain proficient. However, such training will be complicated by the fact that some nations are reluctant to exercise with other nations, even potentially with nations in the same coalition. These nations may exercise in parallel with coalition partners, but not directly with some partners. Coalitions are assembled by nations of the willing, and therefore the ability and authority of individual coalition forces to execute particular missions - whether offensive or defensive in nature - must be understood and respected when it comes to operational planning. Another area which must be addressed is the planning assumptions, which need to be agreed upon by the coalition as a whole to prevent potential confusion or dissention within the coalition. Planners must also appreciate that cultural differences will exist between coalition countries, which will require patience and understanding to overcome. Lastly, future C2 systems should strive to support requests for information via the cultural process of the nation making the request, and to provide the information via their process as well.

Directing Activities

XDO C2 structures must be able to transmit information quickly and securely, using interoperable (between services and nations) communication systems that are highly resistant to enemy attacks. These systems will “need to get the right information to the right person and unit in time to take action inside the enemy's OODA (Observe, Orient, Decide, and Act) loop for friendly mission accomplishment.” Additionally, in case of lost or degraded communications, a clear understanding of commander's guidance and intent, and authorities to act, will be required so that units can execute actions and advance the plan without depending on updates from the commander.

The joint force will need to quickly combine capabilities with mission partners across domains, echelons, geographic boundaries and organizations. Emerging and full-spectrum capabilities, such as cyber, space, ISR, intelligence and special operations forces, need to be integrated with traditional domain capabilities (maritime, land, and air) and employed collectively to achieve access within and across domains. One participant noted, “depending on the units and number of units, be able to change or share units within a structure, as a single unit may be able to effect more than one domain or conduct tasks for two separate commanders depending on C2 structure.” Picking the right asset for the task may require a change in mind set about how to accomplish objectives. Future C2 systems must rapidly deconflict fires and re-allocate forces outside the normal tasking process (ATO from air perspective) based on prioritized requirements of domain, cross-domain, or functional component commanders.

Coalition doctrine must clearly articulate command relationships and authorities over assigned forces. Clear and unambiguous guidance will allow commanders to command and will alleviate confusion as time progresses and the original personalities that formed the coalition are no longer present. Additionally, as new members join the coalition, a clear mandate will be available to set expectations. Finally, if doctrine does not clearly communicate command relationships and

authorities, it will be exponentially more difficult (or impossible) to firmly coordinate across all nations as time progresses and political will changes. The coalition force generation process is a constant negotiation requiring continuous key leader engagement to maintain force flow. The coalition commander must not only balance the granted forces across priorities, but also continually plead the case for continued force flow to coalition nations. Coalition force apportionment and allocation must be balanced against other organizations performing similar or adjacent missions. This can be accomplished via a Joint Intelligence Board where joint priorities can be established and general agreements can be reached to balance the entire force to meet the mission(s).

Monitoring Activities

Situational awareness emerged as the primary theme related to monitoring activities. Responses were further distributed into three broad categories: information processing, information management, and information distribution. Future command structures and processes will have to retrieve, analyze, and disseminate information and intelligence to identify threats that impede forces from gaining and maintaining domain access. Service and joint operations centers will need to maintain timely situational awareness of all forces (Blue and Red) both in and out of theater. Information related to cross-domain capabilities, domain access requirements, vulnerabilities, levels of risk, and performance measures of both BLUE and RED forces must be acquired and disseminated to the entire force. Flexible and scalable communication systems, information exchange systems, and operating pictures common throughout the system will help gain and maintain requisite levels of situational awareness to support commanders.

Future C2 system should account for new ways of organizing and managing information and knowledge related to cross-domain operations in order to better enable cross-domain headquarters “to focus on the right things at the right time with the right people.” While actionable intelligence is challenging to share in a timely manner between US national forces, it is even more challenging to share with many coalition forces, especially for offensive missions. Therefore, the intelligence disclosure process must be well-engineered to create the shortest possible disclosure process timetable, and missions must be assigned in alignment with the ability to share actionable intelligence.

Assessment Activities

Effects assessments are very difficult to generate and share in a coalition due to national interests, disclosure issues, and cultural face-saving boundaries. Commanders must be prepared to accept relatively shallow assessments and develop the capability to assess coalition-generated effects within and across domains. Cross-domain risk assessment and management provides planners with an important tool to understand levels of risk within and across domains, and corresponding levels of effort required to reduce risk. The system must evaluate readiness, logistics support, and relief of defensive forces to ensure they’re able to perform assigned missions across domains. It must also establish continuous risk barometer assessments and analysis of capacity across the domains, and assess the status and location of subordinate, adjacent, and higher echelon forces.

Service and joint operations centers could consider creating a new “strategy cell” designed to conduct mission analysis and recommend utilization of service capabilities, evaluate single and

cross-domain risks, readiness, priorities and objectives. This cell would coordinate, synchronize, and cascade strategic information for current and future cross-domain planning cells. Several responsibilities identified include: evaluate commander tasks and guidance, external conditions (Time-Space-Force), whole of coalition capabilities-limitations-constraints-ROE-authorities, subordinate organization risks-capability-prioritization inputs, likely enemy actions/reactions, time horizon, perform earliest stages of OODA models, evaluate high-level campaign risks, integrate national strategic messaging capabilities-requirements, and provide strategic direction to next level XDO planning (resourcing) entities. Other assessment activities of this cell include: evaluate time-force operational risks, domain weapon system capabilities/roles/capacities/readiness/attrition, and incorporate other component commander risk assessments and recommended priorities.

Coalition Integration Challenges

Participants identified the following primary C2 challenges associated with conducting cross-domain operations with allies and partners in future high-intensity A2/AD environments: classification restrictions and information sharing; language and culture barriers; policy restrictions and execution authorities; doctrinal gaps and overlaps; lack of knowledge or misunderstanding of U.S. and allied objectives, risks, capabilities, authorities, organizational processes, and command relationships; and interoperability among people, platforms, and systems.

U.S. and international allies and partners must develop persistent bilateral and multilateral cooperative engagement activities-in the areas of education, training, and exercises- to develop short-term and long-term collaborative solutions to address these challenges. Military leaders at all levels-from flag and general officers to tactical unit commanders- must develop and maintain trust and confidence, through persistent engagement, to evolve into a combined force capable of addressing any threat or contingency. Participants identified the need to leveraging regional mechanisms to enhance multilateral military cooperation in these areas and working towards expanding current bilateral arrangements into multilateral arrangements.

DOTMLPF Challenges and Joint XDO C2

The DOTMLPF (Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities) construct was used as a lens for participants to examine the myriad implementation challenges associated with conducting joint cross-domain operations in future A2/AD environments. Leadership, authorities, and command relationships emerged as the top three challenges identified by workshop participants. Personnel, facility, and policy challenges identified were limited and discussed within the other categories. While this effort was not a major focus of the workshop or project, the following insights may have applicability to the joint force and warrant further investigation.

Doctrine

The fundamental principles that guide the employment of joint forces attempting to gain operational access in high intensity A2/AD environments are limited. Current joint doctrine—ranging from concepts to tactics, techniques, and procedures—does not address the command and control of forces conducting cross-domain operations in these environments. For changes in doctrine to occur, the joint force must understand and fundamentally alter the way it thinks and

approaches warfare. Specifically, leveraging capabilities in different domains to enhance the strengths or reduce the vulnerabilities in others is an emerging concept difficult to grasp within and between services. However, through the employment of educational briefings and virtual forums, participants developed a deeper understanding towards identifying problems and potential solutions. Increased interaction between services and nations through similar forums would enable military leaders to continue advancing the state of thinking, development, and implementation of directing and controlling forces within and between domains. Participants noted that services tend to be more reliant on their own doctrine than joint doctrine. Therefore, to develop an effective joint XDO C2 process, new approaches to developing and implementing joint doctrine for the 21st century warfighting commander may be required.

Organization

The ways in which the joint force is organized to fight future conflicts may not be optimized. The service and functional constructs of today may require new and innovative ways of organizing to effectively conduct cross-domain operations. Depending on the approach taken, this could be a complete overhaul of existing structures and processes or simply a slight modification. In an effort to gain a competitive advantage over the adversary and win future conflicts, today's leaders should be open to change. Whether making an extensive or moderate change, leaders must first define the mission, roles, relationships, processes, and authorities of their organization. Accordingly, future organizations must work closely with sister services and have the structure to allow for cross representation of personnel based on capabilities and desired effects (e.g., kinetic and non-kinetic). Future structures will also have to overcome classification barriers to allow seamless sharing of information and capabilities. While a single organization would be ideal from a unity of command perspective, span of control challenges may require the force to sub-organize by geographic area, function, or mission, depending on the adversary and region. Future changes to organizations will require a renewed focus on joint training and education.

Training

Executing cross-domain operations in future A2/AD environments require joint forces to develop and maintain specific skills, knowledge, and proficiencies that do not exist today. As one participant noted, deficiency in this area stems from "the customer not fully understanding the product and the producer does not fully understanding the customer." To effectively perform cross-domain operations in a future conflict, U.S. forces must train and practice on a recurring basis in denied and degraded communications environments. As one participant noted, "not practicing any task routinely is a reliable indicator that we will not be able to execute proficiently when needed." The familiarity with organizational relationships, processes, and authorities between organizations that training provides also enhances unity of effort and cross-domain synergy.

Materiel

Cross-domain interoperability in a future command and control system is not a formal definition in current doctrine. This emerging concept refers to the interchangeability of platforms, systems, people, and technical support infrastructure between domains. The overall objective is to replace one or more of these components without reducing the ability of forces to gain or maintain access in multiple domains. The joint force does not acquire and develop new platforms or

systems with this aim in mind. Accordingly, the type of materiel available to the joint force to effectively perform cross-domain operations may be insufficient. One participant indicated, “Information transparency and systems interoperability will be required all the way from the sensor data level up to operational planning.” The joint force must strive to develop and program with the ultimate goal of “allowing units from different services to talk directly to each other.” Breaking down service barriers and working towards this goal will require strategic patience, persistence, and a common approach developed and implemented through the Department of Defense’s Joint Capabilities Integration and Development System (JCIDS). However, as one player noted, JCIDS does not define acquisition requirements and evaluation criteria for future defense programs within the context of cross-domain operations. Closing the material gap will be a long-term endeavor that must be supported by current and future leaders.

Leadership

The way we lead joint forces today was viewed as a key challenge to conducting effective cross-domain operations in future A2/AD environments. The use of mission command type orders and decentralized planning and execution at the lowest levels across the force will require leaders to engage in new forms of education and training. From tactical unit commanders through Flag and General Officers, leaders must embrace and practice this style of command early and often. Leadership education should highlight how the pace of an A2/AD fight does not allow for the traditional, deliberative C2 processes that we have become accustomed to. In addition, leadership within each service should consider changes in the way it views career progression. Current service and community pipelines select leaders mainly on performance within a particular community or service, while viewing career progression based on performance and contributions both within and across domains may enhance joint, cross-domain synergy.

Today’s leaders make decisions in relatively low-risk environments where information, intelligence, and communications are reliable and timely. In future warfighting environments where these necessities may become limited or absent, operational and strategic leaders must communicate clear guidance, priorities and authorities to their subordinate commanders early in the conflict, before communications become degraded and denied. This will enable subordinate commanders to ensure that their execution decisions and apportionment requests remain aligned with the intent and risk tolerance of their commander.

Command Relationships

New command relationships between organizations and services may need to exist in order to foster the creativity and coordination required to overcome communication challenges between domain commanders. Current command and control structures and processes enable leaders to retain control of forces in a particular domain, instead of employing forces in different domains to enhance domain strengths and reduce vulnerabilities in others. Consequently, competing priorities and battle space coordination and deconfliction must be at the forefront of examining future command relationships. Command relationships and authorities will also be essential to ensure that forces are employed effectively from long distances. There must be clear delineation of authorities and transfer of authorities and relationships as the operation moves forward in time and proximity to the fight. If this is not accomplished, key components of the system will fail and cause increased risks to the system.

Friction and misunderstanding between services and command organizations will cause problems and delays in execution when limited time is available to resolve issues or differences. A few seconds could mean the difference between mission accomplishment and failure. Support relationships appeared to emerge as the “most poorly defined of the four command relationships...but we rely upon it more for ego-based reasons than because it makes the most sense.” Clear and simple command relationships built on unity of command will enable leaders to achieve maximum potential from their people and capabilities. Changes to existing command relationships need to be reflected in joint and service doctrine, and practiced among joint forces.

Authorities

The rapidly changing and complex A2/AD environment requires commanders to act quickly and decisively. Pushing authorities down to the lowest possible level in the early stages of a conflict is fundamental to succeeding in this environment. By giving subordinate commanders the “what” to do vice the “how,” it will enable the joint force to play to both its operational strengths and adversarial weaknesses. Providing operational and tactical commanders with the proper authority to act will reduce dependency on hierarchical and rigid C2 processes that increasingly elevate operational authority to the National Command Authority. Working jointly, to determine which forces can control which capabilities, needs to be well thought-out and exercised during phase zero of a campaign.

III. C2 Options Workshop

WORKSHOP OVERVIEW

The three-day C2 Options Workshop was conducted 25–27 June, 2013 at the U.S. Naval War College (NWC) in Newport, RI. Two independent teams, Team A and Team B, notionally represented a Joint Planning Group (JPG) with coalition representation. Teams were led by representatives from the Air Sea Battle Office, assisted by War Gaming Department facilitators. There was no routine interaction between the teams over the course of the workshop. JPGs were tasked with developing recommendations for possible C2 arrangements to support future operations within a fictitious operating environment. The fictional environment included adversarial and allied partners, kinetic and non-kinetic threats, forward operating bases, etc. The participants were also given Commander's Intent and Guidance which outlined the assumptions, limitations and governing factors to be used in developing their C2 options. Each team received slightly different guidance in order to develop different C2 options for examination in the September Capstone Event.

Each team was further divided into three cross-functional “pods.” Each of the pods had a slight bias towards two of the six functions, with an Intel/Fires Pod, Maneuver/Force Protection Pod, and a C2/Sustainment Pod.

The first day of the workshop was focused on building a common understanding of the implications of cross-domain operations on the six operational functions: C2, intelligence, fires, maneuver, sustainment and operational protection. Via a facilitated discussion, participants identified the main inputs, activities and outputs associated with planning, directing, monitoring and assessing each function at the joint/coalition operational level and entered this data into the game tool.

Associated XDO problems were then identified, discussed, and sorted. An XDO problem essentially answered the question, “What deficiencies are there in the way we either plan, direct, monitor or assess a particular operational function which have a negative effect on being able to direct and coordinate cross-domain ops?” For example, “What deficiencies are there in the way we plan fires which have a negative effect on being able to direct and coordinate cross-domain ops?”

On the second day, each pod built a C2 structure designed to mitigate the previously identified XDO problems, resulting in three structures per team (A1, A2, A3 for Team A and B1, B2 and B3 for Team B). Along with the XDO problems, pods checked the C2 structures for functionality by considering the answers to a series of questions addressing operational functions. Questions addressed issues such as intelligence collection and dissemination, dynamic targeting, cyberspace integration, and logistic coordination. The “C2 trade space” was between the combatant commander and the task group. As an operational concept, ASB and XDO exert less

and less influence over C2 arrangements at increasingly strategic levels of decision making. Likewise, at levels increasingly below the task group, tactics and weapon system capabilities dominate, as platforms are fundamentally employed in single domains.

The C2 structures consisted of command organizations (nodes)—groups to whom some form of command authority has been delegated, and exercise direction over subordinate commands and coordination with superior, adjacent, and subordinate commands—and two types of relationships (links): command relationships with legal authorities, and functional relationships that described the nature of the interaction between two nodes.

Pods also considered the degree to which their structure exhibited the following C2 attributes developed during the C2 Requirements Workshop:

- Unity of Effort
- Resiliency
- Flexibility
- Simplicity
- Continuity
- Span of Control
- Stability
- Interoperability
- Span of Understanding
- Mission Accomplishment

On the third day pods presented their C2 structures in plenary. Following the final C2 structures out-brief, the pods used a multi-criteria decision aid, Analytic Hierarchy Process (AHP), to independently pair-wise compare the C2 attributes as criteria in order to weight them. The participants then used these criteria to pair-wise compare their team's three C2 structures in order to inform the team's C2 structure recommendation.

PDMA PROBLEMS AND OPERATIONAL FUNCTIONS

This section summarizes the primary C2 problems identified across all six candidate structures related to planning, directing, monitoring, and assessing cross-domain operations. The nine major problems identified across all areas consist of the following:

1. **Effects of Communications Denied Environments:** Red will work to create a communications-denied environment for Blue, significantly degrading Blue commander's ability to direct forces and reach back to remote information resources.
2. **Authorities:** Retention of C2 authorities at higher levels of command may hamper the speed of speed of command in XDO operations.
3. **Coalition Operations:** C2 difficulties caused by a lack of common equipment and processes with coalition partners will be magnified in a communications-denied environment.
4. **Situational Awareness (SA):** SA requirements increase when operating in an A2/AD environment, due in part to the operational requirement to employ cross-domain solutions to achieve success. To effectively conduct XDO also requires a greater awareness of the status of friendly forces, since these forces may be initially assigned—and then reassigned—under the OPLAN or TACON of various commanders, based on how the campaign is progressing.

5. **C2 Systems/Hardware:** Current C2 systems are not optimized to provide the consolidated, domain-based awareness of Red and Blue forces required to effectively PDMA cross-domain operations. (Related to SA)
6. **Service Parochialism/Bias:** Institutional bias and resistance to change creates hurdles to unity of effort across C2 functions.
7. **Poor Understanding of the use of Capabilities across Domains:** Due to functional area and service stovepipes, as well as classifications impediments, warfighters may be unaware of non-traditional capabilities that could be used to shape a domain and solve access problems.
8. **Prioritization of Assets across Lower Operational and Tactical Commanders:** XDO may require the timely transition of capabilities among commanders. In a dynamic, communications-denied environment, this prioritization of assets and missions will have to be accomplished through collaboration between lower-level commanders.
9. **Risk Management:** Commanders will be forced to make choices between force protection and operational employment considerations.

Table 2 summarizes the primary C2 problems, organized by the following operational functions: command and control, intelligence, fires, sustainment, and operational protection.

Command and Control	
Planning	Highly centralized approval authorities; denied and degraded environments; limited interoperability with coalition partners; lack of environmental awareness; duplicative systems; functional component parochialism in specific domains, along with institutional bias and resistance.
Directing	Lack of secure and reliable communications; hierarchical logistics structures and apportionment processes; no single common operating picture; over-classification of information; lack of XDO C2 training; rapidly changing role of the Commanders; lack of geographic proximity between commanders.
Monitoring	Lack of understanding regarding operational effects; over-manned organizations; over-reliance on technology; internally focused monitoring; unclear and unfocused commander's intent and guidance.
Assessing	Post-strike modifications; common awareness of XDO requirements; consistent assessment practices.
Intelligence	
Planning	Disjointed Collection Management...different collection platforms, TTPs, and products from various services and nations; greater Intel requirements than assets available; unorganized and ill-defined cross-domain processes for intelligence tasking; different doctrinal definitions among coalition partners; lack an effective joint intelligence preparation of the environment (JIPOE) for cross-domain operations; competing COCOM requirements.
Directing	Lack of understanding of adversarial intentions, capabilities, and employment of forces; overreliance on full-motion video; shortened intelligence-operations cycle; no common operations-intelligence picture; limited broadcast of intelligence updates to entire C2 system; TTPs and ISR CONOPS require refinement; operations-intelligence coordination is insufficient; over-reliance on communications for reach back.
Monitoring	Lack of evolved situational awareness regarding strategic intelligence; insufficient speed of analysis, limited situational awareness and ability to analyze domain access requirements, capabilities, and operational effects; multiple COPs; lack effective prioritization of low density, high-demand assets.

Assessing	Lack of common data storage, knowledge management practices, and decision aids; lack timely intelligence assessments; lack the capability to self-assess the effectiveness of the intelligence process; need to reassess balance between subjective and objective analysis techniques and results; lack new JIPOE baseline for XDO; classification barriers stymie intelligence sharing.
Fires	
Planning	None identified.
Directing	None identified.
Monitoring	None identified.
Assessing	Risk-averse decision-making.
Sustainment	
Planning	Dispersing forces among several locations requires placing required infrastructure support at all potential bases; difficulty in sustaining seabasing operations; locations of high-tech weapons reload facilities within adversary weapon ranges.
Directing	None identified.
Monitoring	Requirement for awareness of all forces operating in all domains to support dispersed resupply operations.
Assessing	The lack of more secure and redundant logistics communications systems enables adversaries to inject corrupt data into our supply network, degrading our ability to accurately assess the effectiveness of our sustainment actions.
Operational Protection	
Planning	The difficulty in concealing forces which have been dispersed for extended periods of time; the inability to accept and distribute risk to mission and effectively allocate forces across domains, to include the allocation of force protection assets at the expense of another mission or task; the inability to distinguish operations that harden and defend assets; the difficulty in developing plans to deal with focused enemy attacks when possessing limited "defeat" resources.
Directing	Inability to distinguish force protection operations between units; changing nature of force protection and associated decision-making requirements; transport layer vulnerabilities; difficulty in directing forces that must remain covert or undetected to prevent being targeted.
Monitoring	None identified.
Assessing	Lack of information/intelligence sharing with force protection units.

Table 2: Participant-identified C2 Problems

OVERVIEW OF C2 OPTIONS

Pod A1

A1 was tasked with developing a domain-based approach that was flexible, simple, and improved operational integration at lower echelons. This system was led by a standing Air-Sea Battle Commander (ASB CDR) and a supporting cross-domain staff responsible for planning, directing, monitoring and assessing A2/AD and power projection efforts in the JOA. The ASB CDR had operational control of multiple Cross-Domain Operations Mission Commanders (XDO Mission CDRs), who in turn had tactical control of joint and coalition forces, based on the mission assigned by the ASB CDR. On-station forces were initially assigned to particular XDO Mission CDRs based on the standing OPLAN, as modified by ASB CDR Guidance, with follow-on forces assigned by the ASB CDR to XDO Mission CDRs as required. The cross-domain staffs supporting each XDO Mission CDR maintained the ability to coordinate and integrate personnel and forces to execute XDO missions designed to disrupt, destroy or defeat enemy forces.

Pushing the XDO capability to the XDO Mission Commander level would enable decentralized planning and execution.

Pod A2

A2 was tasked with developing a domain-based C2 structure. This C2 structure was centered on a JTF Commander with subordinate Domain Commanders (DCs) tasked with gaining access and operating within a specific domain. Each DC would have OPCON of assigned forces and TACON of forces or capabilities supplied temporarily by other DCs to accomplish specific missions. When utilizing forces or capabilities supplied by other DCs in concert with his/her own forces, the DC would establish a cross-domain task group (XDO TG). Control measures and PDMA would be done by an XDO coordinator at the JTF level working with XDO cells in each DC staff. This C2 system addresses the challenges associated with a communications degraded environment by pushing XDO functions down to the DC.

Pod A3

A3 was tasked with developing a domain-based C2 system that fosters decentralized execution. This C2 system used a combined joint task force (CJTF) subordinate to the geographic combatant commander (GCC) to oversee and lead operations in the JOA. The CJTF Commander (CJTF CDR) has the authority to establish multiple mission-focused subordinate combined joint task groups (CJTGs), combined joint task units (CJTUs), and combined joint task elements (CJTEs) as necessary to accomplish its assigned mission and tasks. The CJTF CDR will select the most appropriate domain commander (e.g., maritime, land, cyber, etc.) to lead these subordinate commands. For example, the CJTF maritime domain commander might have a few subordinate CTGs. Cross-domain synergy is accomplished in this C2 structure at the GCC, CJTF CDR, and each of the subordinate combined and joint headquarters units.

Each Commander's principle mission is to combine effects to create asymmetric dilemmas for the enemy. There is no one central XDO coordination center. Clearly, comprehensive integration at all levels and the adoption and embracement of dynamic and flexible support relationships will be necessary for this C2 structure to be effective. These paradigm shifts will require training, education and in some cases a cultural shift. This C2 structure relies on centralized planning and decentralized execution which is not to say that planning only occurs at the highest echelons. In fact, planning occurs at every echelon but is informed and guided by an overall centralized plan consisting of clearly stated mission oriented commanders guidance, intent, and an overall desired end state. In this manner, unity of command and unity of effort are maintained while affording the highest degree of flexibility and adaptability. Reliance on informed initiative and trust of subordinates is just as important as simplicity and flexibility in this C2 arrangement.

Pod B1

B1 is characterized by a Joint Force Commander (JFC) who also serves as the Fires/Maneuver/Movement Commander (F/M/M CDR) and is responsible for initially executing all missions to gain and maintain access in accordance with ASB precepts. As access allows across the various domains, this commander will execute missions to achieve broader military

end states by projecting power. The Protection Commander, who is subordinate to the JFC, as well as the F/M/M CDR, executes Operational Protection missions for all forces and places assigned by the F/M/M CDR. The Protection Commander has four primary subordinate mission Task Group commanders, who are responsible for planning and executing missions in the areas of Ballistic Missile Defense (BMD), Space, Cyber, and Sustainment.

Pod B2

B2 emphasized Mission Command and attempted to maximize the ability to operate in a communications challenged environment through the use of a Cross-Domain Operations (XDO) Board at the Combined Joint Task Force Commander (CJTF CDR) level and the employment of multiple Cross-Domain Commands (XDCs) as the mission dictates. Because of the emphasis on mission command and commander's guidance and intent, the XDC Commanders have authority and responsibility for assigned forces and are the point of integration for cross-domain effects for the mission. An XDC would be scalable and tailored to the mission, as determined by the CJTF CDR.

Pod B3

This C2 system used a sub-unified combined task force (CTF) subordinate to the geographic combatant commander to run operations in the JOA. With the U.S. as lead nation among the coalition, the CTF commander utilizes three functional subordinate commanders to manage forces and operations. The Fires, Movement, and Maneuver Commander would conduct offensive attack, offensive cyber operations, offensive space operations, and maneuver focused on the Disrupt and Destroy lines of ASB. A Protection Commander would be responsible for defending forces flowing into theater, focused on the disrupt and defeat lines of ASB, while a Sustainment Commander would provide control, prioritization, and direction for logistics functions supporting operations in the JOA. This structure is intended to enhance cross-domain synergy by breaking down the domain-centric control of force application by operationalizing a matrix-based organizational model where forces are primarily OPCON to the three functional commanders and provided to lower-echelon commanders via short-term TACON relationships.

ANALYSIS AND RESULTS

Participants from Team A and B selected mission accomplishment and unity of effort as the most important criteria for assessing the performance of future XDO C2 systems. Based on the criteria weighting and the subsequent comparisons of the various C2 systems, the workshop results indicated a clear preference for option A1 among the three Team A options, with A1 being the preferred choice across all 10 general criteria and 6 JOAC criteria. In team B, option B2 scored marginally better than options B1 and B3 from a total score perspective, and was the preferred choice for only 4 of the 10 general criteria and 4 of the 6 JOAC criteria. A summary of responses for both sets of criteria are provided in figures 4 and 5.

Team A											
	unity of effort	resiliency	flexibility	simplicity	continuity	span of control	stability	interoperability	span of understanding	mission accomplishment	Score
A1	5.04%	4.43%	4.28%	5.01%	2.69%	2.06%	2.78%	3.06%	3.04%	10.11%	42.48%
A2	3.84%	2.72%	3.31%	3.30%	1.47%	2.12%	1.96%	2.62%	2.22%	6.74%	30.29%
A3	3.12%	2.92%	3.10%	2.24%	1.90%	1.39%	1.58%	2.97%	2.07%	5.62%	26.90%

Team B											
	unity of effort	resiliency	flexibility	simplicity	continuity	span of control	stability	interoperability	span of understanding	mission accomplishment	Score
B1 Fires w/sub Protection (Flexible)	3.27%	2.83%	2.59%	3.20%	2.40%	1.70%	2.47%	2.73%	3.47%	7.82%	32.47%
B2 Cross Domain Commanders	3.79%	3.49%	3.11%	2.18%	2.33%	2.28%	2.19%	2.90%	3.37%	9.04%	34.69%
B3 Fires & Protection (Global Dist)	3.48%	3.01%	2.94%	2.42%	2.33%	2.54%	2.26%	2.90%	3.27%	7.57%	32.73%

Team A		
Criteria	Weight	Rank
unity of effort	10.54%	2
resiliency	9.42%	4
flexibility	8.64%	5
simplicity	7.80%	7
continuity	7.05%	8
span of control	6.52%	10
stability	6.85%	9
interoperability	8.54%	6
span of understanding	10.22%	3
mission accomplishment	24.43%	1

Team B		
Criteria	Weight	Rank
unity of effort	11.99%	2
resiliency	10.06%	5
flexibility	10.69%	3
simplicity	10.66%	4
continuity	6.12%	9
span of control	5.57%	10
stability	6.31%	8
interoperability	8.73%	6
span of understanding	7.41%	7
mission accomplishment	22.46%	1

Figure 4: Player Weighting and Evaluation of General C2 Criteria

Team A							
	cross-boundary operations	global distances	comms challenged	space and cyber incorporation	operational integration	cross domain synergy	Score
A1	3.34%	3.09%	10.76%	4.47%	10.19%	8.57%	40.42%
A2	2.81%	2.41%	6.76%	4.47%	6.02%	6.48%	28.94%
A3	2.63%	3.09%	7.26%	4.60%	6.95%	5.85%	30.39%

Team B							
	cross-boundary operations	global distances	comms challenged	space and cyber incorporation	operational integration	cross domain synergy	Score
B1 Fires w/sub Protection (Flexible)	4.31%	3.10%	7.62%	4.86%	7.09%	5.29%	32.28%
B2 Cross Domain Commanders	4.57%	3.21%	9.09%	5.16%	6.89%	6.82%	35.74%
B3 Fires & Protection (Global Dist)	3.68%	4.38%	7.87%	4.57%	6.28%	4.94%	31.72%

Team A		
Criteria	Weight	Rank
cross-boundary operations	8.78%	5
global distances	8.59%	6
comms challenged	25.03%	1
space and cyber incorporation	13.54%	4
operational integration	23.16%	2
cross domain synergy	20.90%	3

Team B		
Criteria	Weight	Rank
cross-boundary operations	12.69%	5
global distances	10.69%	6
comms challenged	24.58%	1
space and cyber incorporation	14.73%	4
operational integration	20.27%	2
cross domain synergy	17.05%	3

Figure 5: Player Weighting and Evaluation of JOAC C2 Criteria

Overview of C2 Options

The goal of the workshop was to develop two different C2 options that could be examined - along with the current functional component model—in the Global 2013 Capstone event. Since the resulting characteristics of options A1 and B2 were quite similar, options A2 and B2 were selected—based on both their suitability and distinguishability—as the two workshop C2 models for follow-on examination.

Option A2: Domain-Based Commander Model

This structure was organized by domain commanders (DCs). DCs were responsible for gaining and maintaining access in their respective domains, while preventing the adversary from doing the same. Each domain commander would have OPLAN of assigned forces and TACON of forces or capabilities supplied by other DCs for specific missions. When utilizing forces or capabilities supplied by other DCs in concert with his or her own forces, the DC would establish a cross-domain task group (XDO TG). Control measures and PDMA would be done by an XDO coordinator at the CJTF level working with XDO cells in each DC staff. This C2 system addresses a communications degraded environment by pushing XDO functions down to domain commanders. This system also relies on significant and persistent training during peacetime to ensure seamless coordination and integration during a conflict.

The XDO Board consists of the Deputy CJTF and the respective J-Code deputies, augmented by functional LNOs and senior coalition representatives. The board is responsible for defining and evaluating missions, recommending apportionment of allocated and assigned forces among DCs, managing Title 10 and Title 50 capabilities integration, and coordinating with the CJTF staff to link to national and service force providers for sustainment and information. Information is fused at the XDC level. Based on the recommendation of the XDO Board, organic ISR assets are apportioned from CJTF to DC Commanders, and can be re-apportioned to other DCs based on evolving mission requirements and priorities. The DC Commanders control collection requirements. The XDO Board assesses mission essential sustainment requirements and recommends allocation and prioritization to DCs. This assessment is based on direct inputs from DC staffs which are then coordinated, integrated, and prioritized based on CJTF guidance. The Deputy CJTF directs allocation of sustainment to each DC in facilitate mission accomplishment. Each DC maintains a combined XDO coordination element comprised of Navy, Army, Marine, and Air Force personnel, as well as coalition partners. While prioritization of missions and capabilities normally occur at the XDO Board, when communications between the XDO Board and the DCs are lost, these XDO coordination elements coordinate requirements, capabilities and effects across domains. Once XDO Task Groups are formed, local tactical control is delegated to assure continuity of operations. Figure 6 is a graphical depiction of the domain-based commander model, C2 Option A2.

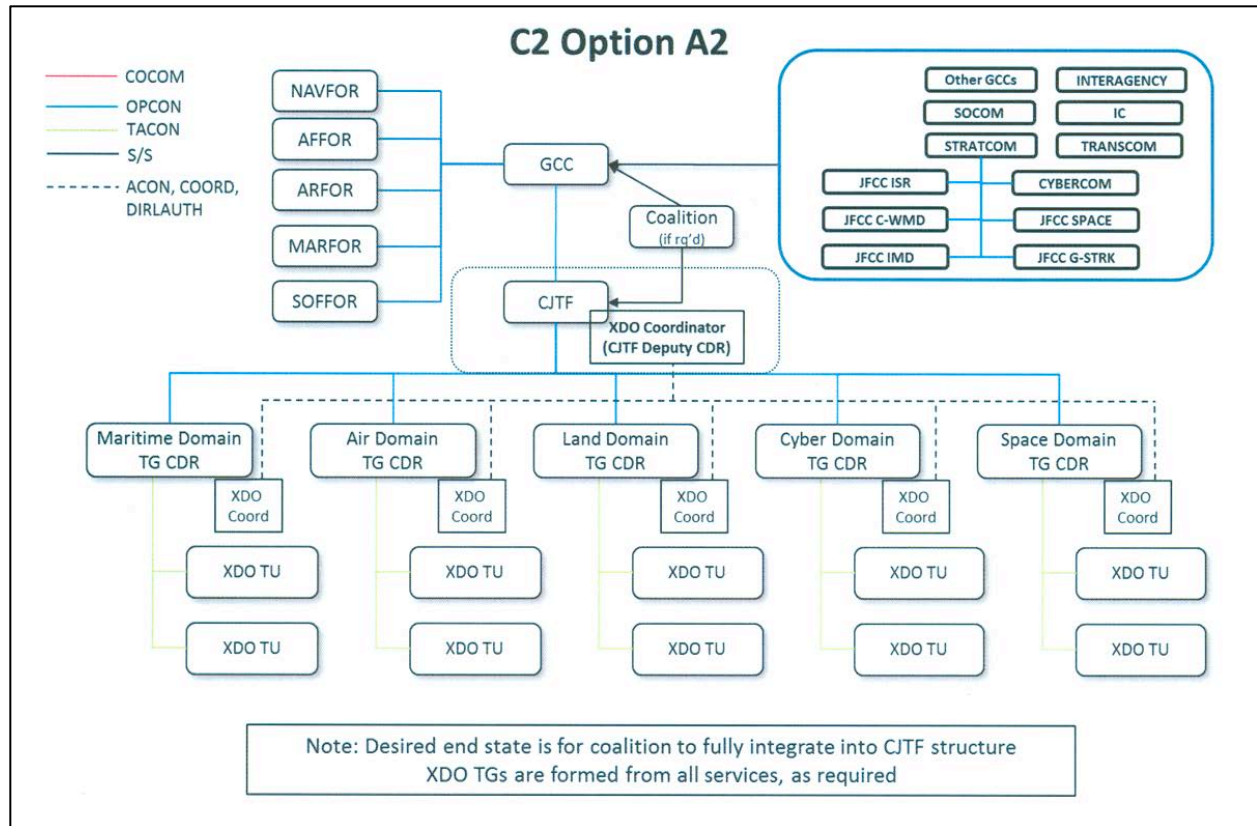


Figure 6: Domain-Based Commander Model

Option B2: Cross-Domain Commander Model

This system emphasized Mission Command and the ability to operate in a communications-degraded environment. This system was organized by Cross-Domain Commanders (XDCs). XDCs are mission based and can be scalable and tailorable to the conflict or region. Keeping the number of XDCs to no greater than five or six will help mitigate potential span of control problems. Each XDC has the authority and responsibility for the forces—as assigned by the CJTF CDR—to complete a specific mission or line of effort. XDCs have OPCON of all assigned forces and can delegate TACON as appropriate. Depending on the mission, XDCs may be in a supporting or supported relationships with other XDCs by order of the CJTF CDR. This model depends greatly on the CJTF CDR's intent & mission orders having sufficient clarity to enable subordinate commanders to operate without additional guidance. Most effects generated in this system are integrated at the XDC level, but can be delegated to appropriate subordinate levels when communications are denied or degraded. The creation and execution of XDCs should be exercised freely as new missions or lines of effort dictate.

Similar to option A2 described previously, this model accounts for an XDO Board at the CJTF level which is responsible for defining and evaluating missions, and apportionment of allocated and assigned forces and assets to XDCs within the JTF as appropriate for assigned missions. Similarly, the XDO Board coordinates XDC staffs to link to national and service force providers for sustainment and information requirements and capabilities. Other similarities to option A2 include intelligence fusion and coordination with national intelligence capabilities conducted by

a dedicated cell located on the CJTF staff. Similarly, coalition forces would also integrate into subcommands or joint task groups based on tailored mission. Accordingly, forces were primarily organized under separate joint integrated task groups by mission or warfare area (e.g., USW, SOF, SUW, Air, etc.). As previously noted, these forces could be delegated TACON to other XDCs as conflict evolves and the prioritization of these missions change. Figure 7 is graphical depiction of the cross-domain commander model, C2 Option B2.

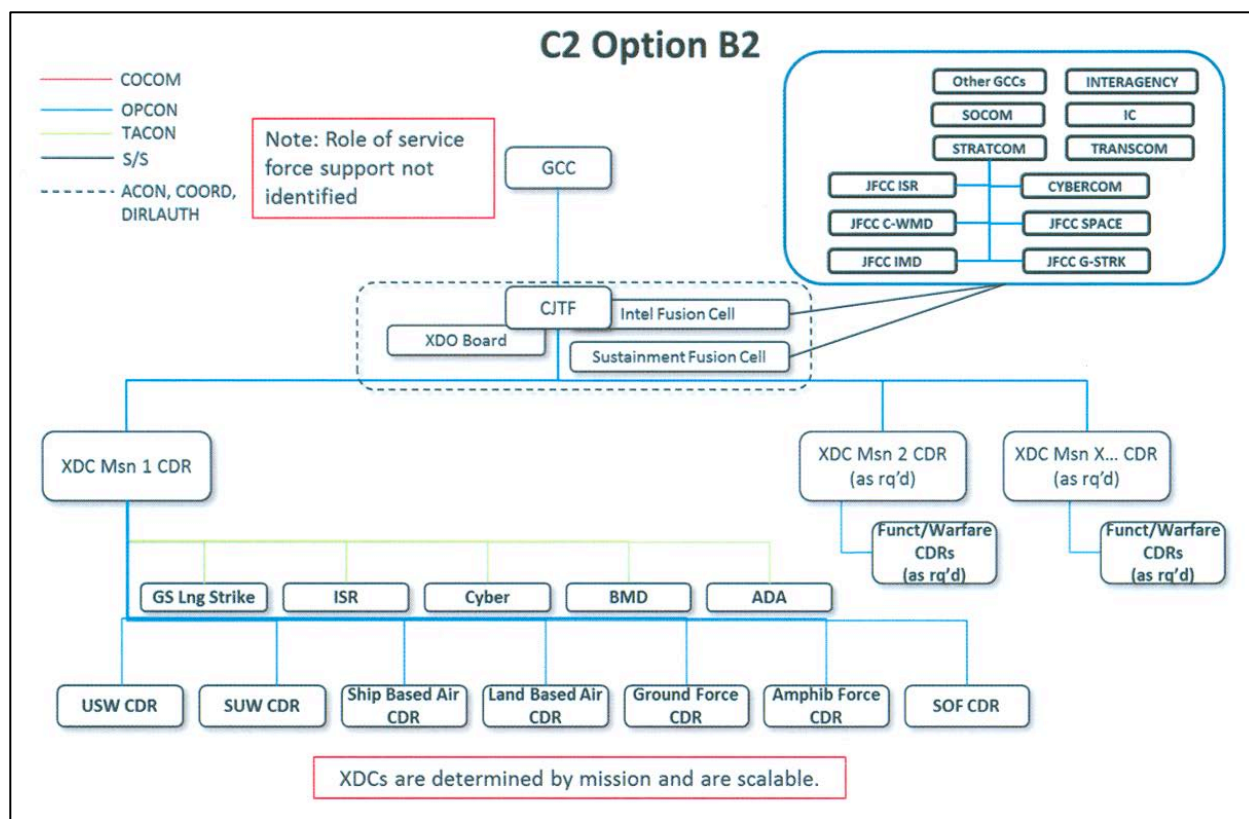


Figure 7: Cross-Domain Commander Model

IV. C2 Criteria Refinement

In addition to the 10 general C2 criteria which were a result of the C2 Requirements Online Workshop, the following 6 additional criteria were derived from the Joint Operational Access Concept and were used to evaluate the options developed in the C2 Options Workshop:

Cross-Boundary Operations: The C2 structure is capable of supporting combat operations which commence immediately upon deployment and span multiple areas of responsibilities en route to the operational area; supports the integration of capabilities of geographical and functional combatant commanders with overlapping responsibilities.

Global Distances: The C2 structure is capable of directing and coordinating forces originating well outside the theater of operations which deploy and maneuver independently on multiple lines of operation from multiple points of origin, and concentrate fluidly as required.

Communications Challenged: A C2 environment characterized by degraded, denied, or hostile (use of EM spectrum increases risk of attack) communication networks.

Operational Integration: High tempo, synchronized operations characterized by the use of mission command-type orders, and decentralized planning and execution at the lowest possible levels.

Space and Cyber Incorporation: A C2 structure which fully includes space and cyberspace operations, enabling forces to exploit fleeting local opportunities for disrupting enemy systems.

Cross-Domain Synergy: A C2 structure capable of leveraging capabilities in different domains such that each enhances and compensates for the vulnerabilities of the others in order to establish superiority in some combination of domains that will provide the freedom of action required by the mission.

Following the C2 Options Workshop, the combined list of 16 criteria was reduced to the following 8, as these criteria were the ones—based on the participant’s AHP results—that were statistically most significant in differentiating between the various options:

- Unity of Effort
- Flexibility
- Simplicity
- Resiliency
- Communications Challenged
- Operational Integration
- Cross-Domain Synergy
- Global Distances

FLAG OFFICER AND GENERAL OFFICER ELECTRONIC QUESTIONNAIRE

These eight criteria were incorporated into a second questionnaire and were distributed to U.S. Flag and General Officers (FOGOs) to get their perspective regarding which C2 criteria were most relevant from an XDO perspective.

C2 Criteria Assessment

Questions 1-8 of the Flag and General Officer electronic survey asked respondents to distribute 100 total points across eight criteria based on their relative importance to evaluating the performance of joint XDO C2 structures. The sum of points from all 27 survey respondents generated the following criteria ranking: 1) unity of effort; 2) operational integration; 3) simplicity; 4) resiliency; 5) flexibility; 6) communications challenged; 7) cross-domain synergy; and 8) global distances. The below figure provides a summary of total points for each of the eight criteria.

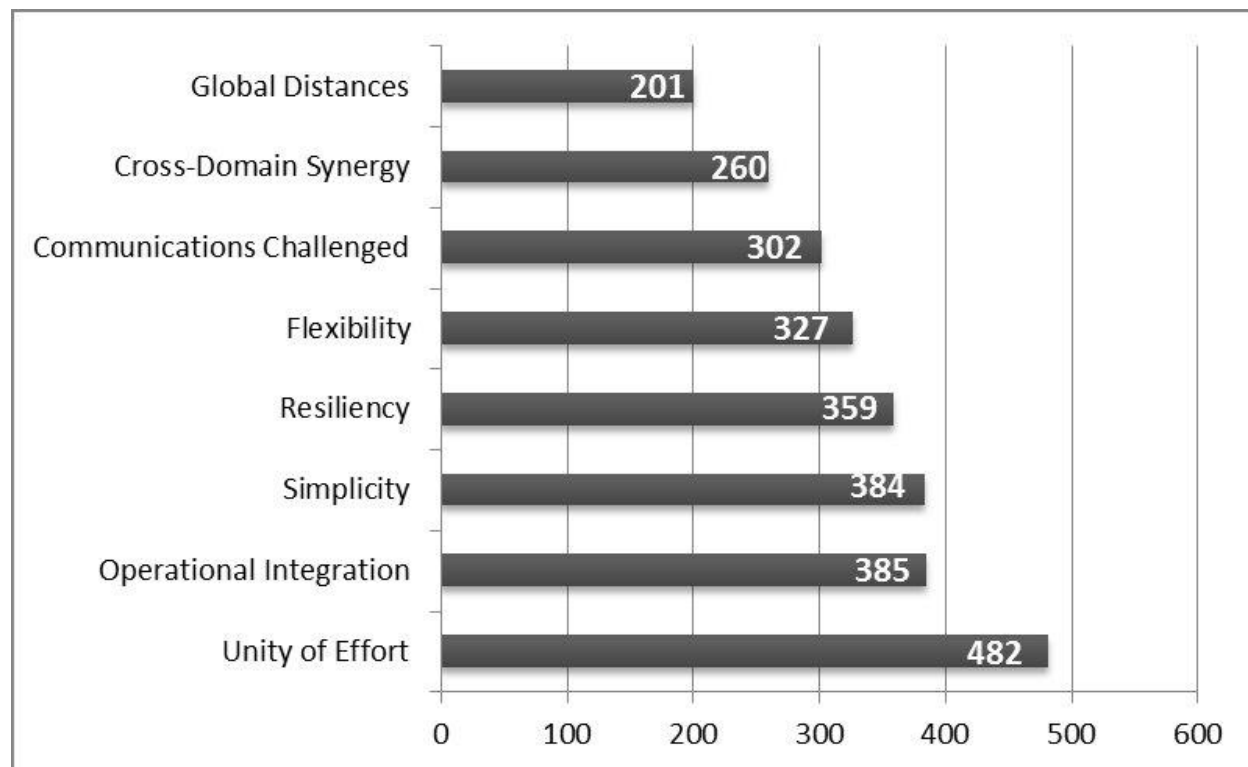


Figure 8: Summary of Points for Eight C2 Criteria

Additional C2 Criteria

In addition to the eight criteria assessed in figure 8, participants also responded to an open-ended question asking for any additional C2 criterion for evaluating the performance of joint XDO C2 structures at the operational level of war. Participant responses focused on criteria that maximize information superiority and coalition and joint integration and interoperability. Information superiority was viewed as the understanding of a “C2 system(s) architecture, vulnerabilities, adversary capabilities, and adversary actions on or against the system(s) in real-time.” Situational awareness across the command and control system should also maintain the “ability to

understand the enemy's order of battle, guidance and intent across all domains and distribute information rapidly and assuredly across friendly forces in order to increase effectiveness of the joint force.” Achieving information superiority in an A2/AD environment “will enable defense of the system and the ability to counter the adversary to ensure system integrity and therefore viability.” It will also enhance the ability of commanders “to out think, plan, direct, and assesses the fight of his opponent.”

Several FOGOs noted that future military operations in A2/AD environments “will be executed with some type of coalition support.” The seamless integration of coalition partners into a common command and control system becomes more vital when executing cross-domain operations in an A2/AD environment. This system would enable forces to leverage allied capabilities in one to domain to gain or maintain access in other domains. For this to occur, the system “must incorporate the expertise and authorities of partner nations in any operation.” It must also support the ability for nations to organize, train, and equip personnel to “fill the joint or coalition manning document in a timely manner and achieve the necessary joint staff coherence that the speed of the problem demands.” Specific capabilities and enablers identified include: tactics techniques, and procedures; equipment and technology; foreign disclosure policy; LNO exchanges; and a common commitment of cooperation, coordination, and transparency to build and maintain trust during all phases of an operation.

The efforts of the Global '13 project strive to maximize the proficiencies of a single C2 system that integrates all capabilities from across the services. One participant noted, “While this may be extremely advantageous, the Services continue to develop independent solutions for controlling forces and resources.” A single solution will require interoperable systems that can share and process data real-time across service organizations and operations centers. The Joint Logistics Enterprise (JLEnt) was identified as “a great example of the way ahead.”

Final C2 Criteria

After reviewing the results of the FOGO questionnaire, the following 6 criteria were settled upon as those criteria that would be used during the Capstone event:

1. **Unity of Effort:** The C2 construct ensures that all execution decisions and apportionment requests remain aligned with the operation's mission and commander's intent. The organizational structure fosters a sense of cohesion and unity of purpose from planning to directing to monitoring to assessing.
2. **Flexibility:** The C2 construct is broadly adaptable to a wide range of regions and tasks. The organization can expand or contract with changing circumstances without serious loss of effectiveness. It is able to respond to changes in mission and resources. Information is acquired and passed quickly and reliably to help build the situational awareness of subordinate, superior and adjacent commands. It exercises decentralized execution, delegates specific defined functions, and rapidly deploys forces to meet specific situations.
3. **Simplicity:** Chain of command is clear and straightforward. Responsibilities and authorities are clearly delineated with no overlap. Subordinate commands are

- responsible to no more than one superior at any given time. Processes and procedures are straightforward and foster clear direct communication.
4. **Resiliency:** The positive ability of the C2 system or a specific organization to adapt and overcome setbacks and fill important positions quickly and satisfactorily. This robustness is also a function of the number of command layers, degree of centralization vs. decentralization, and reliability of supporting C4ISR systems under degraded, denied or hostile communications environments.
 5. **Operational Integration:** A C2 system capable directing and coordinating high tempo, distributed, synchronized operations characterized by the use of mission command-type orders, and decentralized planning and execution at the lowest possible levels across the force, regardless of service, nationality or physical distances, concentrating their efforts seamlessly.
 6. **Cross-Domain Synergy:** A C2 system capable of leveraging capabilities in different domains such that each enhances the strengths and compensates for the vulnerabilities of the others in order to establish superiority in some combination of domains that will provide the freedom of action required by the mission. A high degree of situational awareness and battle-space sense-making is a necessary enabler.

V. Global Capstone Event

OVERVIEW

The Global '13 Capstone Event was conducted 23–27 September, 2013 at the U.S. Naval War College in Newport, RI. The participants were divided into three combined Operational Planning Teams (OPTs) which were notionally formed by the Geographic Combatant Commander (GCC) of a fictional region. Consisting of a scenario where regional tensions were escalating between an antagonistic Red and their regional neighbors, the GCC directed that contingency planning be conducted which would focus on the refinement of possible C2 arrangements for a combined task force to deal with the situation.

Each OPT was assigned one of three possible C2 structures: a functional component commander based model and two novel approaches developed during the Options Workshop, one based on a “Domain Commander” and another based on a “Cross-Domain Commander.” The six criteria (or governing factors) which were identified prior to the event were used to guide the development of each candidate C2 structure.

In addition to identifying command relationships and authorities, each OPT determined how their respective C2 structure addressed four key processes of interest—deliberate and dynamic targeting, intelligence tasking, collection, processing, exploitation, analysis, production, dissemination and integration, integrated air and missile defense (IAMD), and sustainment.

Four vignettes which incorporated Red courses of action and likely Blue Coalition actions were used to stress and potentially drive improvements to the candidate C2 structures. The vignettes posed “what if” type problems to facilitate the critical analysis of a given C2 structure.

Once all the C2 structures were modified in response to the vignettes and subjected to a “Peer Review” by all three OPTs, the finalized C2 structures were presented to the GCC (in the form of a flag panel, composed of 17 FOGO participants) during a “Super Plenary” session which was attended by all participants.

It is important to remember that the Capstone event was modeled on a planning activity to recommend C2 arrangements, and was not a course of action (COA) development or move-step gaming activity intended to “fight the fight” and defeat Red. The OPTs were planning for the C2 of a possible future conflict against Red, not conducting the actual operation.

PRE-VIGNETTE WORK

An Operational Environment/Road to Crisis (OE/RTC) described the geography and the relationships among the nations within the fictional region, as well as the military capability of

the regional antagonist, Red. It introduced a sequence of events which served to escalate tension in the region and lead to hostilities.

Participants were to assume that all Blue coalition governments would support full participation of their military forces in potential Blue coalition operations versus Red, and that coalition of countries (AUS, CAN, GBR, JPN and U.S.) would act in concert to deter Red, and should deterrence fail, defeat Red's A2/AD capabilities and their ability to achieve their regional military objectives. Due to Blue's anticipated heavy reliance on advanced communications systems, participants were also to assume that Red would attempt to degrade Blue's use of the electromagnetic spectrum, to include disruption of space and cyber systems, targeting both fielded forces and headquarters' C2 systems.

Up to this point, there had been little information pertaining to the C2 structures as to HOW certain activities would be conducted. While previous workshops defined some of the roles and responsibilities associated with given command nodes, the level of detail and completeness was insufficient for continued analysis. The participants therefore first described how the following processes were conducted within their particular C2 structure, focusing on their command node roles and responsibilities:

- **Deliberate and Dynamic Targeting:** Described how the C2 system identified, developed and prioritized (and re-prioritized) targets, to include deliberate and dynamic targets. How did the C2 system identify available forces (to include cyberspace, space and coalition forces) and assign (or re-assign) them to targets/missions?
- **Intelligence Process:** Described the all-domain intelligence architecture organic to the C2 system which supported national and theater level ISR management, I&W, SA building, and targeting.
- **Integrated Air and Missile Defense (IAMD):** Described the C2 arrangements to defend against aircraft, cruise and ballistic missiles from a theater or JOA perspective.
- **Sustainment:** Described the process by which logistic requirements (supply and maintenance) were identified and prioritized, limited logistic resources were allocated and directed, and effectiveness was assessed.

Given the limited amount of time available for this part of the event, participants focused on identifying where in their C2 structure key decisions are made as part of a particular process. Requirements prioritization, resource allocation, direction and adjustment, and assessment decisions were therefore of the most interest. Interest in a given decision was further increased when aspects of urgency, uncertainty, interdependency and dynamic change were present.

Once all sub-processes had been assigned, each process group briefed the cell lead and the team on the rationale for their sub-process assignments, and entered the data into the game tool.

VIGNETTE-BASED WORK

Vignettes were briefed via PowerPoint presentation. Vignette drivers came in two forms: the C2 system evaluation criteria, as well as "exemplars" which asked the participants to trace out a particular process based on XDO-related problems.

Based on the cell's current C2 system (structure plus processes), cells initially determined their system's strengths and weaknesses (S/W) using the six C2 criteria. To generate the initial S/W, participants individually wrote down any criteria based S/Ws on Post-It Notes, which were then discussed, clustered, summarized and prioritized prior to being entered into the game tool. Based on the weaknesses identified above, and tackled in priority order, participants made changes to their C2 structure.

After completing the desired changes per weaknesses, the facilitator posed a series of specific questions or "exemplars" using details from the current vignette. Exemplars were designed to provide specific "what if" situations to help "wring-out" the four key processes above, which in turn had been mapped to ten XDO problems associated with the six operational functions derived from the C2 Options Workshop. The exemplars were not all inclusive; rather they exemplified the type of problem a cross-domain C2 system should be able to address. In the interest of time, not all functions or processes were examined during every vignette. Rather, the exemplars were distributed across the four vignettes in order to limit the breadth—but increase the depth—of analysis during each vignette. Organized by operational functions, the following questions were used to focus the C2 system review:

1. **Command and Control:** How does this C2 structure facilitate a high degree of integration and synchronization in planning and execution across multiple domains simultaneously (and at lower echelons) at an operating tempo the enemy cannot match? (*Focus Area: XDO Synergy, Mission Command*).
2. **Intelligence:** How is information (to include that gathered through computer network exploitation) tasked, collected, processed, exploited, analyzed, produced, disseminated and integrated within this C2 structure to facilitate XDO (I&W, targeting, situational awareness, etc.)? (*Focus Area: Sense-Making*).
3. **Maneuver:** How does this C2 structure support distributed forces operating at global distances, deploying and maneuvering independently on multiples lines of operations from multiple points of origin, and concentrating fluidly as required? (*Focus Area: Distributed Forces Over Global Distances*).
4. **Fires:** How does this C2 structure provide for the rapid re-tasking of employed units in any domain (implies reaching across *organizational, service and national C2 divisions*) to exploit transient, localized opportunities? Includes the reallocation of an asset between different chains of command (COC), and the retasking of assets, based on mission priority (*Focus Area: Re-Allocation of Forces*).
 - a. How does this C2 structure provide for access to and the coordination or integration of offensive cyberspace capabilities in a joint access campaign? (*Focus Area: Cyberspace Integration*)
 - b. How does this C2 structure provide for access to and the coordination or integration of space capabilities in a joint access campaign? (*Focus Area: Space Integration*)
 - c. How does this C2 structure provide for the coordination or integration of coalition forces with varying degrees of participation? (*Focus Area: Coalition Force Integration*)

- d. How does this C2 structure conduct deliberate and dynamic targeting at a pace commensurate with XDO? (*Focus Area: Re-Prioritization of Targets*).
5. **Operational Protection:** How does this C2 structure facilitate the direction and coordination of force protection, to include integrated air and ballistic missile defense and computer network defense?
6. **Sustainment:** How does this C2 structure provide the necessary visibility of force status to enable real-time C2 of sustainment forces in support of rapidly changing XDO?

At the end of each vignette, each participant completed a Likert survey to assess the C2 system's overall strength and weakness relative to the C2 criteria. The facilitator monitored the survey results, in particular looking for outliers or disparities in the results, which were then discussed with the group in order to help the participants continue to refine their ability to assess the effectiveness of a C2 system.

POST-VIGNETTE WORK/PRE-PLenary

Once the vignette portion of the event was completed, each team prepared two products. One was a brief for the participating FOGOs which explained the philosophy behind the C2 option they were given to examine and how it evolved over the course of the work. The second product was a final plenary briefing consisting of their final C2 structural configuration, including all relationships and key processes; the predominant strengths and weaknesses of the resulting C2 system in terms of the criteria; and any final thoughts or observations. As there had been no plenary or other "cross-talk" events earlier in the week, a "peer review" session was conducted with the members of the other OPTs one day prior to the final plenary session. During this session, cell leads presented their draft C2 system briefs for the purpose of receiving constructive criticism from the other teams. Participants from the opposite teams first entered criteria-based weaknesses into the game tool, and then were able to question and further discuss aspects of the particular C2 system. At the completion of all three C2 briefings, participants returned to their cells and determined which, if any, weaknesses they wished to address in their final plenary brief. During this update period, the cell leads briefed the participating FOGOs on their respective C2 options, which prepared the FOGOs to actively participate in the final plenary session the following day.

FINAL PLENARY

The final plenary was attended by all participants. Each team presented their final C2 system brief, followed by a short question & answer session intended to provide any required clarification or amplification. The intent of these activities was to provide the fullest description of each C2 system in a consistent format to enable an informed vote via AHP to determine the preferred C2 option. Once the participants used the AHP tool to conduct personal pair-wise comparisons, the plenary facilitator displayed the results in two groups—FOGO and general participants—as a means to stimulate discussion, which was captured using the Web-IQ threaded-discussion tool.

SUMMARY OF GAME PLAY

Option A: Domain CDR Model

Overview

This model uses domains (maritime, air, land, space, and cyber) as its organizing principle. Domain Commanders are responsible for gaining, maintaining, and exploiting access within the assigned domain and denying the enemy from doing the same. They also exercise Operational Control over joint and combined forces rather than relying on support relationships between functional components.

Force is allocated based on the anticipated need to project power through given domains, the threats to forces operating in those domains, and the need to disrupt, destroy or defeat those same domain threats. XDO Centers with each Domain Commander use Integrated Tasking Orders to provide direction to subordinate Combined Joint Task Units (CJTU) and control/coordinating instructions for CJTUs from other domain commanders which are operating in the same physical domain (e.g., airspace deconfliction, water space management, fire control measures, etc.).

The CJTU is a tailored, combined-arms, joint force which includes coalition forces and has either a mission or geographic orientation. This organization enables self-synchronization within the close fight in a degraded communications environment.

Organizational Philosophy

Domains are the organizing principle for this system. Domain commanders seek to gain, maintain, and exploit access within their assigned domain and deny the enemy from doing the same. This may include taking action in other domains with attached forces for the purpose of affecting the assigned domain. Domain Commanders exercise OPCON over joint, combined forces rather than relying on support relationships between functional components. This may enhance the combined forces' ability to gain more responsive, flexible, and integrated use of the full spectrum of military capabilities. The A2/AD challenge is expressed in terms of risk to own force while attempting to operate within a given domain. Degrading the commander's ability to control forces will be part of an adversary's A2/AD strategy. The Domain approach puts the C2 solution into the same terms as the A2/AD problem.

The Defense Strategic Guidance and the Joint Operational Access Concept acknowledge that rolling back the A2/AD threat, peeling the threats back layer by layer, will be too costly in terms of time and treasure. Rather, domain access must be managed according to time, space, and force requirements, as well as leveraging access opportunities—along with low signature forces—in one domain to reduce risk and create opportunities in other domains. By Domain Commanders actively managing domains rather than managing the force through Functional Component Commanders, the CJTF maximizes his freedom of action.

The primary features of this domain-centric approach are the CJTF XDO Command Board, Domain Task Group Commanders, associated Cross-Domain Operations Centers (XDO Centers), and the subordinate Combined Joint Task Units (CJTUs). The commanders employ mission-type orders issuing priorities, engagement authorities, and terms of reference on how subordinate units are authorized to employ assigned forces, along with expectations for mutual support.

Force is allocated based on the anticipated need to project power through given domains, the threats to forces operating in those domains, and the need to disrupt, destroy or defeat those same domain threats. As such, the majority of forces allocated to a given domain will most likely be optimized to operate in that domain (e.g. naval forces will be assigned to the Maritime Domain TG). However, the remaining balance of force for a given Task Group (TG) will likely include forces traditionally associated with other services that operate in different domains (e.g., the Maritime Domain TG CDR may have attached a land-based artillery battery to counter coastal defense cruise missile launchers). This occurs only when those forces are determined to be most effective at countering threats to the assigned domain and best employed under that domain commander.

Structure

The CJTF, located at the Tier II level, has OPCON of all assigned and attached forces. The CJTF has broad responsibility for managing the campaign and cross-domain planning, including the initial allocation of forces to the Domain TG CDRs. Domain TG CDRs then form JTUs, establish authorities for support relationships, and ensure forces are trained and ready for the Domain TGs and CJTUs. The XDO Command Board is the primary coordination mechanism between the Domain TG XDO Centers and is responsible for target and critical asset prioritization and apportionment, as well as force re-allocation when necessary. A Joint Intelligence Support Element (JISE) arranges intelligence functions at the Tier II level and coordinates Tier III intelligence activities. Task force sustainment functions are managed through several centers and boards to include the following: CJTF Joint Logistics Operations Center (JLOC), Joint Deployment and Distribution Operations Center (JDDOC), the Daily Logistics/Movement Coordination Board (L/MCB), and the Joint Movement Center (JMC).

The Tier III level is divided into domain-based task groups—Maritime TG CDR, Air TG CDR, Land TG CDR, Cyber TG CDR, and the Space TG CDR. The Domain TG CDRs will define the CJTU's access requirements, and projection or protection (IAMD) objectives with mission-type orders. The Domain TG CDRs' XDO Centers provide resiliency through a matrix'd organizational structure of command (e.g., vertical) and control (e.g., horizontal). Domain TG CDRs are primarily responsible for managing their respective domains by working to lower risk in their assigned domain in order to accomplish the CJTF campaign plan. Domain commanders allocate forces between CJTUs; nominate, assign, and assess targets; and support intelligence functions.

The CJTU, located at the Tier IV level, is a tailored, joint force which includes allied forces. The CJTU structure strives to maximize simplicity at the tactical level. Organizing the CJTUs by mission or geography and directly coordinating with each other may allow them to self-synchronize in the close fight with degraded communications. CJTUs are pre-integrated through training and are allocated sufficient force to fulfill the majority of the CJTF's campaign objectives. As previously noted, Domain Commanders have the majority of the forces that they require to achieve their end state, with minimal reallocation of forces required. Figure 9 provides a graphical depiction of Team A's final C2 structure.

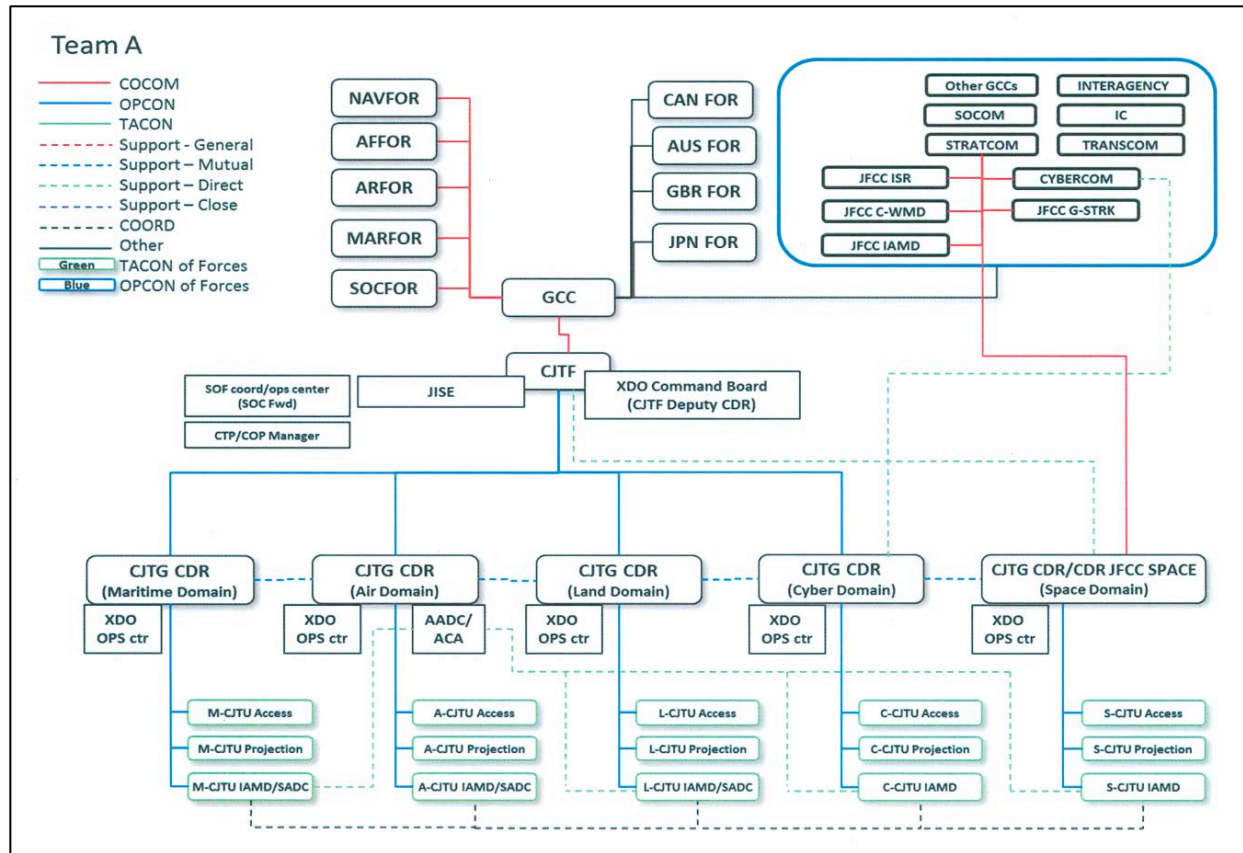


Figure 9: Team A Final C2 Structure

Targeting Process

Potential targets are identified, researched, developed, vetted, and validated, after which they are nominated to the CJTF's Joint Targeting Coordination Board (JTCB). The Joint Targeting Working Group (JTWG) builds a draft Joint Integrated Prioritized Target List (JIPTL). Targets are then prioritized and apportioned among domain commanders according to force capability, target types, geographical separation, mission alignment, risk, and other relevant factors.

After Domain TG CDRs assemble data on the current status (capability and availability) of friendly forces and munitions, they assign forces, munitions, and nonlethal capabilities to specific targets and aim points. Upon receipt of tasking orders, detailed planning is carried out at the CJTU level for operations against both deliberate and dynamic targets. The CJTF XDO Center and Domain XDO Centers coordinate to prioritize, assign, and deconflict force execution against critical, time-sensitive dynamic targets. Rapid re-tasking of assets is facilitated by the cognizant XDO Centers when one Domain TG CDR needs support from another.

Targeting assessments flow up from CJTUs to the Domain TG CDRs, who evaluates access and projection effectiveness for their respective domains. The CJTF then aggregates and evaluates domain assessments to provide a clear picture of effects achieved, priority targets not engaged, and the overall progress of the campaign.

Intelligence Process

Planning and direction of intelligence functions and collections efforts are focused at the CJTF staff and the JISE. Within the JISE, the Collections Operations Cell chairs the daily Domain Collections Working Group and participates in the daily Joint Collections Management Board at the GCC level. The Collections Operations Cell (COC) drafts the daily collections tasking order for dissemination to Domain TG CDRs' staffs for execution while concurrently monitoring the status of ongoing collections' efforts. The COC has the ability to direct dynamic re-tasking of assets if required by the CJTF. The JISE is co-located with JTCB and JTWG. This integration of operations and intelligence better informs the CJTF staff and supports effective tasking of Domain TG CDRs.

Processing, Exploitation, Analysis, Production, Dissemination and Integration (PEAPDI) is performed concurrently by the CJTF CDRs and Domain TG CDRs. This effort aims to build the tactical and common intelligence pictures. Target assignment and assessment is also performed at the Tier III level with close support from the various intelligence functions.

Integrated Air and Missile Defense (IAMD) Process

The CJTF staff prioritizes, apportions, and allocates defensive IAMD resources. Critical asset nominations are prioritized by the XDO Board—chaired by the CJTF Deputy CDR—through the Criticality, Vulnerability and Threat (CVT) assessment process. The final Critical Asset List (CAL) is submitted to the CJTF CDR for approval. Once approved, the CAL is returned to the XDO Board for resource allocation. The Air Domain TG CDR is designated as the Area Air Defense Commander (AADC) with overall responsibility for executing IAMD at the Tier III level. As the AADC, the Air Domain TG CDR synchronizes IAMD across domains through the XDO Centers and assesses readiness of defensive units.

The IAMD CJTUs under each domain direct defensive actions for tactical execution of IAMD, and are in direct support of the AADC. To enable efficient tactical level performance across domains, the establishment of AMD cells at the CJTUs is employed to prevent fratricide, provide defense in depth, and deconflict fires between weapons systems. Maritime, Land and Air Domain CJTUs are delegated additional responsibilities as Sector Air Defense Commanders (SADCs). Cyber and Space CJTUs have IAMD cells (without the SADC designation) to ensure complete synergy and integration among all domains.

Sustainment Process

Due to the joint nature of the CJTU and the wide distribution of logistical assets between Domain TGs, sustainment processes are centralized at the CJTF staff, with organic supply and maintenance forces at the CJTU level. The CJTF Joint Logistics Operations Center (JLOC) coordinates and synchronizes logistic operations such as engineering, contracting, materiel readiness, mortuary affairs and host nation support. The CJTF's Joint Deployment and Distribution Operations Center (JDDOC) optimizes inter-theater and theater deployment, distribution, and sustainment operations. The Daily Logistics and Movement Coordination Board (LMCB) manage these functions to provide guidance, policies and priorities to the CJTF CDR. The Joint Movement Center (JMC) coordinates the employment of all means of transportation (including allies/Host Nation) to help execute the mission.

Coalition Integration

Assuming coalition governments fully support participation of their military forces in potential operations, coalition forces are integrated directly within the domain task groups to the greatest extent possible. All coalition partners retain national command of their forces, with national commanders residing within the CJTF. Coalition partners will transfer operational control to the CJTF, with the caveat that some coalition forces may be constrained by national ROE. A coalition officer could serve as the Deputy CDR of the Domain TG when coalition forces reside within that domain task group.

Sustainment and logistics remains a national responsibility. Sustainment and logistics will be provided under extant acquisition and cross-servicing agreements, with the CJTF theatre logistics commander (J4) responsible for prioritization and delivery. Integration of coalition intelligence capabilities will be driven by access controls and system interoperability. While unique collections capabilities provided by coalition partners can provide increased access and situational awareness, tasking ISR assets may be problematic across the coalition due to limitations imposed by national laws and restrictions.

Space Integration

U.S. Strategic Command's Joint Force Component Commander for Space (USSTRATCOM JFCC-Space) is dual-hatted as the CJTF's Space Domain TG CDR. This CDR remains OPCON to USSTRATCOM, and serves in direct support of the CJTF CDR. The GCC/CJTF may delegate TACON of specific CJTF forces to the Space Domain TG CDR to gain and maintain space superiority when and where required for the CJTF. Delegation may not include all required capabilities, which can be acquired through mutual support from other Domain TG CDRs as required.

The Joint Space Operations Center (JSPOC) at Vandenberg AFB, CA, is the control center for the JFCC-Space and is designated the Space Domain Operations Center (SDOC) for a given CJTF. Additional manpower can be provided as required to aid command and control of any attached CJTFs. SDOC will produce a Space Integrated Tasking Order that incorporates Domain Support Requests (DSRs) and Domain Control Requests (DCRs) to command assigned and attached forces and coordinate space operations.

Cyber Integration

Cyber Domain TG CDR operates in-theater as a dedicated asset to the CJTF CDR and commands those cyber forces that are prioritized to support the local conflict. U.S. Cyber Command (USCYBERCOM) directly supports the Cyber TG CDR by quickly providing cyber assets which are not located in theater to the Cyber Domain TG CDR. USCYBERCOM retains the authority for striking targets outside of the joint operating area. Cyber forces are attached OPCON to the Cyber Domain TG CDR to provide in-JOA offensive non-kinetic fires, with forces from other domains attached as necessary to accomplish cyber effects. Additional domain support beyond attached capabilities is requested through the Cyber XDO Center. The mutual support relationship engendered by the XDO Centers supports synergistic effects for access or force projection in other domains.

Authorities to use offensive cyber operations and prepare the operational environment are pushed down to Tiers III and IV, much like Defensive Cyber Operations. The Cyber Domain TG CDR

owns, operates, maintains, and defends all networks in theater with attached assets and may request unique Cyber Protection Teams (CPTs) and capabilities from other GCCs and CYBERCOM, as required.

Figure 10 provides a graphical representation of Team A's final C2 system, consisting of both structure and assigned processes.

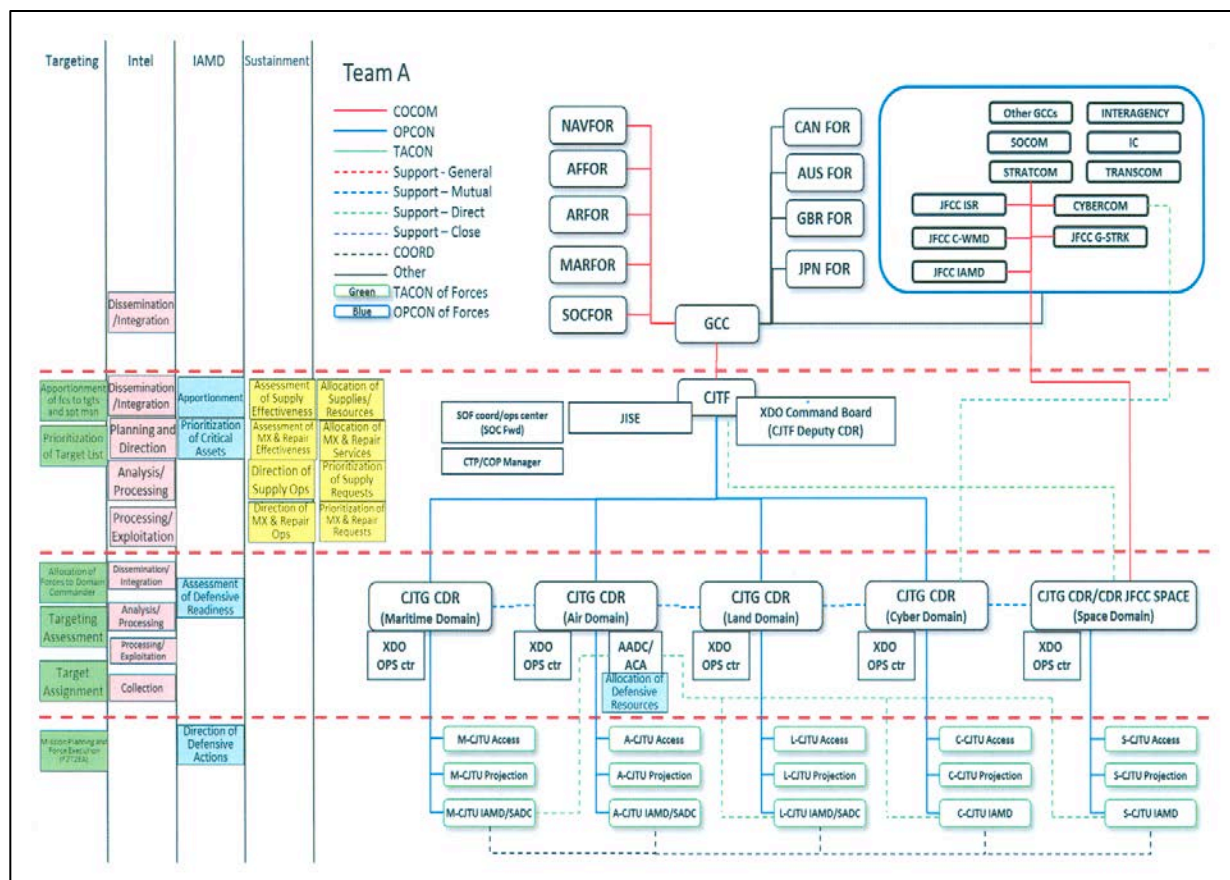


Figure 10: Team A Final C2 System (Structure and Processes)

Team A Strengths and Weaknesses Summary

The strengths and weaknesses identified by Team A for their resulting C2 system are summarized in Table 3.

Option B: Cross-Domain CDR (XDC) Model

Overview

This system is designed around XDO that incorporates maximum redundancy for an anticipated highly contested future environment. The Cross-Domain model focuses on organizing joint effects under commands subordinate to the CJTF that are precisely tailored to the Theatre Campaign Plan. Known as “Cross-Domain Commanders” (XDCs), each Tier III headquarters controls an array of joint capabilities and operates much like a mini-CJTF, focused on a specific line of operation as prescribed in the campaign plan.

Unity of Effort	<i>Strengths:</i> CJTF CDR vertically aligns all tasks via the XDO Board and horizontally coordinates via the XDO Centers. When able, tasks can be assigned to a single Domain TG CDR with sufficient autonomy to independently accomplish objective while remaining aligned with CJTF intent. Centralization of sustainment functions at CJTF staff improves efficiency. <i>Weaknesses:</i> Unity of effort may break down along domain lines unless domain definitions are clear, and Low Density/High Demand capabilities must be carefully managed between domain TGs to prevent dilution of effort.
Flexibility	<i>Strengths:</i> Domain construct allows expansion/contraction of mission, resources, and areas as necessary. Support relationships and procedures have been designed such that info can be passed quickly and force allocation can be updated quickly. <i>Weakness:</i> Mutual support relationships may not be sufficiently nimble to be effective in a dynamic environment.
Simplicity	<i>Strength:</i> Access and projection requirements are easily mapped to Domain Commanders. <i>Weakness:</i> Simplicity is degraded with the expansion of the conflict and overlap in CJTU areas of operation. The subsequent difficulty in coordination across domain lines could result in confusion and redundancy of tasks between domains.
Resiliency	<i>Strength:</i> Pre- integration and training of the CJTUs in the execution of mission-type orders—coordinated via the XDO Centers—provide a high degree of resiliency. <i>Weaknesses:</i> Close dependency on the XDO Centers for all coordination could prove problematic over time in a communications degraded environment; centralization of multiple functions/processes at the CJTF level, especially those related to sustainment, represents potential vulnerability.
Operational Integration	<i>Strengths:</i> CJTU structure primarily encourages coordinated, high tempo, combined joint action at the lowest possible level using mission type orders, with secondary and tertiary integration accomplished via the XDO Centers and XDO Board respectively. <i>Weakness:</i> Geographic overlap, along with broad span of control within each domain, may hinder operational integration and will require deconfliction at the Tier III-IV levels, which may be difficult in a communications-degraded environment.
Cross-Domain Synergy	<i>Strengths:</i> The XDO Center and Command Board is focused on XDO synergy and is structured to provide effective targeting and force allocation. Further support between Domain CDRs is enabled through mutual support relationships. <i>Weakness:</i> For the XDO Board to be effective there must be a shared situational awareness regarding domain risk levels to determine which domain should be leveraged to compensate for vulnerabilities in other domains and achieve the desired effects.

Table 3: Team A Strengths and Weaknesses Summary

Organizational Philosophy

The independent nature of each XDC allows them to operate autonomously, limited only by the extent of their authority and the capabilities of their assigned forces. Individual XDCs are able to task and organize their forces as required in response to changing missions and lines of operation. All forces are either assigned OPCON to XDC Task Forces (TFs) or available for tasking directly by the CJTF CDR. Additional theater assets or assets from outside the joint operating area (JOA) are assigned TACON to the XDC as needed. Shifting the TACON of units among XDCs, as the situation dictates, allows for enhanced flexibility in the C2 system as the campaign unfolds and operational requirements change. To facilitate redundancy and ensure resilient operations in a communications challenged environment, this system relies on functions and processes being commanded and accomplished at the lowest possible level in the overall organization.

Consequently, the task units located at the Tier IV level are predominately joint and cross-domain in nature. Because of the broad spectrum of capabilities under the control of each XDC, staff officers will require a level of joint education and training far above today's standards. This structure is a significant departure from current C2 doctrine and challenges existing doctrinal paradigms. For example, the functions of a Combined Air Operations Center (CAOC) are split among three organizations at two tiers of command. Provided communications can be maintained, a normal ATO cycle is possible. But in a degraded environment, the principles of mission command become paramount, and Cross-Domain Commanders would operate independently following existing commander's intent using predetermined methods of deconfliction.

Structure

This construct is heavily influenced by the lines of operation prescribed by the theatre campaign plan, with an XDC responsible for an entire Line of Operation. Each XDC must understand higher headquarters intent and mission orders with sufficiently clarity to operate independently and absent additional guidance, if required. In a communications-challenged environment, this structure relies heavily on the mutual support relationship among XDCs and assumes a high level of coordination and collaboration at that level. As the environment becomes more permissive and the CJTF commander's span of control becomes more manageable, the CJTF CDR may assume a greater role directing actions between the XDCs.

In response to the scenario and associated vignettes, three Tier III XDC organizations were developed: XDC Offense, XDC Defense, and Task Force Sustainment. XDC Offense conducts all offensive operations including those offensive actions required to support XDC Defense and TF Sustainment. XDC Offense is not constrained by geography and has OPCON of all assigned forces. The XDC Offense Commander may delegate TACON to other XDCs as appropriate. XDC Defense is responsible for conducting defensive operations within the assigned Joint Operational Area, including integrated air and missile defense. Task Force Sustainment is a joint logistics command formed to ensure efficient, flexible sustainment and medical support to Blue operational forces.

Each XDC headquarters features a Cross-Domain Operations and Intelligence Center (XDO/IC) to coordinate activities among XDC's and synchronizes with the XDO Board at the CJTF level when possible. Moreover, individual XDCs are empowered to task and organize their forces as required in response to changing missions and lines of operation ordered by the CJTF. All forces are either assigned OPCON to XDCs/TFs or available for tasking directly by the CJTF. Additional assets—either based in-theater or outside the JOA (OJOA)—would be assigned TACON to an XDC as needed. Shifting TACON of units between XDCs as the situation dictates allows flexibility as the campaign unfolds and operational requirements dictate. With the additional command layer of the XDCs, this model may appear more complex than necessary. However, this complexity is mitigated by the flexibility and simplicity inherent in the OPCON relationships that characterize this structure, along with the resiliency provided by multiple CJTF-like organizations subordinate to the CJTF CDR. Figure 11 provides a graphical depiction of Team B's final C2 structure.

Target nomination and prioritization for lethal and non-lethal fires and effects occurs at all levels. The CJTF staff develops the Joint and Restricted Target Lists, with input and recommended priorities from the XDCs and their subordinate commanders. The CJTF staff manages the Joint Integrated Prioritized Target List (JIPTL) through an organization known as the XDO Board. The XDO Board functions as a Joint Target Coordination Board (JTCB), though now expanded to include all domains. With its proximity to the CJTF Commander, the XDO Board can quickly make apportionment decisions that reflect the latest intent and priorities.

Community resources, as well as Targeting Assessment reports from XDCs and Tier IV commanders to provide a holistic assessment of kinetic and non-kinetic targeting effectiveness.

Intelligence Process

Intelligence organizations and tailored intelligence support will occur at all levels of the system. Intelligence personnel are embedded into each cross-domain headquarters, in the form of a Joint Intelligence Support Element (JISE). All units retain their organic intelligence personnel to the maximum extent possible. Planning and direction (guidance) in the form of an OPS/ISR strategy will flow downward. The intelligence processes are assigned to specific levels to facilitate the development and maintenance of an intelligence common operating picture which will survive in a communications-degraded environment. Information requirements are generated at the lowest level, passed up echelon for validation, collection and exploitation. The dissemination of finished intelligence from the Intelligence Community (IC) and the CJTF CDR level will flow down to the XDCs and subordinate forces. This construct allows for the intelligence cycle to occur at the Tier IV level, should connectivity be lost with higher echelons.

Integrated Air and Missile Defense (IAMD) Process

The CJTF CDR retains authority and responsibility to manage the Critical Asset List (CAL) development process and allocation of IAMD resources through the Joint Theater Air and Missile Defense Working Group and Board. Authority is delegated to XDC Defense to manage the defense of those assets identified on the Defended Assets List (DAL), in addition to managing IAMD in the rear area battlespace. XDC Offense retains IAMD capabilities organic to its force and manages IAMD actions in the deep and close battlespace. XDCs coordinate IAMD priorities through the XDO/IC structures to ensure alignment and gain cross-domain synergy.

Sustainment Process

Theater sustainment is conducted through Task Force Sustainment, a Tier III joint logistics command formed to ensure efficient, flexible support and sustainment of forces; since service forces now are assigned to various XDCs, vice a single functional or service component commander. It works largely as a pass-through organization, and is designed to allow Service Component logistics organizations to execute sustainment.

Task Force Sustainment plans, prioritizes, allocates, synchronizes, and coordinates sustainment requirements across services and XDCs. It coordinates with Defense Agencies (DLA, TRANSCOM) Coalition, and host nation support structures. Constantly assessing force requirements and supply status, it determines proper sources of supplies and maintenance and the means of distribution. Task Force Sustainment coordinates and executes all intra-theater transportation (Air, Sea, and Land) and provides C2 and coordination of Blue medical services. Logistics status and readiness are reported to the CJTF CDR and ultimately the GCC through the CJTF Sustainment Fusion Cell. Sustainment Forces include Service component operational sustainment forces, as well as intra-theater airlift, intra-theater sealift, air refueling tankers, and logistics helicopters.

Coalition Integration

Each coalition partner utilizes a national force provider to interface with the GCC to coordinate manning, training and equipping of their forces and to act as the conduit to their national command authority. Operational level force integration is achieved through coalition representatives in each XDC headquarters.

Space Integration

JFCC—Space will provide reach-back support for the CJTF under a general support relationship and will be responsible for day-to-day planning and execution of space activities.

Cyber Integration

A Cyber Support Team (CST) is integrated at the CJTF CDR level to support the offensive and defensive cyber requirements of all XDCs. A Cyber Support Element (CSE) is attached to each XDC to conduct and integrate cyber planning, as well as prioritize cyber requirements. While the requirements for offensive cyber effects are generated by each XDC and their subordinate commanders, the actual offensive cyber operations are conducted by national organizations outside the theater.

Figure 12 provides a graphical representation of Team B's final C2 system, consisting of both structure and assigned processes.

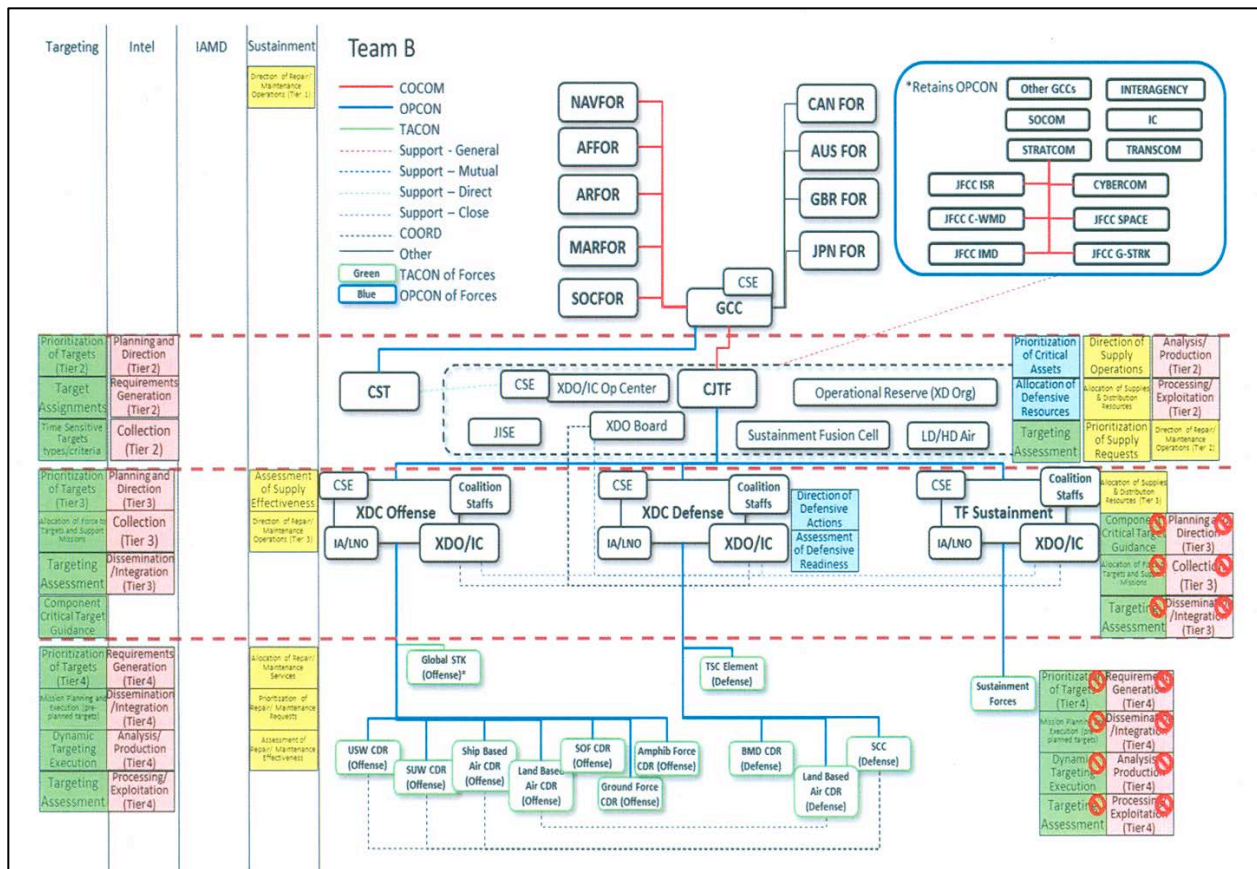


Figure 12: Team B Final C2 System (Structure and Processes)

Team B Strengths and Weaknesses Summary

The strengths and weaknesses identified by Team B for their resulting C2 system are summarized in Table 4 below.

Unity of Effort	<i>None Identified</i>
Flexibility	<i>Strength:</i> The structure allows for the formation/disestablishment of purpose-driven Tier 3 XDCs to achieve localized or relatively short-term campaign objectives. Allocation decisions are clearly tied to operational objectives simplifying priority and level of effort decisions in an asset constrained environment. This structure simplifies asset allocation under each XDC. <i>Weakness:</i> Shifting assets and coordinating tasks among XDCs may be difficult in a communications-denied environment. When disconnected from higher headquarters, XDCs may interpret intent and guidance differently, leading to inefficient use of assets that could be better employed by another XDC.
Simplicity	<i>Strength:</i> Each XDO has very clear and simple C2 lines to Tier IV forces. <i>Weaknesses:</i> Simplicity begins to break down when considering the roles and missions of each XDC. Geographic and mission responsibilities and authorities are not clearly delineated. This lack of clarity may lead to confusion at the Tier IV level. This problem is exacerbated by the fact that many capability areas are spread across multiple XDCs including Intelligence Community support, SOF and ISR. Dual role assets may not be used effectively because of difficulties in shifting control between XDCs.
Resiliency	<i>Strengths:</i> Each XDC has the C2, planning, and force capabilities required to operate semi-autonomously, based on higher headquarters intent and guidance, when communications are disrupted. This independence also allows one XDC to accomplish tasks normally assigned to another if required. <i>Weaknesses:</i> Depending on how XDCs are aligned (assigned to LOOs) and the magnitude of the crisis, they may be faced with a large, disparate mission set across the entire battlespace. This wide span of control may become unmanageable.
Operational Integration	<i>Strengths:</i> This construct facilitates decentralized planning and execution and promotes the concentration of efforts. There is sufficient control to direct and coordinate distributed, synchronized operations. Target priorities are decided at the lowest level based on the overall CJTF CDR guidance. Supply and maintenance forces are centrally managed at the Tier III level by the TF Sustainment CDR, which should aid in theater planning and prioritization. <i>Weaknesses:</i> The XDC construct allows for the possibility of overlap and conflict among XDC operations. Air, Space, Cyber, Maritime, and SOF operate in 3 different environments; coordination, distribution, and synchronized operations are difficult across each line of operation depending on the daily weight of the main effort. Sustainment may be less efficient with centrally-managed forces, as opposed to keeping sustainment forces under service control.
Cross-Domain Synergy	<i>Strength:</i> By designing each XDC as a mini-CJTF with the range of capabilities across domains to achieve its assigned objectives, cross-domain synergy is organic to the structure. <i>Weakness:</i> The independent nature of XDCs may lead to a breakdown in coordination and integration below the CJTF CDR level. This will have the greatest impact on capabilities like cyber, space operations, and ISR that must be shared by XDCs.

Table 4: Team B Strengths and Weaknesses Summary

Option C: Functional CDR Model

Overview

This is an evolved functional command and control system with improved cross-domain operational effectiveness created by placing command authority for assigned joint forces at lower echelons in time and space, as limited by span of communications, for effective joint forces employment in a denied environment. Cross-domain effectiveness at the CJTF CDR and Functional Component CDR levels is improved by developing Cross-Domain Coordination Elements (XDCE) in each of these commands, and physically co-locating these commands to create and exploit deep, big-picture knowledge across all domains within the area of operations. Combined Joint Task Force Component Commanders (CJTFFCs) for Logistics and Sustainment additionally increase CJTF effectiveness. Evolutionary improvements in force integration and battlespace understanding across the CJTF increase operational tempo and effectiveness in a progressively demanding A2/AD environment.

Organizational Philosophy

This command and control system meets future area denial challenges by evolving from existing service-derived functional component commands within the CJTF to a system with additional capabilities to enable effectiveness in a communications-denied environment.

The operational (CJTF) commander and the on-scene or mission commander integrating joint forces have different requirements. Examining command and control from the top down and from the bottom up simultaneously enabled a coordinated evolution of existing systems and processes to better meet the future requirements of all commanders in the CJTF. The evolved system sacrifices simplicity and flexibility relative to the criteria of unity of effort, resiliency, operational integration, and cross-domain synergy. The CJTF CDR and the component commanders must specify in advance the mission command, tasking and ‘contract’ orders that will be executed by an on-scene mission commander across a communications-limited span of control. The tactical command and control thus prescribed enables the mission commander to dynamically employ the full range of provided joint capabilities to best accomplish the mission.

Four key characteristics illuminate this command and control system. First, the system is an evolutionary progression from existing military service-developed functional component commands. Second, functional logistics and information warfare component commands are added to expected legacy commands that include air, land and maritime components. Third, processes that enable a greater understanding, ‘deep’ and ‘wide’ across all the warfighting domains, are developed at every appropriate level of joint force integration within the CJTF. Fourth, processes to enable dynamic integration of joint forces by an on-scene or mission commander with a limited span of control are incorporated into this structure. Individually, these characteristics link to existing and legacy methods of operating within or across service cultures. Collectively, full incorporation within a CJTF structure represents a significant evolution of joint force capability within the most demanding expected operational environment.

Existing service-led functional components are the basic building blocks of this command and control structure. This begins with the assignment of the CJTF commander based on the preponderance of assigned forces, nature of the mission and ability of the commander to exercise command and control. Functional component commanders for Land, Air, Maritime, Special

Operations, Cyber and Space would then be assigned below the CJTF CDR echelon. Service components would be designated for each service providing forces to the CJTF. Building from these basic ‘blocks’ leverages the strengths of our existing service-centric military forces.

Creation of a logistics component commander enables placement of assigned theater sustainment forces OPCON/TACON to this commander as required. Across a large area of operations, increased operational effectiveness will be obtained by assigning a peer logistics component commander co-equal to the warfighting commanders to provide additional focus and fidelity to logistics synchronization within campaign planning and execution.

The information warfare component commander increases the operational effectiveness of the execution of the campaign plan by focusing kinetic and non-kinetic fires and all elements of information warfare under the umbrella of a single, focused functional commander. By conducting operations in the traditional domains of warfare as well as the space and cyber domains to interface with both the adversary’s fighting forces and civilian population, the Combined Joint Forces Information Warfare Component Commander and Space Control Authority (CJFIWCC/SCA) takes a holistic and focused approach to all elements of IW and improves the CJTF performance in this area.

Cross-Domain Coordination Elements (XDCE) represent a revolutionary process within the command and control system. Appropriately scaled for each headquarters commanding and controlling joint forces, XDCEs create a deep, detailed knowledge and understanding of the battlespace across the operations area. This understanding must bring together enough data from the environment (e.g. “COP”) and add the wisdom (the “so what”) that exceptional operational commanders develop, and then needs to be rapidly disseminated throughout the CJTF.

(Note: Some Global 2013 Capstone participants offered that a “combined arms approach” as practiced in some current headquarters already performs this process of developing cross- domain understanding. While these efforts should be applauded, they do not appear to be of the scope or scale required to achieve the requisite understanding and communicate it to the operating forces at a tempo that enables military success.)

Structure

This CJTF builds on current combined joint task force doctrine and practice. The CJTF command headquarters is a joint headquarters operating traditional Boards, Bureaus, Centers, Cells & Working Group (B2C2WG)-based processes. An intelligence JISE (Joint Intelligence Support Element); MNCE (Multi-National Command Element—command authority for coalition forces by country); and XDCE conduct additional key processes at the CJTF HQ. The CJTF CDR exercises OPCON of the following subordinate functional combined joint force component and service commands: Combined Joint Force Logistics Component Commander (CJFLOGCC), Combined Joint Force Maritime Component Commander (CJFMCC), Combined Joint Force Air Component Commander/Area Air Defense Commander (CJFACC/AADC), Combined Joint Force Land Component Commander (CJFLCC) Combined Joint Force Special Operations Component Commander (CJFSOCC), and the CJFIWCC/SCA, along with the Air Force service component commander (AFFOR). The CJTF will also have other command relationships with special operations, cyber, space and other forces, depending on the situation.

Forces are assigned or attached to service and component commanders. The CJFLOGCC exercises TACON over assigned logistics forces. The CJFMCC exercises OPCON over assigned USN and USMC forces and TACON over other coalition or service forces. The AFFOR exercises OPCON over USAF forces. The CJFACC/AADC exercises TACON over assigned U.S. and coalition forces. The CJFLCC exercises OPCON over USA forces and TACON over other assigned U.S. and coalition forces. The CJFSOCC is OPCON to the Theater Special Operations Command (T-SOC) and exercises TACON of SOF in support of CJTF missions. The CJFIWCC/SCA exercises OPCON or TACON of a variety of forces conducting CJTF missions. Across the CJTF, command relationships of OPCON and TACON are supplemented by supporting and supported relationships, and coordination authority is broadly distributed.

Operations under this construct are enabled by prescriptive orders and instructions where required. The specific command authorities, role and responsibility assignments, and other rules required to enable necessary flexibility and responsiveness in the execution of joint force operations are determined and promulgated in advance through processes executed at the CJTF and Functional Component Headquarters. Figure 13 provides a graphical depiction of Team C's final C2 structure.

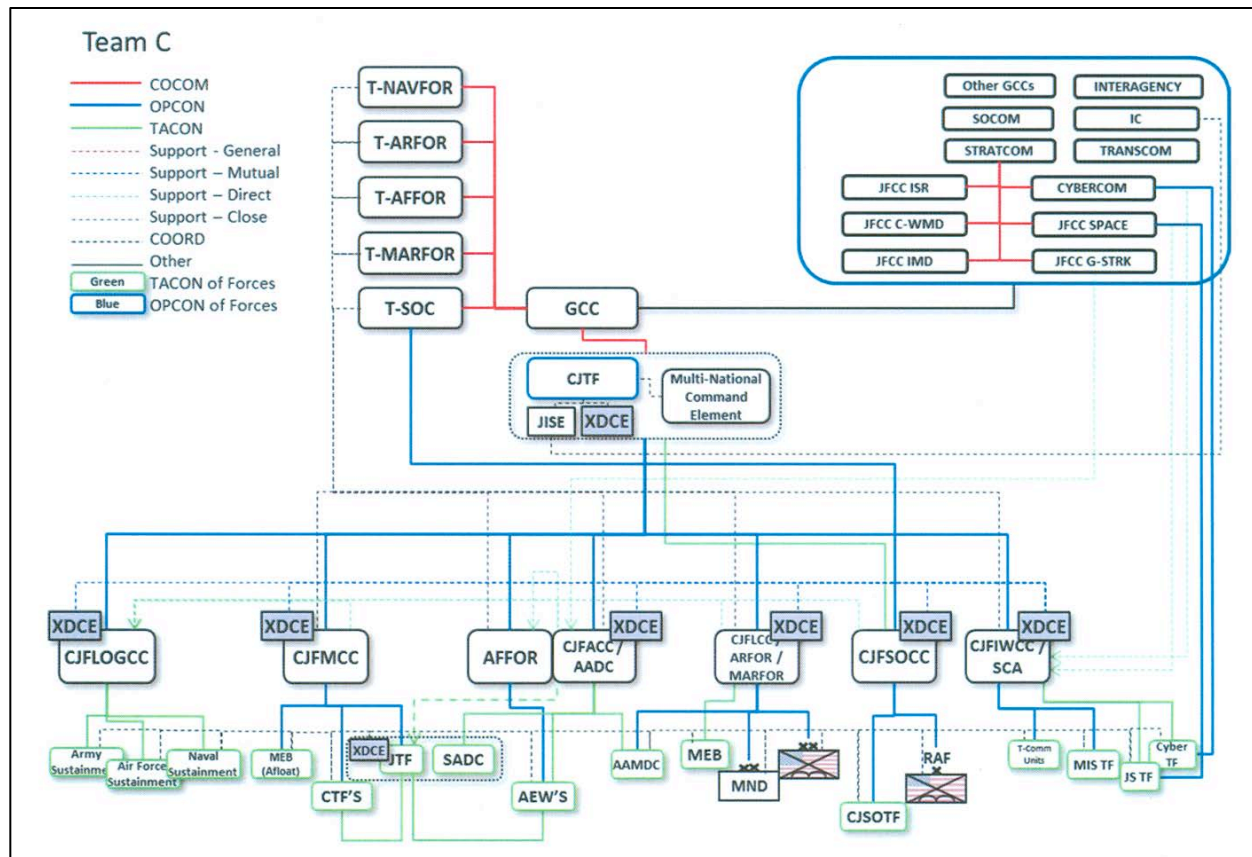


Figure 13: Team C Final C2 Structure

Targeting Process

Prioritization of all targets occurs at the CJTF level to include guidance for the categorization of time sensitive targets (TSTs). The Joint Targeting Coordination Board (JTCCB) integrates and synchronizes all weapons systems and capabilities. The targeting assessment process is also conducted at the CJTF staff level and is used to measure progress of the joint force toward mission accomplishment.

During execution, Component Commanders continually monitor progress toward accomplishing tasks, creating effects, and achieving objectives. Assessment actions and measures help commanders adjust operations and resources as required and make other decisions to ensure current and future operations remain aligned with the mission and desired end state. The JTF Commander's intent, guidance and objectives are given to the Component Commanders to plan and execute. The Component Commanders then plan, prioritize, apportion and task their forces to conduct operations to achieve the JTF Commander's objective. The component commanders then examine the targets and their vulnerability, allocate available forces, conduct weapon-target pairings, to include non-kinetic weapons, as appropriate, and task subordinate units as required.

The Subordinate Commanders are responsible for the Find, Fix, Track, Target, Engage & Assess (F2T2EA) process for both deliberate and dynamic targets. Upon receipt of tasking orders, the warfighter must perform detailed planning for combat operations, in a dynamic operational environment that changes as a result of actions from the joint force, adversary, while maintaining focus on the CJTF CDRs objectives.

Subordinate commanders also conduct target assessment actions and measures, help commanders adjust operations and resources as required, and make other decisions to ensure current and future operations remain aligned with the mission and desired end state.

Intelligence Process

GCC Joint Intel Ops Center provides analytical production support, oversees the development and prioritization of collection requirements from Tier IV up to the GCC and leverages the national Intelligence Community (IC) to support CJTF requirements. The CJTF J2 plans and directs intelligence support and collection requirements in support of the CJTF CDR's Priority Intel Requirements (PIRs). The CJTF-embedded JISE develops overall situational awareness and provides joint cross-domain intelligence support via low bandwidth, coalition releasable "smart push" support to lower echelon forces. Components execute collections operations management over assigned forces and provide processing and exploitation of raw intelligence from organic collection platforms. Service units provide processing and exploitation of raw intelligence from organic collection platforms as well as collection from service forces.

IAMD Process

Prioritization of critical assets must happen at the theater level because those critical assets are shared resources. In response to the challenges posed by the Capstone scenario and associated vignettes, a Battle Management Area (BMA) was designated within the JOA and was assigned to a Tier IV JTF subordinate to the CJFMCC. This subordinate JTF would be task-organized, composed of various cross-domain assets, and would be constrained either temporally or geographically. Due to the authorities delegated to the commander of this subordinate JTF, they must be assigned by the CJTF CDR directly.

Allocation of Defensive Resources—Campaign allocation of resources will rest with the CJTF CDR, based on advice from his co-located component commanders. An Assessment of Defensive Readiness would be produced by the CJFACC/AADC, and would be a collation of the component commander and subordinate command inputs in accordance with the normal battle rhythm (Since the AFFOR is not an operational commander, they would not assess defensive readiness). Based on the results of the assessment, the CJTF CDR may recommend to the GCC a reprioritization of critical assets. To be effective, however, the actual battle management must be pushed to the lowest level. Logistics, Regionally Aligned Forces (RAF), and cyber units do not direct defensive actions due to the fact that their IAMD defense is provided by other units.

Sustainment Process

Resource providers plan, program and acquire logistics resources and position in accordance with phase zero plans. When an operation occurs and a CJTF is stood up, requirements in addition to these resources will be developed by the CJTF J4 (or Joint Deployment and Distribution Operations Center (JDDOC), if established) and presented to the GCC for sourcing.

The CJTF J4 (or JDDOC) will synchronize and optimize inter-theater and theater deployment, distribution, and sustainment operations within a GCC's AOR. The CJTF staff will allocate and prioritize supply, repair and maintenance services provided for this operation. The CJTF staff will integrate logistics operations and operate a fusion center (movement control organization), acting in consonance with the GCC's overall requirements and priorities. Acting on behalf of the GCC, The CJTF staff may direct common user and intra-theater distribution solutions.

The CJFLOGCC is established to direct all elements of the supply & maintenance systems in order to deliver the “right things” to the “right place” at the “right time” to support the joint force commander and component commanders. The CJFLOGCC must determine the proper balance of efficiency and effectiveness in distribution processes being executed, and remain flexible to employ new methods as the environment changes. The other component commanders are responsible for assessing the effectiveness of repair, maintenance and supply. Units are responsible for identifying logistical requirements and reporting readiness up the chain of command.

Coalition Integration

Assuming coalition governments fully support participation of their military forces in potential operations, coalition forces are integrated directly within task groups to the greatest extent possible. All coalition partners retain national command of their forces, with national commander's resident within the MNCE (Multi-National Command Element), by nation, at the CJTF HQ. Coalition partners will transfer operational control (OPCON) to the CJTF, but coalition forces are constrained by national ROE. Sustainment and logistics remain national responsibilities. Sustainment and logistics will be provided under extant acquisition and cross-servicing agreements, with the CJFLOGCC responsible for prioritization and delivery when supporting coalition forces.

Space Integration

STRATCOM's CDR JFCC-Space is dual-hatted as the GCC's Space Component Commander. JFCC-Space remains OPCON to USSTRATCOM, and is in direct support to the CJFIWCC/SCA. JFCC-Space may attach forces TACON to the CJFIWCC/SCA to gain and maintain space superiority when and where required. Additional capabilities required to accomplish CJFIWCC/SCA space missions will be assigned OPCON, TACON or in a support relationship.

Cyber Integration

CJFIWCC/SCA conducts offensive and defensive cyber operations as the information warfare commander for the CJTF. Cyber, Space, communication and IW units will be assigned OPCON, TACON or in support of the CJFIWCC/SCA as appropriate. CYBERCOM is in direct support to the CJFIWCC/SCA to provide cyber assets that are not in theater in a timely manner. CYBERCOM retains the authority for striking OJOA targets with Cyber capabilities. The CJFIWCC/SCA, as the information warfare commander, takes a broad look at IW operations across the joint operating area and fully integrates offensive and defensive cyber capabilities across the combined and joint force to ensure that cyber supports gaining and maintaining access in all domains, as required.

Figure 14 provides a graphical representation of Team C's final C2 system, consisting of both structure and assigned processes.

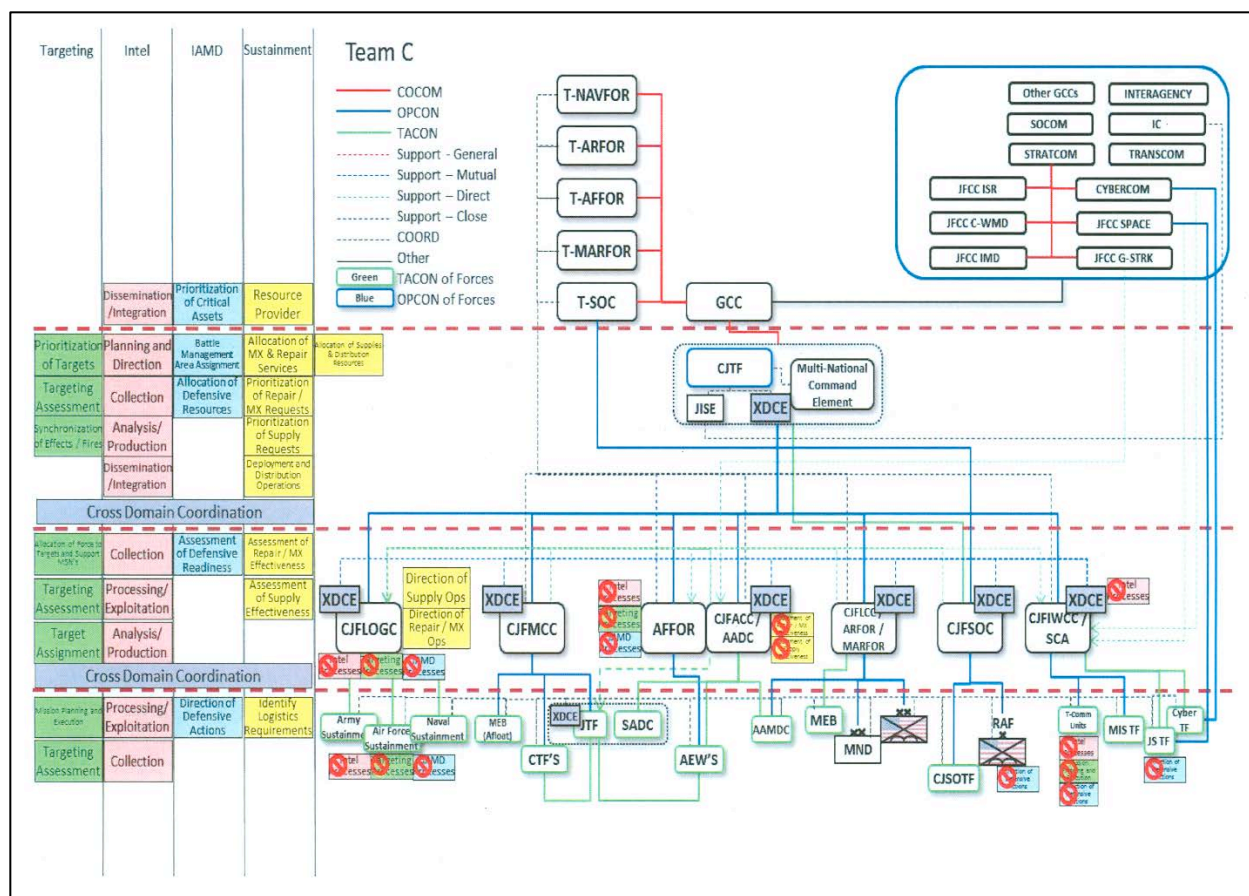


Figure 14: Team C Final C2 System (Structure and Processes)

Team C Strengths and Weaknesses Summary

The strengths and weaknesses identified by Team C for their resulting C2 system are summarized in Table 5 below.

Unity of Effort	<i>Strengths:</i> Effective task organization allows for focused mission execution of CJTF CDRs intent in relation to campaign objectives, enabling effective C2 across the functional components, thereby maximizing coalition cohesion. CJFIWCC provides a single component CDR responsible for communications and use of the electromagnetic spectrum. <i>Weaknesses:</i> Approval authority still resides within a parallel command structure, which limits the CJTF CDR's ability to direct operations across all the domains. This impacts IAMD dynamic targeting, which is split between two Tier III commands and will therefore involve two separate methods for attacking the problem set.
Flexibility	<i>Strengths:</i> Co-location of Tier II CJTF CDR and Tier III Component CDRs maximizes speed and quality of decisions, as well as situational awareness. Subordinate-JTF C2 construct provides an adaptable structure for employing the BMA construct, thereby enabling cross-domain authority to execute the mission in an A2/AD environment. <i>Weaknesses:</i> Degraded communications may prevent required coordination between Tier II intelligence and targeting node and Tier III components. Process to utilize multi-mission assets from other functional components and to dynamically shift missions between components is unclear.
Simplicity	<i>Strengths:</i> Alignment with current functional/service component structure enables service-level training and service-sponsored C2 systems/organizational structure to seamlessly support CJTF construct. <i>Weaknesses:</i> Lacks simplicity due to too many required lines of coordination. BMA assignment creates multiple geographic boundaries, which increases complexity in execution.
Resiliency	<i>Strength:</i> Creation of CJFLOGCC and retention of Coalition and Joint component commands increases resiliency and resource sustainability for the campaign. <i>Weaknesses:</i> Highly vulnerable to degraded communications, since stove-piped functional component CDRs rely on coordinating, deconflicting and synchronizing movements and actions with the CJTF CDR and other component CDRs. Co-locating all component CDRs and centralizing the intelligence process at the CJTF staff makes it easier to disrupt/destroy a key C2 node.
Operational Integration	<i>Strength:</i> Capabilities and command authorities are jointly represented at the lowest level of command (in the case of the subordinate JTF construct) <i>Weaknesses:</i> This C2 model discourages XDO solutions, as Tier III units are likely to look to solve their problems predominately with their allocated forces. Having CYBERCOM and JFCC Space retain OPCON of the Joint Space Task Force (JS TF) and the Cyber Task Force (Cyber TF) at the Tier IV level will cause chain of command problems, as well as conflicting C2 issues. This system is not capable of coordinating high tempo, distributed ops across a large JOA. Coordination of different types of forces is held at the Tier III - vice Tier IV - level, which will hinder the rapid and timely development of integrated plans.
Cross-Domain Synergy	<i>Strengths:</i> Co-location of Tier II CJTF CDR and Tier III component CDRs optimizes mission execution and synchronizes the multiple service and coalition components. <i>Weaknesses:</i> Tasking processes inhibit cross-domain synergy at the Tier IV level. A dogmatic overreliance on doctrine will degrade C2 effectiveness. Difficult to direct (Tier II) and coordinate (Tier III/IV) kinetic and cyber/space ops in time and space in a communications-degraded environment. This C2 structure is essentially the same as what we utilize now. Each Tier III commander owns and fights only with forces that operate in each individual domain—with the occasional TACON shift when required.

Table 5: Team C Strengths and Weaknesses Summary

C2 OPTIONS ANALYSIS AND RESULTS

Participants used AHP to weight the six criteria for assessing the overall performance of a cross-domain command and control system that operates in high intensity A2/AD environment. The aggregate responses of the twenty-one flag and general officers (black) were sub-divided into 3 cohorts: USN FLAG (blue); US GENERAL (USAF, USMC, and USA; in red); and COALITION FOGO (green). All non-FOGO participants, including non-FOGO coalition participants, are depicted in purple. Figure 15 depicts the how each cohort assessed the importance of the six criteria relative to each other.

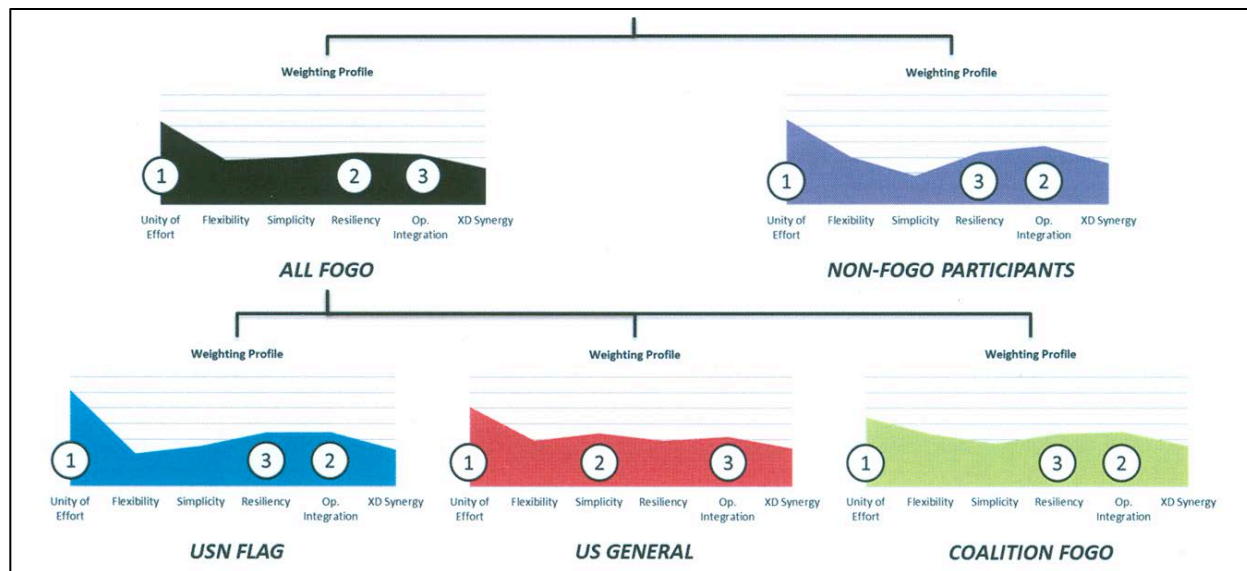


Figure 15: Cohort Weighting Criteria Profiles

When interpreting the results of Figure 15, the higher the peak, the more important that particular criterion was viewed by participants. The top three criteria for each cohort are indicated by the circled number. With the exception of the US GENERAL cohort, all participants assessed unity of effort, operational integration, and resiliency to be the top three most important criteria for maximizing the performance of a joint, cross-domain command and control system. In addition, the USN FLAG, COALITION FOGO and NON-FOGO PARTICIPANTS cohorts identified the same top three criteria and in the same relative order: 1) unity of effort, 2) operational integration, and 3) resiliency.

Figure 16 depicts how each cohort assessed the resulting C2 systems, based on their weighting of the six criteria. The first row of bar graphs at the top of the image depict the overall preferences for Options A, B and C sorted by cohort. The ALL FOGO results, shown in black, are the mean of the consolidated USN FLAG (blue), US GENERAL (red), and COALITION FOGO (green) results. These results indicate no clear preference between the three options. The ALL FOGO cohort slightly preferred Option A, while the NON-FOGO PARTICIPANTS slightly preferred Option B. Among the FOGO cohorts, the USN FLAG group preferred Option C, the US GENERAL group preferred Option A, and the COALITION FOGO group preferred Option B.



Figure 16: Global '13 C2 Options AHP Results

The lower six plots show how each of the options scored by criterion and cohort. Data points which are close together indicate relatively similar scores between cohorts, while points which are farther apart show a divergence in scores. The flatter the line for a given cohort, the less variation (or differentiation) exists between option scores for that criterion. Analysis of the plots indicates the following:

- Regarding the unity of effort criteria, the USN FLAG cohort rated Option C much higher than the other three cohorts.
- Regarding the simplicity criteria, the COALITION FOGO cohort rated Option B much higher than the other three cohorts.
- For the remaining four criteria (flexibility, resiliency, operational integration and cross-domain synergy), the shape of the plots indicates relatively minor differences between the cohorts regarding the relative importance of the criteria and how they assessed the three C2 options at satisfying that criteria.

Findings and Recommendations

Enhancing Unity of Effort through Mission Command and Authorities

Global '13 described three distinct ways to command and control the joint force in a high intensity A2/AD environment. In all cases, the importance of Mission Command and pushing authorities and commander's intent to the lowest effective level (Tier IV) was emphasized as a way of mitigating the effects of communications challenges. In order for lower tier commanders to execute based on mission orders and intent, they must have the appropriate authorities to act. Therefore, commander's intent and guidance must be provided—and authorities must be delegated—to the appropriate level before communications are interrupted.

The decentralized execution of military operations based upon mission orders is the core focus of Mission Command. Because communications challenges may force autonomous execution and decision making at lower levels, commanders will need the clarity of intent provided by mission orders. Mission orders must present a clear understanding of roles and missions among commanders at each level in the structure, along with the prioritization of the associated tasks and lines of effort.

In order to ensure that all execution decisions and apportionment requests remain aligned with the operation's mission and commander's intent, the joint force must commit to a culture of leadership that relies on decentralization and trust. In order for tactical commanders to effectively execute their missions, they need clear commander's intent and guidance. Conversely, senior commanders must trust that tactical commanders will appropriately interpret and act upon their guidance. Senior commanders must become comfortable with not being able to directly influence the outcome of a mission, but rather indirectly influencing outcomes by effectively enabling those subordinate commanders that are best-positioned to carry-out the fight.

Cultivating trust and confidence between Senior Commanders and their subordinates will take time and require new ways of thinking about joint leadership, education and training. This trust must be earned through persistent engagement between leaders at all levels and a common commitment to changing the culture of joint command and control. A key part of commander's intent and guidance is a clear understanding of the appropriate level of risk to assume. When tactical commanders are operating under mission command, they need to be able to quickly identify the likelihood that an event or action may occur and the potential impact it would have on mission accomplishment. Tactical commanders must not only know how much risk the commander is willing to accept, but they also must have a clear understanding of acceptable and unacceptable deviations from the intent and guidance provided. Once tactical leaders develop this understanding, they will need to practice it. This practice can come in various forms, such as gaming, simulations and real-world exercises. Pushing mission orders and authorities to the lowest levels succeeds in an environment where leaders at all levels value, encourage, and expect innovation, creativity and initiative.

Revolutionary vs. Evolutionary

Participants debated the merits of using a new approach (e.g., domain or cross-domain-based models) as opposed to revising today's functional component model. Concepts such as "Domain" and "XDO" need to be better defined and understood across the force before a shift in operational C2 can occur. Participants appeared reluctant to commit to any change that was radically different than what is in place today. While still realizing the benefits and strengths of the three models, changes to current C2 structures and processes would have to occur at a deliberate and moderate pace. This assertion was communicated by the vast majority of U.S. and coalition participants.

Coalition representatives highlighted that clear commander's intent and guidance and pushing mission orders down to the lowest echelon would improve coalition integration. They also indicated that the pace and extent of change must be tempered and conducted in a way that enables coalition forces to operationally integrate. As one Coalition Flag Officer said, "If you go evolutionary, then we can follow. Revolutionary, we can't follow."

Regardless of the pace and extent of changes to current C2 systems, players recognized that integrating the characteristics of any XDO C2 system into today's model would require new ways of thinking about warfare and breaking down service-specific culture barriers. This realization may be best characterized by the following player comment:

"I think that while it is natural to try to keep a structure with which we are comfortable, a paradigm shift in approach is required and we should not be trying to keep elements of what we have or do but rather start with the blank sheet of paper which appears to have been the case in Option B. We must guard against being 'prisoners of our own experience'."

No one C2 system developed during the game out-performed another. This was mainly because the game was designed to develop and refine each C2 system on its own. Results from AHP and qualitative analysis yield no clear preference among the three options. Achieving an optimal C2 system will require a long-term dedicated effort that constantly examines and informs current doctrine and policy. The future C2 system would most likely consist of integrating emerging key concepts derived from the project with that of today's C2 systems. XDO Centers, Information Warfare and Sustainment Commanders, as well as Joint Task Units are four key emerging concepts that could be integrated into today's C2 architecture. These four concepts, along with other emerging characteristics of any XDO C2 system, are described later in the report.

Degraded Communications Environment

While reliable communication among forces that operate in different domains will be exceptionally difficult, it can be critical to achieving synergistic effects. Forces operating in different domains may be widely distributed as a protective measure or simply due to their operational characteristics. For example, aircraft, SOF, and submarines could be tasked to destroy elements of the coastal defense cruise missile kill chain to reduce risk in the maritime domain. Cross-domain operations also rely on communication to permit a higher degree of shared situational awareness, which provides an understanding of the risk associated with operations in each domain. This enables commanders to determine where domain access opportunities can be leveraged to create effects in other domains. If communication is disrupted, operational control may have to be assumed at lower echelon levels.

Participants identified operations in a communications-degraded environment as a significant weakness across all three constructs. These weaknesses were described through the lens of each of the six C2 evaluation criteria. Players noted the importance of cross-domain planning at the lowest levels and the adoption of simplified C2 procedures as options to mitigate the effects of an environment where constant communications is not guaranteed. Problems may arise over target deconfliction, force allocation, and the tempo of operations. Any problems or inefficiencies caused by ambiguity in authority or unclear lines of control will be exacerbated by degraded or denied communications. Because of the relationship among Unity of Effort, Operational Integration, and Cross-Domain Synergy, any systemic deficiency caused by a communications-denied environment is likely to impact all three of these C2 attributes.

Option B created multiple joint force commanders (the XDCs) that were subordinate to the CJTF. The use of multiple commanders could reduce the simplicity of the C2 system. However, participants highlighted elements that may allow the system to function in a communications-

denied environment. Each XDC is essentially a mini joint task force with independent joint operational planning and execution capabilities across domains. With clear commander's intent, the XDCs may be able to conduct coherent operations independently, absent real-time communications with higher headquarters.

Relying heavily on supported-supporting relationships to coordinate operations among functional components, Option C was criticized for its apparent lack of cross-domain synergy. Service and functional organizations are stove-piped, requiring lateral coordination lines that could be broken in a communications-degraded or denied environment. When communications are not available, the structure may lack the ability to plan and direct operations. If the CJTF and functional component headquarters cannot be co-located, integration of forces operating in different domains will occur on an ad-hoc basis at the CJTF located at Tier II level. The resulting integration may be insufficient to effectively direct operations in a high tempo, communications-denied environment.

Domain Boundaries/Definitions

There was broad consensus among the participants that clear domain definitions are required to support any C2 structure organized by individual domains. Unity of Effort, Cross-Domain Synergy, and Simplicity are the three attributes which are adversely impacted by the lack of clear definitions. While weaknesses caused by poorly defined domains were most associated with Option A, any construct where a commander is responsible for all operations in a domain or responsible for shaping a domain must have a clear definition of that domain that is understood and accepted by the entire chain of command. Current service definitions of the various domains have overlaps that would clearly cause confusion for commanders issuing orders and for tactical units attempting to operate from, create effects in, or even transit from one domain to another.

Span of Control

Participants identified a wide span of control at the Tier III level as a weakness in all three constructs. A wide span of control could impact a commander's ability to effectively direct operations and could slow responsiveness during high tempo operations. The effect of a wide span of control was especially prevalent in Option B. The Tier III Offensive Cross-Domain Commander (XDC), responsible for offensive operations across the entire JOA and all domains, had almost the same span of control as the Tier II CJTF commander. This wide span of control could be mitigated by organizing XDCs by either geographic area or particular lines of operation.

Attributes of an Effective Cross-Domain C2 System

By analyzing player recommendations and stated strengths and weaknesses in the three systems that were considered, four attributes—A Cross-Domain Coordination/Control Element, an Information Warfare/Dominance Commander, a Sustainment Commander, and Combined Joint Task Units (CJTUs)—have emerged that could be included in future C2 systems to promote cross-domain synergy and unity of effort. A description of each is provided below.

Cross-Domain Coordination/Control Element

All three C2 models incorporated some form of a cross-domain coordination/control cell—or operations center—to synchronize effects and mitigate resource shortfalls at the Tier III level.

This feature was developed to enhance cross-domain synergy and operational integration. Team A used their XDO Centers, which resided within each Domain Commander's headquarters, to produce Integrated Tasking Orders to provide direction to subordinate Combined Joint Task Units (CJTUs). They also provided control and coordinating instructions for CJTUs from other domain commanders that operated in the same physical domain (e.g., airspace deconfliction, water space management, fire control measures, etc.). Each XDO headquarters in Team B featured a Cross-Domain Operations and Intelligence Center (XDO/IC) to coordinate activities among XDO CDRs and synchronize with the XDO Board at the CJTF CDR level. Team C developed Cross-Domain Coordination Elements (XDCE) at the CJTF and functional component headquarters. These centers were physically co-located to create and exploit greater knowledge and understanding across all domains within the area of operations.

Several comparisons were drawn to existing Army Battlefield Coordination Detachments and today's use of liaison officers (LNOs). The staffs that would comprise these XDO Centers would include joint and international operators and planners that are educated and trained in planning and executing cross-domain operations. These centers would ultimately enhance the knowledge and awareness of access and power projection requirements, capabilities—and opportunities associated with each domain. As one player noted, "Until we all do alternate tours as airmen, sailors, soldiers, marines, cyber and logs specialists (and we would clearly never do it) we need to force together staffs—XDCE—that truly co-join their staffs to achieve coordinated effects."

Information Warfare/Dominance Commander

The establishment of a commander responsible for information dominance was strongly supported by the participants. This standing organization would coordinate and integrate requirements and capabilities across the entire range of the information spectrum (cyber, space, EW, communications, intelligence, METOC, IO, etc.) in order to support commanders' domain access and power projection requirements, push appropriate authorities down to the lowest levels, and better affect the internal workings (processes, biases, etc.) of an adversary's C2 system. This structure would be comprised of joint and international capabilities and staffs that train and exercise regularly. One flag officer noted, "The integrated information command from Team C is an important and novel idea and the information environment will be a key feature in emerging forms of warfare."

A commander responsible for information warfare would need to integrate its actions with the desired effects sought by each domain, cross-domain, or functional commander to obtain the cross-domain synergy required to support the CJTF CDR's objectives in an A2/AD environment. This organization would need the communications capabilities to conduct real-time coordination among these commanders to reduce redundancies and overlaps, and ultimately synchronize effects across the fight.

Sustainment Commander/Task Force Sustainment

The sustainment of forces will be a major challenge to gaining a competitive advantage over a highly capable adversary. Traveling from long distances, these forces will be highly vulnerable to advanced adversary A2/AD systems. Any C2 structure must be able to accommodate the flow of forces deployed from the United States and throughout the region. The C2 systems developed over the course of the game highlighted some potential ways to plan and execute sustainment

operations in an A2/AD environment. A commander responsible solely for sustaining forces during the conflict emerged as one potential approach. Also referred to as Task Force Sustainment, this organization would be designed to help commanders (domain, cross-domain, or functional) achieve their objectives by coordinating and integrating requirements and capabilities across the joint force under the auspices of one commander. Such an approach could help synchronize logistics efforts and enhance unity of effort across the joint force.

A standing joint sustainment command would provide several benefits to planning, directing, monitoring, and assessing the sustainment of forces in an A2/AD environment. As one participant noted, such an organization would direct all elements of the supply and maintenance system “to deliver the right things to the right place at the right time to support the joint force commander and component commanders.” The characteristics of this organization were compared to today’s Joint Deployment and Distribution Operations Center (JDDOC). The Sustainment Commander must determine the proper balance of efficiency and effectiveness in distribution processes being executed, and remain flexible to employ new methods as the environment changes. The other component commanders would be responsible for assessing the effectiveness of repair, maintenance and supply while joint task unit commanders would be responsible for identifying logistical requirements and reporting readiness up the chain of command. Aerial refueling, theater airlift, theater sealift, and ground transportation not organic to combat forces may be best aligned to TF Sustainment at the Tier III level, while control of low-density, high-demand capabilities may be best retained at the CJTF CDR/Tier II level.

Combined Joint Task Units

Participants in all three cells strongly supported the concept of projecting power through joint and/or combined commands below the Tier II/CJTF level which forces from different services that operate in different domains controlled through a combination of OPCON and TACON relationships. Participants pushed cross-domain command down the chain of command to enhance cross-domain synergy when communications prevented coordination across the battle space. Option A utilized Combined Joint Task Units (CJTUs) at the Tier IV level, subordinate to domain based commanders. Option B created Tier III Cross Domain Commanders (XDC) based on lines of operation. In Option C, they utilized mini-JTF’s at the Tier IV level, subordinate to a functional component commander.

The CJTU is envisioned as a tailored, joint and coalition force, with capabilities from multiple domains. CJTUs can be assigned to any type of commander (domain, cross-domain, functional) within any type of C2 system. The CJTU structure embodies simplicity at the tactical level and maximizes operational integration and unity of effort across the C2 system. CJTUs could have mission or geographic orientations that allow them to self-synchronize and directly coordinate with each other in a degraded, denied, or hostile communications environment. CJTUs are pre-integrated by training and allocated sufficient force to fulfill the majority of the CJTF’s campaign objectives. Specific commanders would be provided with the majority of the forces required to achieve their end state, with minimal reallocation of forces required. The make-up of these units drew comparisons from the participants to current Marine MAGTFs, Army Battalion Task Forces, and Navy Battle Groups. However, the tailored combination of multi-domain forces—to include cyber and space—is the fundamental difference between the CJTU and today’s service-specific task forces.

VI. Way Ahead

Because an evolutionary approach was viewed as the preferred method for improving current C2 structures and processes, Global 2014 will explore how the four emerging C2 attributes (information warfare/dominance commander, sustainment commander, cross-domain coordination and control element, and combined joint task units) derived from Global 2013 could be integrated into the current functional component model of today. This effort will entail developing a hybrid C2 model which incorporates these attributes, along with a supporting XDO C2 Concept of Operations (CONOPS), and to then examine and refine the CONOPS in order to lay the foundation for future Tactics, Techniques, and Procedures (TTP) development.

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