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# Air Force Command and Control

## The Need for Increased Adaptability


Jeffrey Hukill — Team Leader
Lieutenant Colonel, USAF, Retired

Larry Carter
Colonel, USAF, Retired

Scott Johnson
Colonel, USAF, Retired

Jennifer Lizzol
DAF Civilian

Edward Redman
Colonel, USAF

Dr. Panayotis Yannakogeorgos
DAF Civilian



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Lt Col Jeffrey Hukill, USAF, Retired (Team Leader)
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DEPARTMENT OF THE AIR FORCE
OFFICE OF THE CHIEF OF STAFF
UNITED STATES AIR FORCE
WASHINGTON DC 20330

NOV 23 2010

MEMORANDUM FOR THE AIR FORCE RESEARCH INSTITUTE

FROM: HQ USAF/CC
1670 Air Force Pentagon
Washington, DC 20330-1670

SUBJECT: AFRI CSAF Research Priority for FY11

The topics described below represent my FY11 research priorities for AFRI. Please approach these subjects from a holistic and balanced perspective, avoid parochial or functional biases, consider "third-rail" sensitive issues as necessary, and ensure that the studies examine implications for increased risk and provide risk mitigation strategies where appropriate.

**Acquisition Requirements Reform.** Review the Air Force requirements process to improve the acquisition system and better meet Combatant Commanders' needs. Review how to instill discipline in the process, which will help keep requirements from multiplying. Finally, while OSD and other organizations focus primarily on reforming acquisition legislation, this study should recommend acquisition reform strategies that are within the Air Force's control.

**Leadership Development.** Review current Air Force leader development. Address experience, training, and education, starting with the Developing of Aerospace Leaders (DAL) initiative, and taking it forward. Generational gaps require a fresh look where changes in learning styles and technologies may point to new ways to develop Airmen. Focus on leader development that prepares Airmen of all ranks for the evolving security challenges in the Joint and Service environments.

**Airpower Command and Control.** Review airpower command and control changes that are required in Air Force doctrine and organizational structures, to ensure success in uncertain and dynamic future scenarios. As always, the focus is on delivering the right effects at the right place and right time. Moreover, any proposed structure should be flexible for success across the full spectrum of warfare.

NORTON A. SCHWARTZ
General, USAF
Chief of Staff

## About the Authors

**Lt Col Jeffrey B. Hukill, USAF, retired**, is a military defense analyst for the Air Force Research Institute. He served in operational, command, and education positions, including assignments as an installation commander, an Air Command and Staff College department chairman and dean, and a B-52G electronic warfare officer. He has been published in such periodicals as the *Armed Forces Journal*, *Joint Force Quarterly*, and *Defense Analysis* and in various Air University Press titles.

**Col Larry G. Carter, USAF, retired**, is a military defense analyst for the Air Force Research Institute. He commanded the 48th Support Group and the 79th Fighter Squadron. He was an Air Staff planner and research and development engineer with operational experience in the F-111 and T-38 as an aircraft commander, instructor, and check pilot. He contributed to research in deterrence, downsizing, and strategy and has been published in the *Air and Space Power Journal,* the Royal Air Force *Air Power Review,* and several reports.

**Col Scott Johnson, USAF, retired**, is a military defense analyst for the Air Force Research Institute (AFRI). He has served as an RF-4C weapon systems officer, squadron and wing commander, North Atlantic Treaty Organization plans officer, major command supply director, and Air War College department chair. His work has appeared in the *Air and Space Power Journal* (Chinese edition); Air Force Doctrine Document 1-1, *Leadership and Force Development*; and various AFRI studies.

**Jennifer L. Lizzol, DAF**, is a military operations research analyst for the Air Force Logistics Management Agency (AFLMA). She has served as primary analyst on command and control and planning systems for the Air Force Operational Test and Evaluation Center and in the strategy divisions of the Air and Space Operations Centers in the Republic of Korea and Southwest Asia. She is published in the AFLMA *Journal of Logistics*. She earned her bachelor's and master's degrees at the University of New Mexico.

**Col Edwin H. Redman, USAF**, is the director of war-fighting education at the LeMay Center for Doctrine Development and Education. He is a command pilot with over 3,000 hours in

bomber and trainer aircraft. Colonel Redman deployed and flew combat missions in the B-2 in support of Operation Iraqi Freedom and is a 2005 graduate of the Air Force's School of Advanced Air and Space Studies.

**Dr. Panayotis "Pano" A. Yannakogeorgos, DAF**, is a cyber defense analyst and faculty researcher at the Air Force Research Institute. His research is focused on the impact of malicious cyber activities on global and military affairs and the establishment of global norms of behavior for cyberspace. Recent publications include "Challenges in Monitoring Cyberarms Compliance" and "Cyberspace: The New Frontier—and the Same Old Multilateralism." Dr. Yannakogeorgos earned his PhD and MS in global affairs from Rutgers University and an ALB in philosophy from Harvard University.

## Executive Summary

On 23 November 2010, the chief of staff of the Air Force tasked the Air Force Research Institute to review Air Force command and control (C2) to determine whether doctrine and organizational structures require changes to ensure success in uncertain and dynamic future scenarios. The research team's approach began with the assumption that any proposed structure must be adaptable to achieve success across the range of military operations and continue the focus on delivering the right effects at the right place at the right time. Accordingly, this study developed in four phases. First, the research team identified criteria for effective C2. Second, it used those criteria to conduct an analysis of Air Force C2 across seven operational examples that represent the range of military operations. This analysis sought to identify problems in the Air Force's C2 structure that indicated a need for increased adaptability. Third, based upon the problems identified, the team developed recommendations to improve adaptability of the Air Force's C2. Finally, the team validated the recommendations against key characteristics of the expected future operating environment.

The research team concluded that, to maximize effectiveness, the Air Force must organize, train, and equip its C2 structure to increase adaptability, building improved integration with partners—especially below the combatant commander level. The study's recommendations should lead to more effective and efficient operations in support of the joint force commander's requirements. Current and future operations demand this change. The emerging operating environment and the nature of air, space, and cyberspace operations conducted by the modern military will become increasingly joint, coalition, distributed, complex, intense, and global. These changed conditions necessitate adaptive C2 of Air Force capabilities, more so than ever.

Adaptive C2 design has the goal of creating unity of effort through integration at the lowest appropriate organizational level, achieving agility and speed of action in delivering effects. Creating unity of effort through horizontal collaboration built on mutual trust among war-fighting partners rather than a primary emphasis on traditional vertical interaction in the military hierarchy is critical. The design for realizing the goal of

adaptive C2 will vary from situation to situation; it is important for a commander to understand what causes these variations.

The study presents six questions to aid a commander in the design of an adaptable C2 structure. The answers to these questions will assist the commander in identifying the lowest appropriate organizational level to integrate operations. The questions address the following issues: the nature of an operation, available resources, capabilities of subordinate units, degree of trust and confidence, political risk, and the desire to exploit interaction among the speed, range, flexibility, versatility, and battlespace perspective of Air Force capabilities. When designing a C2 approach, a commander must assess how these items will influence an operation.

The study's concluding analysis identifies three overarching problems that the Air Force must overcome in order to attain an adaptive C2 structure: lack of clarity among command relationships, lack of confidence and trust, and lack of capability and capacity regarding Air Force integration elements. Although these three problems manifested themselves in different ways during each operational example, they accurately describe the fundamental issues requiring Air Force action to reach the goal of unity of effort through integration at the appropriate level, enabling agility and speed of action in delivering effects.

The research team makes the following recommendations. To overcome unclear command relationships, the Air Force should broaden Airmen's understanding of the concept of centralized control and improve their comprehension of command relationships—especially support—through adjustments to training, education, assignments, exercises, and policy. Furthermore, the Air Force should conduct a review of all concept and operational plans to ensure that C2 approaches are realistic.

To address a lack of confidence and trust between commanders and between staffs, the Air Force should create organizational structures that produce C2 elements at the appropriate organizational echelons. In addition, the service should establish habitual relationships through routine exercises, predeployment spin-ups, and force-rotation policies.

Finally, to tackle the lack of capability and capacity of its C2 elements, the Air Force must organize, train, and equip for more than one primary C2 construct. Further, the service

should develop a force-development strategy for subtheater commanders. Additionally, it should modernize nuclear C2 communications before existing equipment becomes obsolete. Solving these three overarching problems will create a C2 framework able to make the proper adjustments to meet the demands of military operations across the spectrum of conflict.

# INTRODUCTION

On 23 November 2010, the chief of staff of the Air Force tasked the Air Force Research Institute to review the service's command and control (C2) to determine whether doctrine and organizational structures require changes to ensure success in uncertain and dynamic future scenarios. Moreover, any proposed structure must have sufficient adaptability to achieve success across the range of military operations and continue the focus on delivering the right effects at the right place at the right time.[1] The research team addressed the chief of staff's tasking by developing the following research questions: Does the C2 of Air Force capabilities (air, space, and cyber) need to become more adaptive to ensure both effective and efficient operations in support of the combatant commander's (CCDR) requirements across the range of military operations? If yes, what changes are needed to improve the service's C2 adaptability? The team used a variety of means to find answers to these questions, including a literature review of joint and Air Force lessons-learned documents, interviews, research conducted at the combined air operations center (CAOC) at Al Udeid Air Base, Qatar, and sponsorship of a C2 workshop.

The study developed in four phases. First, the research team identified criteria for effective C2. Second, it used those criteria to conduct an analysis of the Air Force's C2 across seven operational examples that represent the range of military operations. This analysis sought to identify problems in the service's C2 structure and doctrine that indicated a need for enhanced adaptability. Third, based upon the problems identified, the team developed recommendations to improve adaptability of the Air Force's C2. Finally, it validated the recommendations against key characteristics of the operating environment expected in the future.

The results of the study showed that the design of Air Force C2 requires changes that will increase adaptability and thereby better support missions across the range of military operations. The analysis produced guidelines for an adaptive design for C2. In addition, after discovering three problem areas that affected the adaptability of Air Force C2, the team made eight recommendations that address those issues.

## A Framework for Analyzing Command and Control Structures

The basis for an effective analysis across varied operations lies in establishing a common definition and developing an analytical model that captures the fundamental elements of C2. For the purposes of this study, joint and Air Force doctrine supply the necessary definition. Doctrine describes the concept of C2 as encompassing the way the Air Force organizes, commands, plans, controls, and executes capabilities to attain a joint force commander's (JFC) objectives. It further describes C2 as separate but interrelated functions.

*Command* "is the art of motivating and directing people . . . into action to accomplish missions." It includes authorities and responsibilities for the effective use of available resources.[2] These authorities, also known as command relationships, are delegated to a commander by law or delegated by senior leaders and commanders over assigned and attached forces.[3] Combatant command (COCOM), operational control (OPCON), tactical control (TACON), and direct support represent common types of command authorities.[4]

Doctrine describes *control* as a regulation function inherent to command. It is the commander's method for integrating and synchronizing functions by establishing requirements, allocating means, determining organizational effectiveness, identifying and correcting variance from set standards, and delegating authority. Ultimately, control gives commanders a means of measuring, reporting, and correcting performance.[5] Simply put, "command is perceiving and deciding, whereas control is communicating the decisions, organizing to carry them out, and then monitoring and measuring performance to feed back to command."[6] It is important to note that the process of commanding and controlling does not occur in isolation at one organizational level. Rather, it occurs at many organizational levels simultaneously, both independently and in concert with each level.[7]

## Analytical Model

When Dr. David Alberts and Dr. Richard Hayes worked with the North Atlantic Treaty Organization (NATO), they developed

an analytical model to evaluate C2 approaches, as described in their book *Understanding Command and Control*. Alberts and Hayes based this model upon ideas developed during their three-year involvement with an international research collaboration conducted under a charter from NATO's Research and Technology Organization.[8] Subsequently, NATO used the model to analyze the agility of C2. The research team selected this model to guide analysis of the seven selected operational examples because of its inherent versatility in evaluating multiple C2 designs used to employ the Air Force's air, space, and cyber capabilities across the range of military operations. The model consists of three fundamental C2 elements by which one can characterize and differentiate alternative C2 approaches.

The model's three fundamental C2 elements include allocation of decision rights, patterns of interaction among actors, and distribution of information.[9] Allocation of decision rights entails giving designated individuals the authority and responsibility to make decisions among possible options, using command relationships to clearly define a commander's decision authority and responsibility. Patterns of interaction address who needs to communicate (e.g., commanders, staffs, and employees), how they communicate (e.g., face-to-face or by means of video teleconferences), and what types of transactions (e.g., decision, advice, and situational awareness) occur during the communication. Distribution of information consists of the various ways and means of sharing information to inform all partners involved in an operation. It includes information sharing across C2 structures of service, joint, coalition, other-government, and nongovernment agencies.

The three fundamental elements describe an approach to C2. As shown in figure 1, varying C2 approaches reside within the space bounded by the three axes. The x-axis represents the allocation of decisions, the y-axis the patterns of interaction, and the z-axis the distribution of information. The position from which an organization would operate within this space depends upon the degree of centralization of each of these elements. For example, an organization that limits its allocation of decisions, distribution of information, and patterns of interaction is in the centralized portion of this C2 design space.


**Figure 1. Analytical model**. (Adapted from David S. Alberts and Richard E. Hayes, *Understanding Command and Control* [Washington, DC: Command and Control Research Program Publications, 2006], fig. 11, "C2 Approach Space," 75, http://www.dodccrp.org/files/Alberts_UC2.pdf.)

An organization's location in this space will vary based upon function, type of capability, and time. For example, C2 for a humanitarian-relief effort would differ from that for a major conventional combat operation. Moreover, within the same operation, C2 for cyber capabilities may differ from that for air capabilities. An effective C2 design creates the proper balance of centralization between each element.[10]

Additionally, the three fundamental elements are interrelated. The design and implementation of one element will affect how the other elements react. Analyzing a C2 approach demands an understanding of the interaction among them.[11]

Having a clear definition and analytical model for command and control provides a basis for analyzing varied C2 approaches used across the range of military operations. The research team

selected four named operations—Operation Allied Force, the major combat phase of Operation Iraqi Freedom (OIF), the counter-insurgency (COIN) phase of Operation Enduring Freedom (OEF) and OIF, and the disaster-relief effort for Hurricane Katrina—and three mission sets (nuclear, space, and cyber) for evaluation.

## RESULTS OF THE ANALYSIS

The research team sought to determine whether Air Force C2 is sufficiently adaptive to meet the varied needs of the JFC and, if not, identify areas needing improvement. The analysis used the three fundamental C2 elements from the Alberts and Hayes model to evaluate the C2 of Air Force air, space, and cyber capabilities at the global, theater, and subtheater levels during operations across the range of military operations. Doing so offers insight into the needed range of C2 means and the existence of capability gaps. The team selected the seven operational examples for the following reasons. First, Allied Force illustrated the coercive use of Air Force capabilities within an alliance without the presence of a substantial ground force. Second, the major combat phase of OIF depicted the use of Air Force capabilities in the presence of a large ground force. Third, the COIN phase of OEF and OIF evoked the use of those capabilities in a distributed land operation supporting two different joint task forces (JTF) within one CCDR's area of responsibility. Fourth, disaster relief during Katrina illustrated the use of Air Force capabilities in support of a domestic relief effort. Finally, the nuclear, space, and cyber mission sets reflect the unique nature of these missions.

A comprehensive review of the issues showed that the Air Force needed adjustments to its C2 structures and processes—specifically, more adaptivity. The analysis indicates that the current Air Force structure (theater commander of Air Force forces / joint force air component commander [COMAFFOR/JFACC]) centralizes the C2 of capabilities primarily at the CCDR level. Further, it demonstrates that, although productive for global and theater operations, this one-size-fits-all configuration runs contrary to fully effective C2 of Air Force capabilities across the range of military operations. JTF-led operations often rely heavily upon ad hoc arrangements of Air Force C2

organizational structures, equipment, and personnel to support the JTF commander's requirements. The ad hoc structures hindered the integration of Air Force air, space, and cyber capabilities into joint plans. At times unforeseen circumstances caused the unplanned arrangements; however, in many cases they resulted from a C2 structure not organized, trained, or equipped to fully integrate at the JTF level.

Traditional constructs within the Air Force would have space and cyber capabilities using one C2 model, which would retain OPCON and TACON with the functional commanders for space and cyber while providing direct support to a geographic CCDR. Although this is possible, actual operations need more adaptability. In practice, for some space and cyber capabilities, OPCON and/or TACON authorities passed from the functional commanders to a geographic CCDR. The delegation of OPCON and TACON relied upon ad hoc C2 arrangements. The Air Force must organize, train, and equip its C2 structures to support the delegation of OPCON and/or TACON to a geographic commander.

Synthesis of the issues found during the analysis of the seven operational examples led the research team to suggest improvements to the adaptability of Air Force C2. These ideas include guidelines for adaptive C2 design as well as recommendations to overcome three major challenges that affect the service's ability to create adaptive C2 structures.

## Guidelines for Adaptive Command and Control

Guiding a commander in developing an adaptive C2 structure requires two key elements. The first is clearly understanding the overall end state or goal of an adaptive C2 design, and the second is comprehending how key influences affect the final design.

### Goal of Adaptive Command and Control

Analysis of the seven operational examples identified the following common traits needed for the development of adaptive command and control: focusing on unity of effort as well as unity of command, integrating command and control functions at the lowest appropriate level, creating agility, and enhancing

speed of action. Combined, these traits provide an accurate description of the overall goal of adaptive command and control design for Air Force capabilities. The primary goal of adaptive C2 is the creation of unity of effort through integration at the lowest appropriate level, thereby achieving agility and speed of action in delivering desired effects.[12]

Unity of effort stresses coordination and cooperation toward common objectives from participants not necessarily part of the same command or organization.[13] For most missions across the range of military operations, a commander will need to integrate capabilities that reside with other joint, interagency, multinational, and government as well as nongovernment partners. Some individuals consider such interdependence risky because success depends upon capabilities that a commander may not directly control. However, capabilities necessary to support missions across the range of military operations and the makeup of the current force structure render this situation a reality. Commanders do not need to "own or control" partners' assets to guarantee access to their capabilities. Adaptive C2 structures must create synergy through utilizing horizontal collaboration built on mutual trust among all war-fighting partners rather than simply emphasizing the traditional vertical interaction characteristic of the military hierarchy. Lack of trust among partners leads to the desire to "own" all assets needed for an operation; this leads to excessive control and prevents synergy. C2 that concentrates on unity of effort will enable a one-team, one-fight mind-set and will increase effective access to a wider range of capabilities.[14]

Another key aspect of the overall goal of C2 involves maximizing the agility and speed of action a commander needs to decide and act quicker than an adversary to produce the desired effects. Decentralizing C2 to the lowest appropriate level capable of integrating assets is the best way to increase a commander's ability to act swiftly. Inappropriately centralized C2 structures may lose agility and impair initiative, resulting in mission failure. A commander's clear guidance, intent, and priorities, as well as acceptable risk and appropriate authority for the level of responsibility, must accompany the decentralization process. Further, command relationships that enable

effective horizontal collaboration among partners can enhance both agility and speed of action.[15]

The design for attaining the goal of adaptive C2 will vary from situation to situation. A commander must understand what causes these variations or what influences the fundamental elements of C2.

## Influences on the Fundamental Elements of Command and Control

In *Power to the Edge: Command and Control in the Information Age*, Alberts and Hayes capture the idea that in a perfect world, the most effective way to realize unity of effort and speed of action during an operation entails decentralizing to the lowest organizational level the allocation of decisions, distribution of information, and patterns of interaction.[16] In reality, however, certain influences—*common* ones and those *unique* to the Air Force's capabilities—limit the decentralization of these three fundamental elements of C2. These influences' level of impact will vary according to the situation. Thus, when designing a C2 approach, a commander should assess how these items will affect an operation.

Although countless factors determine the design of a C2 structure, the key *common influences* identified across all seven operational examples include the nature of an operation, available resources, capabilities of subordinate units, degree of trust and confidence, and political risk.[17]

**Nature of an operation**. Different operations drive different balances of centralization among the three fundamental elements. For example, global operations such as airlift or some forms of strategic attack generally require a high degree of centralization in order to direct mission sequencing and make adjustments during execution. Contrastingly, air operations supporting ground forces in a distributed land fight are most effective when conducted with a higher degree of decentralization, given the desire to retain tactical responsiveness. Other operations, such as interdiction, benefit from a mix of centralization and decentralization. Centralization allows direction of overall priorities and weight of effort while decentralization enables a faster tempo of operations during execution.[18]

**Available resources**. Simple supply and demand are significant determining factors with regard to the appropriate degree of centralization among the fundamental elements of C2. If plenty of Air Force assets are available to deliver the desired effect, then one can highly decentralize C2 of those assets. However, scarce resources warrant a more centralized C2 approach to carry out the processes for determining prioritization and allocation against competing requirements.[19]

Preestablished priorities of assets in limited supply but high demand, made in a centralized fashion, will allow decentralized decision makers to quickly adjust assets to execution realities. Effective prioritization permits commanders to take advantage of the unique speed, geographic range, flexibility, and versatility of Air Force capabilities. For example, if an event drives the need for change at the tactical level during mission execution, lower-echelon control nodes need not wait to receive higher-echelon approval to change targets for strike aircraft, to release satellites to other organizations, or to alter the cyber communications plan. Effective and clearly communicated prioritization of capabilities supports decentralization of integration, improving the speed of action.

**Capabilities of subordinate units**. Other influences may allow for greater decentralization of the three fundamental elements, but unit capabilities may not permit this form of C2. To perform the function of C2 successfully, units must be properly organized, trained, and equipped—a process that demands clear direction concerning a unit's types of decision authority and that calls for proper development of communications infrastructure, which facilitates effective interaction and sharing of information.

**Degree of trust and confidence**. In general, the greater the confidence and trust among commanders, subordinates, and partners, the more likely the decentralization of fundamental C2 elements. Trust builds confidence in others. The presence of confidence regarding the competence and actions of others encourages greater willingness to grant decision authority and share information with others. Trust is built through interaction, whereby partners must plan for that virtue and continually reinforce it. Also, when designing a C2 approach, one must understand that trust generally begins with shared experiences

and face-to-face interaction. In light of the perishable nature of confidence and trust, one best establishes those qualities in person, not virtually, and should take pains to guard that confidence, which is difficult to rebuild once lost.

**Political risk**. Typically, a C2 architecture should let front-line decision makers make on-scene decisions, especially during the execution of complex, rapidly unfolding operations. However, as commanders and staffs build plans for operations, political considerations may dictate a more centralized approach to C2. For instance, significant political concerns could arise due to the potential for collateral damage, or creation of a strategic-level effect with nuclear or cyber weapons would likely dictate a centralized approach. It is critical to keep such instances to a minimum. Modern information technology may entice commanders to C2 operations centrally even when those operations do not warrant such control. Despite vast improvements in technology, a single person cannot gain full situational awareness during operations with multiple, simultaneous engagements throughout a large operating area. Senior commanders must balance overall campaign execution against the pressing need for tactical flexibility. The proper mix of fundamental C2 elements should enable a subordinate's decision to support the commander's intent and meet campaign objectives.[20]

C2 structures also are designed to exploit each of the Air Force's *unique capabilities*: speed, range, flexibility, versatility, and battlespace perspective, and such exploitation leads Airmen to a more centralized approach to decision making, interaction, and distribution of information.[21] Coordinating and integrating global, theater, and subtheater operations; managing scarce assets against high demand; conducting real-time mission retasking; and simultaneously creating strategic- to tactical-level effects make a centralized approach desirable. A centralized C2 approach allows a commander to respond to changes in the operating environment and to take advantage of fleeting opportunities.

## Using the Influences to Design Adaptive Command and Control

Ascertaining the proper balance of centralization versus decentralization among allocation of decisions, distribution of

information, and patterns of interaction to attain adaptable C2 of Air Force capabilities is no simple task. It is as much an art as a science. Constant tension exists among a joint force's command elements during the process of determining the degree of centrally controlling Air Force capabilities. Turning the influences into a series of questions offers a practical way of aiding commanders in the art of designing adaptive C2.

Using the influence descriptions above to think through the answers to the following questions, which apply to all Air Force air, space, and cyberspace capabilities, will aid a commander in the design of an adaptable C2 structure:

- What is the nature of an operation?
- What is the capacity of available resources versus the requirement?
- What are the capabilities of subordinate units?
- What is the degree of trust and confidence among partners? Can it be changed?
- What is the political risk?
- At what echelon should authorities reside and planning and execution take place in order to exploit the speed, range, flexibility, versatility, and battlespace perspective of Air Force capabilities? (When answering this question, consider whether or not an established JTF exists, the scope of an established JTF, the required responsiveness, the number of theater JTFs, Air Force requirements throughout the area of responsibility, and the capability of lower-echelon sourcing and manning.) [22]

Having established a clear goal for effective and adaptive C2 across the range of military operations and having identified influences that affect the actual design, one should then identify and recommend solutions to problems that hinder realization of this goal. To do so, the research team identified three overarching problems involving organizing, training, and equipping that the Air Force must overcome.

## ORGANIZE, TRAIN, AND EQUIP: OBSERVATIONS AND RECOMMENDATIONS

The research team's review of the seven operational examples identified three major problem areas: lack of clear command relationships, lack of confidence and trust, and lack of capability and capacity of Air Force integration elements. Although these problems manifested themselves in different ways during each operational example, they accurately describe the fundamental issues requiring Air Force action if the service wishes to reach the goal of unity of effort through integrating assets at the appropriate level, thus enabling agility and speed of action in delivering effects. If the service does not adequately address these issues, it once again will be forced to rely upon ad hoc means to meet demands for C2 across the range of military operations.

### Observation: Agility and Speed of Action Suffer from Unclear Command Relationships That Hamper Vertical and Horizontal Integration.

Developing clear command relationships has received emphasis because of problems associated with Operation Anaconda in Afghanistan, during which poorly defined command relationships led to planning and execution challenges that forced commanders to rely on luck for success.

Establishing clear command relationships is critical to effective vertical and horizontal integration. Without them, one faces confusion and misunderstanding with regard to decision authority, which leads to difficulty in determining with whom one should interact vertically or horizontally within an organization to exchange information in order to make decisions. Poor vertical and horizontal integration hinders the ability of a commander and staff to make timely and accurate decisions, ultimately impeding agility and speed of action in delivering desired effects.

The research team identified the lack of clear lines of authority as a major issue in five of the seven selected operational examples. Exceptions included the nuclear mission set and the major combat portion of OIF, both of which enjoyed clear command relationships because of the emphasis placed on this critical concept for these events. The importance of the nuclear

enterprise demands that all partners understand the clear lines of authority, a requirement facilitated by constant exercises involving nuclear C2. Regarding OIF's major combat phase, commanders and staffs spent considerable time jointly developing and then disseminating the command relationships to all partners, a process that began early in the planning phase, with refinements occurring during execution. In addition, the fact that the commander of US Central Command led secure video teleconferences while staffs held synchronizing conferences allowed for both vertical and horizontal integration, thus producing a truly joint campaign plan.

Vertical and horizontal integration of planning and execution suffered in the other five operational examples due to lack of clear command relationships, although the causes differed. In four of the operational examples, failure to fully utilize capabilities of the support command relationship prevented effective horizontal integration of the partners. For example, during the COIN phase of OEF and OIF, as well as during the Katrina relief effort, lack of clear guidance on priorities and intent from the establishing authority impaired the supported/supporting relationship. Moreover, several of the C2 models for space and cyber capabilities overemphasize the ownership of OPCON and TACON at the expense of the support relationship. During Allied Force, dual command structures caused confusion about who had decision authority, a situation that affected the distribution of information and damaged vertical and horizontal integration. When OEF and OIF entered the COIN phase, the failure to understand space command relationships adversely affected the employment of space capabilities. This poor understanding resulted from the fact that competing space C2 models placed authorities at different echelons for different assets and that many space personnel were not accustomed to working at the theater level. The relief effort following Katrina saw confusion of command authorities among active, Reserve, and Guard forces, which caused the timeliness of decisions and distribution of information to suffer. Finally, cyber command relationships, a subject currently under intense debate, involve three models, each with different command relationships. The first model retains OPCON/TACON at the US Cyber Command level, with direct support to a geographic CCDR. The second retains

OPCON at the Cyber Command level, with TACON passed to the geographic CCDR. The third passes OPCON and TACON from the commander of Cyber Command to a geographic CCDR. Unclear cyber command relationships will hinder the development of an effective C2 approach for this capability.

Although reasons varied from operation to operation, the analysis indicated that indistinct command relationships inhibited interaction between commanders and staffs as well as the sharing of information, resulting in poor vertical and horizontal integration. The research team offers three recommendations for improving the clarity of command relationships.

**Recommendation: Broaden Airmen's understanding of the concept of centralized control by changing policy, doctrine, training, and education**. The current interpretation of the concept of centralized control stands as the greatest impediment to an Airman's understanding of how to develop appropriate command relationships that support an adaptive approach to C2. Mainstream Air Force thought holds that centralized control of its capabilities occurs only through the command of a senior Airman at the CCDR level, supported by centralized planning. The theater COMAFFOR/JFACC model, supported by the air and space operations center (AOC), translates this philosophy into reality. The command authorities for this model are very straightforward. OPCON and administrative control (ADCON) of attached Air Force forces reside with the theater COMAFFOR. TACON of other joint capability can be passed to the JFACC for execution in support of the JFC's objectives. If JTFs are created, then liaison elements assist in the integration of Air Force capabilities, but all command authorities still reside at the theater COMAFFOR/JFACC level. The present philosophy dictates that attaching forces and passing command authorities to a JTF commander would "penny-packet" Air Force capabilities, violating centralized control.[23] Using the term *penny-packet* automatically demeans the concept by virtue of the pejorative sense it has acquired in Air Force history and lore. So the current interpretation of centralized control forces Airmen's thinking into a one-size-fits-all C2 model that limits the way to think about command authorities. Even though joint and Air Force doctrine allows for the attachment of forces to a JTF with specification of OPCON and TACON,

the Air Force is not organized, trained, or equipped to support this idea.

The problem with this rigid C2 approach is that Airmen have tried to force-fit this model, along with the accompanying command relationships, into all missions across the range of military operations rather than let operations adjust the model. Sending an Air Force commander together with appropriate command authorities to an echelon below the CCDR level or attaching Air Force forces to a JTF does not violate the doctrinal concept of centralized control. The research team's analysis of the seven operational examples concluded that effectual C2 of Air Force capabilities require flexible control, with decision authority centralized at the appropriate echelon of command. At times the theater COMAFFOR/JFACC model is best suited for an operation, as it was during the major combat phase of OIF. Other operations, such as the COIN phase of OEF and OIF, dictate the need to send an Air Force commander below the theater COMAFFOR/JFACC level. The concept of C2 in-depth captures the essence of adaptive C2, a fact that would help broaden the contemporary interpretation of centralized control.

One obtains C2 in depth by inserting commanders with legal decision authority in control nodes placed at appropriate organizational levels capable of integrating Air Force capabilities with those of other partners to produce unity of effort. The C2 node must have the situational awareness to understand the requisite actions and the authority to direct forces or delegate decision authority to allow them autonomy.[24] This concept better supports the overall C2 goal of integration of assets at the lowest appropriate organizational level. Commanders must decide the appropriate level at which to place both commanders and control elements, basing that decision on the influences discussed earlier—not on a rigid, incorrect interpretation of centralized control.

The recent creation of Air Force subtheater commanders in Iraq and Afghanistan represents a step toward broadening the concept of centralized control and creating command in depth. To ensure success, the service must evaluate the concept and organize, train, and equip to best practices.

**Recommendation: Educate Airmen on proper global, theater, and subtheater command relationships, especially support, during training, education, and exercises**. Learning

is a never-ending process—a statement that rings true in terms of understanding command relationships. Developing the expertise to establish effective command authorities among all partners involved in an operation is no trivial matter. It takes deliberate action throughout an Airman's career to provide appropriate training, education, and experiential opportunities that will impart the knowledge necessary for success. These events must employ the full spectrum of Air Force capabilities and cover the variety of missions expected across the range of military operations. In addition, they must incorporate interaction with joint, coalition, and other-government agencies as well as nongovernment agencies. Prior to actual operations, exercises that include partners will help develop a better understanding of different C2 philosophies. Furthermore, the service must quickly roll knowledge gained from recent operations into these events, which should include such concepts as C2 in depth as well as a broader definition of centralized control.

An understanding of all command relationships (e.g., OPCON, TACON, and ADCON) is critical; however, analysis of the seven operational examples identified support as one of the most powerful but least understood of these. Because support relationships convey the authority and basis for effective horizontal integration in dealings with joint, coalition, other-government, and nongovernment agencies, training, education, and experiential events should place more emphasis on them. Gaining OPCON and/or TACON of these partners' capabilities may be neither possible nor necessary. The support relationship makes supporting commanders responsible for the success of the supported commander—a concept essential to horizontal integration, creating unity of effort that allows access to capabilities "owned" by other partners. Successful completion of most missions across the range of military operations requires commanders to rely on partners' capabilities.

Learning events that include the support command relationship should cover several key ideas. That relationship works best when subordinates receive clear direction regarding a commander's priorities and intent. Creation of an establishing directive that states the desired effects, time, place, and duration of the supporting effort and that establishes priority relative to other missions is critical to the effective use of this authority.[25]

Such learning events should stress the importance of an establishing directive, and appropriate events should require the writing of that directive. The understanding obtained from clear direction allows subordinates to work horizontally with each other in carrying out tasks. The establishing authority for the supporting relationships must then set conditions for and demand cross talk among supported and supporting commanders.[26] Subsequently, the supported and supporting commanders must do the same within their own organizations. Establishing liaisons between supported and supporting commanders will assist in bringing about the effective exchange of information, leading to improved integration. The cross talk will build and reinforce the necessary horizontal personal relationships, trust, and confidence. After establishment of the conditions for horizontal cross talk, all levels of a C2 structure should attempt to self-regulate their apportionment of capabilities to one another through horizontal cross talk. The cross talk among partners will allow them to arrive at the optimal apportionment of capabilities that will complete their assigned tasks and support the designated supported commanders. Finally, the establishing authority must stay involved and, when necessary, arbitrate and resolve conflicting understanding of priorities or revise guidance based on subordinates' input.[27]

**Recommendation: Review all concept and operational plans to ensure the realism of command and control approaches**. Although no plan survives first contact with the enemy, that fact does not constitute an acceptable excuse for poor planning. The Katrina relief effort revealed that the worst time to start sorting out command authorities is during a crisis or the middle of an ongoing operation. A well-thought-through and coordinated plan can save much time, confusion, and, possibly, lives. Plans that rely on extensive capabilities from coalition, other-government, and nongovernment agencies contain some of most complex command relationships in existence. To ensure the practicality of command authorities and to guarantee all partners' understanding of them, one must review these types of plans.

**Observation: Lack of Two Key Influences—Confidence and Trust—Affects Partners' Willingness to Decentralize Authority, Share Information, and Interact Productively.**

Confidence and trust between commanders, between staffs, and between partners help make any C2 approach more effective. When confidence and trust suffer, so does the C2 approach. Establishing these two qualities does not happen by accident but through a deliberate effort to interact and build relationships. Furthermore, the means of interacting has significance. Leaders must decide when face-to-face meetings or the use of information technology is more appropriate. Generally, one best builds trust through personal contact and shared experiences—not solely through video teleconferencing. To quote an often-used expression, "Virtual presence is actual absence." Trust, especially its initial development, demands "actual presence." Just as personnel must understand a foreign nation's culture when they conduct operations, so must they understand the culture of the services that need air, space, and cyberspace effects. The culture of two such services that Airmen work with daily, the Marine Corps and Army, thrive on personal relationships. Technology must support the C2 of Air Force capabilities but not replace the presence of commanders and planning expertise at the appropriate planning levels. Sometimes presence alone produces the desired effect.[28]

Establishing confidence and trust between partners is an issue for any operation. Analysis of the operational examples showed that, although the effectiveness of all seven relied on confidence and trust between partners, five of the seven suffered from a lack of those two influences, with nuclear operations and the major combat phase of OIF affected the least by this deficit. The constant training and exercising of nuclear C2 help create confidence and trust among the individuals and organizations involved. During the planning phase for major combat operations in Iraq, commanders made a concerted effort to ensure personal and virtual interaction among themselves, their staffs, and their partners. The confidence and trust built during these events carried over into the execution phase of the operation, easing friction between partners over the proper way to C2 capabilities.

The lack of confidence and trust affected the other five operational examples to varying degrees, most notably during the COIN phase of OEF and OIF. Personal interaction and common understanding of the situation between commanders and staffs suffered because the JTF commanders did not have a senior Airman with command authorities at their echelon of command. The theater COMAFFOR/JFACC model did not provide for an Airman with command authorities below the CCDR level, making personal relationships difficult to maintain due to this structure's reliance on a virtual rather than physical presence. A virtual relationship does not facilitate the ability of senior air component commanders to build close, trusting relationships with JTF counterparts, thus hindering the ability of Airmen to advocate effectively for the proper use of Air Force capabilities.[29]

The research team found that confidence and trust issues also cause friction in the C2 of space and cyber capabilities—prime examples of low-density, high-demand assets, which encourage C2 approaches that overemphasize the need for ownership of capabilities through OPCON and TACON authorities. Ownership ensures availability of the limited capability for a specific operation and lessens the likelihood of its redirection in support of another mission. Though good for the owner, this situation may impede others' access to these capabilities. On the one hand, lack of confidence and trust inspires belief in ulterior motives or the feeling that "I am not getting my fair share." On the other hand, their presence between partners increases the likelihood of sharing access to capabilities through command authorities such as support. The establishment of trust allows partners to count on support and have confidence that other commanders do not hoard assets by means of ownership-type command authorities.

Finally, habitual relations between commanders and staffs help fortify confidence and trust, unlike the situation during the COIN phase of OEF and OIF as well as the Hurricane Katrina relief effort. Continuity of the relationship between commanders and the staffs of supporting and supported components remains critical to the success of virtually all operations.

The Air Force must create the opportunity for commanders and staffs to build confidence and trust with each other and

with partners involved in operations. The research team offers two recommendations for doing so.

**Recommendation: Create organizational structures that, by design, produce command and control capabilities at appropriate organizational echelons**. Building confidence and trust among service, coalition, other-government, and non-government agencies is essential to an effective C2 approach. When gaps in interaction occur, perceived and/or real, partners need to close the seams by using organizational structures that establish C2 capabilities at appropriate organizational echelons. The Air Force's current one-size-fits-all C2 model limits the organizing, training, and equipping of mobile C2 elements. Adopting a philosophy of in-depth C2 would provide the basis for organizing, training, and equipping a more adaptable C2 approach. Obviously, in the absence of a structure that permits individuals to work together and establish habitual relationships, they cannot effectively interact to build trust.

**Recommendation: Establish habitual relationships through routine exercises, predeployment spin-ups, and force-rotation policies**. Habitual relationships aid in the development of confidence and trust through long-term interaction that produces a common perspective and the shared sense of problem/solution ownership. One can take several actions to establish such relationships. First, partners that normally work and deploy together should attend routine and predeployment exercises together. Second, force-rotation policies between partners should align as closely as possible. Although capability and capacity issues cause differences in force rotations, one should keep the gap as small as possible. Clearly, if one partner's personnel turn over four times faster than another's, relationships will not develop easily. Lastly, established relationships need nurturing through commander and subordinate cross talk at all C2 echelons.

### Observation: Lack of Capability and Capacity of Air Force Command and Control Elements Limits Integration with Partners.

C2 structures designed to integrate assets at the lowest appropriate organizational level are a critical factor in the quest to

reach the goal of adaptive C2. Thus, the Air Force must present to the CCDR C2 elements that are ready to command, plan, execute, and support simultaneous global, theater, and subtheater operations. Unfortunately, the service has not organized, trained, or equipped its C2 structure to fully integrate with partners at levels below the CCDR level and faces issues with the communications capabilities that support both, at and below the CCDR level. These deficiencies leave gaps in the number of C2 elements needed and in the capability within existing elements. An insufficient number of these elements (or fully capable ones) adversely affects the ability to decide, interact, or inform at the appropriate level.

The research team found that five of the seven operational examples exhibited problems with the capability and capacity of Air Force C2 elements. Common themes included sending command and/or control capability to echelons below the CCDR level; integrating with a broad range of partners, which drives the requirement for liaison capability; and effectively supporting communications equipment.

During the Katrina relief effort, poor integration between Air Force and civilian entities impeded unity of effort. Further, the lack of interoperable, deployable communication equipment hampered effective communication across service, joint, and interagency partners. Use of liaison officers at the proper channels could have smoothed operations and aided in coordination and cooperation toward common objectives.

During the COIN phase of OEF and OIF, the issues concerned the joint air component coordination element (JACCE) concept, appropriate planning expertise at lower echelons that would integrate the full range of Air Force capabilities into joint plans, and capabilities of the theater air control system for supporting distributed land operations.[30] Questions about the rank and liaison status of the JACCE director (a liaison officer with no authority to make command decisions), along with the lack of sufficient JACCE staff, stymied this concept for years. After lengthy debate, elevating the rank of the JACCE director to O-8 helped that individual access the JTF commanders, but it did little to address the absence of command authority. Without the latter, the JACCE could not consolidate operations within the joint operations area and lessen the Air

Force Central Command commander's span-of-control challenges with an intermediate echelon of command between the multiple air and space expeditionary wings and Air Force Central Command. In addition, for many years the makeup of the JACCE staff lacked robustness and good integration with the JTF staff, hurting the effective integration of Air Force capabilities into joint plans and helping to create the perception that the service had not fully committed itself to support the JTF.

The nature of the operations in both Iraq and Afghanistan drove the paucity of sufficient operational planners at echelons below the CCDR level during the COIN phase of OIF and OEF. In a COIN fight, much of the ground planning occurs at the tactical level to encourage small-unit initiative. Most Air Force planning expertise, other than close air support, however, resides at the CCDR level. Having only a few planners with expertise in intelligence, surveillance, and reconnaissance; space; mobility; and interdiction at lower echelons also contributed to the poor integration of Air Force capabilities into joint plans. Finally, all theater air control system elements, including the AOC, experienced integration problems with other service and coalition C2 systems. A dearth of common digital data links and of systems' ability to accept transmission formats impedes integrated war-fighting C2.

Cyber and space operations rely heavily on integration elements to support operational- and tactical-level actions. This reliance is based upon their global missions and the fact that limited quantities exist compared to the demand. For CCDRs and JTF commanders to tap into space and cyber capabilities, integration elements must exist within their C2 organizations. The Air Force faces the challenge of having enough trained cyber and space operators to support all the required integration cells, in addition to supporting other national agencies.

The C2 of nuclear operations is a problem waiting to occur. The communications equipment essential to the C2 of nuclear forces is facing obsolescence. Without reliable communications capability, commanders and staffs along the vertical integration chain could not interact to incorporate decisions and information essential to nuclear operations. In this area, the stakes are too high not to modernize.

An adaptive C2 structure depends upon C2 at all organizational levels. The research team makes three recommendations for improving the capability and capacity of Air Force C2 elements.

**Recommendation: Organize, train, and equip for more than one primary command and control construct**. Adopting the broader concept of C2 in depth would require the Air Force to develop scalable C2 capabilities for lower-echelon units. These units will promote effective integration and synchronization of the service's capabilities with the joint mission, including aligning forces and establishing command authority, along with planning expertise, at the appropriate organizational level. Further, lower-echelon units must effectively integrate with global and theater command structures. Such integration, from the global to subtheater levels, will preserve flexibility at the strategic and operational levels of war while increasing tactical flexibility. Including lower-echelon elements in a C2 design will help preserve the proper degree of centralization versus decentralization among the three fundamental elements of C2. Expectations regarding future defense budgets suggest that the Air Force likely will find itself unable to fully staff and equip an AOC to support every lower-echelon unit, such as a JTF. With this constraint in mind, the service must address the matter of organizing, training, and equipping appropriate C2 forces below the CCDR level along two tracks.

The first track, developing Air Force command elements below the CCDR level, demands greater attention. Doctrine development is not the problem. Chapter 7 of the October 2011 update to Air Force Doctrine Document (AFDD) 1, *Air Force Basic Doctrine, Organization, and Command*, thoroughly covers the concept of sending an Air Force commander to lower echelons. As discussed previously, the problem is that the current philosophy of centralized control does not require these elements, so the Air Force is not organized, trained, or equipped to create them. The following two options for creating lower-echelon command elements involve either attaching forces to a subtheater-level JTF or organizing them to support the JTF directly.

In option one, the CCDR may decide to attach Air Force forces to a JTF, a preferable action when span of control or scope of operations is less than theaterwide or when operations are fluid,

requiring planning and execution at more tactical levels.[31] If the CCDR does attach forces, such as an air and space expeditionary task force (AETF), to a JTF, then the AETF commander would be designated COMAFFOR for those assigned forces. If the JTF already has a JACCE assigned, then the latter can be dual hatted as COMAFFOR, retained as a separate position, or eliminated. Unity of command and effort for attached Air Force forces will occur at the JTF level. Command of global and theater forces not attached to the JTF but supporting it will remain at or above the theater JFACC level. This arrangement allows for unity of command and effort of forces that routinely range throughout the theater and around the globe. If the CCDR needs them, that individual has the authority to reassign forces attached to a JTF to address higher theater priorities.

The following set of questions from AFDD 1 can aid the CCDR in making a final decision on whether or not to attach Air Force forces to a JTF:

- Do the operational tempo, intensity, duration, and scope warrant near full-time use of an attached AETF?
- Do the operational tempo, intensity, duration, and scope justify a dedicated AETF that, once attached to the JTF, may not be available to support operations elsewhere?
- Does the priority of the JTF mission, relative to other theater missions, justify a dedicated AETF that, once attached to the JTF, may not be available to support operations elsewhere?
- If the choice is to attach an AETF to a JTF, does the Air Force have the ability to provide the required C2 of Air Force forces?
- Does the provision of forces to a subordinate JTF, either by attachment or direct support, effectively demonstrate and enable the Air Force component's commitment to the joint force effort?

AFDD 1 further states that "if the decision is to attach forces, the follow-on question is whether the forces should be attached with specification of either OPCON or TACON."[32] Even though joint and Air Force doctrine describes this option and although actual operations demonstrate the need for it, the service is

totally unprepared to support this option other than through ad hoc means.

If, however, the CCDR decides not to attach forces to an established JTF but needs a lower-echelon Air Force command element, then the Air Force service commander may create a single-service task force. This second option may occur when dealing with more than one joint operating area of significant size and complexity within a CCDR's area of responsibility and when the JACCE option does not sufficiently integrate operations. Execution of this option entails designation of an appropriately sized expeditionary unit composed of all Air Force forces physically present within the JTF commander's area of operations in direct support of that commander.[33] Since the forces are essentially dedicated to the JTF commander under a single Air Force commander, this construct provides unity of effort at the JTF level. This arrangement retains unity of command at the CCDR level by the theater COMAFFOR, unlike the attachment of forces to a JTF, giving the COMAFFOR the authority and flexibility to shift those forces as required in response to the CCDR's direction without first having to regain control from the JTF commander. Creation of this new intermediate level of command supplies unity of effort at the JTF level while retaining unity of command and effort at the CCDR level. As with any tailored organization, the process should involve careful consultation among the service and joint force commanders involved. Obviously, the CCDR makes the final decision on establishment of the subordinate organization and distribution of command authorities. This option describes the new Air Force C2 structure that supports operations in Iraq and Afghanistan. To ensure the greatest success, the Air Force must review and implement the best practices from this concept and then organize, train, and equip forces to execute the concept routinely.

Neither of these options eliminates the need for the current JACCE concept, which is well suited for situations that require an integration element without command authority at a lower echelon, such as a JTF. This concept lends itself perfectly to scenarios in which on-hand air component expertise and a direct link back to the theater JFACC and AOC is sufficient.

The successful C2 of Air Force capability also depends upon the second track—effective integration of operational joint planning processes at lower echelons. As with command authority, the current interpretation of centralized control excessively places Air Force planning expertise at the operational level of war. Such centralization at the theater COMAFFOR/JFACC level becomes detrimental when distribution of information and interaction necessary for planning occurs at lower echelons. Decentralized planning consists of placing the correct expertise and appropriate planning tools at locations where operational plans are born and refined.

The location of a planning cell depends on the partner's C2 design. It should reside at the appropriate levels where plans are developed and integration occurs within organizations. For example, if a State Department team in a dispersed location needs Air Force capabilities, then—to maximize success—the service must have a structure with appropriate equipment and personnel ready to send to that location.

If a JTF established by the combatant commander without a ground component needs Air Force asset integration, then, again, the service must possess an adaptive C2 structure to send an integration team to support the JTF. If the latter does contain a ground component, then the Air Force can attach additional planning capability to tactical air control parties, which offer ready structures for placing experienced personnel with expertise in air planning, electronic warfare, intelligence, space, airlift, and cyber, thus improving planning integration. Establishing a standing requirement for a broader range of planning expertise would replace the current ad hoc tactical air control party organization that supports the noncontiguous fights in Iraq and Afghanistan.

However, the Air Force has no defined core operational and tactical requirement for deployable, scalable C2 capability. Without additional funding, developing the necessary scalable equipment capabilities for both of the tracks mentioned above calls for an integrated Air Force C2 planning, programming, and budgeting effort. Without integrated, defined requirements, various functional mission areas pursue similar capability independently, an approach that leads to interoperability problems along with wasteful spending caused by overlapping

development efforts. Consequently, the service needs a concept of operations for AETF C2. As the strategy document that serves as the basis for the C2 core-function master plan, the concept of operations should designate a lead agency organized and equipped to develop integrated C2 requirements. A clearly defined C2 strategy will go a long way toward concentrating scarce resources to develop integrated requirements that support the full range of military operations.

Manning for the lower-echelon units can come from several sources. For rapid augmentation needs, the Air Force should either establish a dedicated unit with manning positions taken from existing CAOCs or develop a tiered quick-response package (QRP) with personnel identified first from the Air Force component enterprise and then from C2 expertise throughout the wider Air Force. If the QRP option is selected, the use of unit type codes to prebuild integration element modules will further expedite the deployment of qualified personnel. By having the personnel system identify individuals who have performed subtheater command or JACCE staff duties or other liaison functions, the Air Force could easily find experienced people to fill modules for a newly established forward location or to replace deployed personnel during extended operations. Whichever option is selected, it is imperative that the Air Force fully fund, identify, and train personnel for rapid augmentation teams. Follow-on support to the lower-echelon units can come from an AOC's associate air reserve component unit with the appropriate activation.

**Recommendation: Develop a subtheater COMAFFOR/JFACC force-development strategy**. Adopting the C2 in-depth concept demands the presence of COMAFFORs and JFACCs at lower echelons of command. In turn, the effective preparation of future COMAFFORs/JFACCs requires a force-development strategy that ties together the needed education, training, and experience, particularly emphasizing several items. First, the Air Force must identify a cohort of individuals that will someday become commanders at the subtheater level and then deliberately develop them. This process should begin at preaccession training and education, with reinforcement at education and training events throughout their careers. Although this pool will be substantial early on, it will shrink as the careers of these

personnel under consideration by the Air Force progress and as early development, continued screening, and tracking occur.

Second, to enhance experiential learning, the service must emphasize the value of candidates' operational assignments—such as tours at an AOC; on an Air Force forces or a CCDR staff; or at a contingency response group, air support operations group, or air support operations squadron—which would round out the ADCON experience acquired as Air Force wing commanders. Although important, ADCON experience does not imbue an individual with skill sets for commanding and controlling airpower at the operational level of war.

Third, the Air Force must change the normal assignment path for command by forming a structure that allows personnel to step away from typical career paths without limiting their opportunities. Instead of insisting on the two traditional command tours, the service should allow them one group or wing command (O-6 level) and then an equivalent operational-type assignment (e.g., AOC division chief, Air Force forces staff, commander of an air support operations group, etc.). This change would signal that the Air Force values these positions and would allow people time to gain both ADCON and operational command experience within a normal career time frame.

Fourth, the service should review course curricula to ensure emphasis on the importance of operations. Where gaps exist, it should adjust the scheduling and content of current training and education curricula. For example, the wing commanders' course taught at the Ira C. Eaker Center for Professional Development, Maxwell AFB, Alabama, could be expanded beyond its coverage of ADCON duties to include command at the subtheater level. Further, the Air Force should review and adjust the timing of course offerings within individuals' careers. Allowing recently graduated wing commanders, for instance, to attend the JFACC course would help prepare them to command at both the subtheater and theater levels.

Finally, the Air Force personnel system needs an effective tracking mechanism to identify people with the training, education, and experience for command at the subtheater level. The complex and uncertain global environment demands that the service identify and track people who will fill subtheater C2

elements at a moment's notice. Currently the Air Force has no easy way to gather this information.

**Recommendation: Update nuclear command and control communications**. Obsolescence, budgetary constraints, and the lack of a coordinated effort by the Department of Defense to modernize communication equipment that supports nuclear C2 all present significant challenges. The Air Force must make this critical capability a priority.

## THE FUTURE RELEVANCE OF COMMAND AND CONTROL

The adaptability of C2 is essential to success in the dynamic operating environment of the future. Despite the impossibility of forecasting perfectly, *The Joint Operating Environment, 2010* captures the general consensus among studies regarding the nature of the future operating environment: "The next quarter century will challenge U.S. joint forces with threats and opportunities ranging from regular and irregular wars in remote lands, to relief and reconstruction in crisis zones, to cooperative engagement in the global commons."[34] Enemies include foreign states, nonstate entities, and loosely organized networks with a distributed hierarchical structure. Confronting these adversaries will require complex operations ranging from traditional major combat operations to continuous, simultaneous combinations of offensive, defensive, and stability or civil-support operations conducted in a highly integrated, networked, and distributed environment under JTF control. Since these operations serve a mixture of military and civil objectives, it is natural to see a blending of strategic, operational, and tactical levels. These enemies are defined by more than simply their military capabilities. The United States must understand and assault them through a comprehensive approach, using the lethal and nonlethal capabilities of all elements of national and international power. Success in operations against these foes demands the integration of capabilities from all government agencies, services, and coalition partners. Such integration stresses the need for unified action that leads to unity of effort. Finally, cyber operations deserve special mention. The

cyber capabilities of our enemies grow as do the nation's and military's cyber vulnerabilities. Network attack and network defense operations will occur at speeds greater than those of other Air Force capabilities.

To operate effectively, C2 approaches must adapt to the changing realities of the expected complex security environment. Creation of agility to take advantage of opportunities in this dynamic environment calls for decentralization of decisions, information, and interaction between commanders and staffs to the lowest appropriate level capable of integrating assets. Effective operations in this environment will at times necessitate the presence of commanders having decision-making authority, possessing the required information, and interacting at organizational levels below the CCDR—individuals who can provide optimal span of control, unity of command, and tactical flexibility. These operations also warrant distributing planners and control elements to appropriate partners' echelons and giving them information access and the authority to make decisions. If the Air Force wishes to create adaptable C2 structures that will allow it to function in this dynamic operating environment, the service must address the changes recommended here.

## CONCLUSION

The Air Force possesses an effective C2 structure optimized for directing, planning, and executing its capabilities to support operations at the global and theater levels. This study suggests that the service needs adjustments in its C2 design to maximize effects across the range of military operations. Specifically, the Air Force must organize, train, and equip its C2 structure to increase adaptability and thereby improve integration with partners, especially below the theater level. These improvements will ensure both effective and efficient operations in support of JFC requirements across the entire range of military operations. The nature of current and future operations dictates such a change. That is, both the emerging operating environment and modern military air, space, and cyberspace operations will become increasingly joint, coalition, distributed, complex, intense, and global. These conditions demand adap-

tive C2 of airpower with appropriate decision authority at the most appropriate level of command.

Before making any adjustments, the Air Force must agree upon a clear goal for the design of an adaptive C2 structure. Again, this study suggests that an adaptive design for C2 has the critical goal of creating unity of effort through integration at the lowest appropriate level, producing agility and speed of action in delivering effects. Such unity of effort occurs through horizontal collaboration built on mutual trust among all warfighting partners rather than an emphasis on the traditional vertical interaction within the military hierarchy. The research team found that commanders do not need to "own/control" partners' assets to guarantee access to their capabilities. Further, the decentralization of C2 to the lowest appropriate level capable of integrating assets maximizes agility and speed of action. The challenge for commanders lies in agreeing on what constitutes the lowest appropriate level.

Understanding how the variety of common and Air Force–unique influences affects the design of C2 will help determine that level. The Air Force's dogmatic interpretation of centralized control stands as the greatest obstacle to resolving this issue. Without a broader interpretation, the lowest appropriate level will remain that of the theater COMAFFOR/JFACC.

Expanding the concept of centralized control is not a doctrinal issue. As currently written, Air Force doctrine presents adaptive C2 models. Rather, Airmen must believe in the concept, as they once did, that creating C2 in depth by attaching Air Force forces to a JTF does not imply the penny packeting of capabilities. Once this paradigm shift occurs, the service will realize that problems exist with organizing, training, and equipping. Solutions to these problems must address the development of clear command relationships that produce effective vertical and horizontal integration, create confidence and trust among partners, and engender the appropriate capability and capacity of integration elements.

Solving these problems will pave the way for a C2 framework with supporting capabilities that can make proper adjustments to the allocation of decisions, distribution of information, and patterns of interaction based upon needs across the full range of military operations. Properly balancing the

three fundamental elements will lead to effectual C2 of Air Force capabilities through flexible control, with decision authority centralized at the appropriate echelon of command.

**Notes**

1. The range of military operations varies "in size, purpose, and combat intensity within a range of military operations that extends from *military engagement, security cooperation, and deterrence* activities to *crisis response and limited contingency operations, and if necessary, major operations and campaigns*" (emphasis in original). Joint Publication (JP) 1, *Doctrine for the Armed Forces of the United States*, 2 May 2007, incorporating change 1, 20 March 2009, xi, http://www.dtic.mil/doctrine/new_pubs/jp1.pdf.

2. JP 3-0, *Joint Operations*, 11 August 2011, III-2, http://www.dtic.mil/doctrine/new_pubs/jp3_0.pdf.

3. The term *assign* is defined as "plac[ing] units or personnel in an organization where such placement is relatively permanent, and/or where such organization controls and administers the units or personnel for the primary function, or greater portion of the functions, of the unit or personnel." *Attach* is defined as "the placement of units or personnel in an organization where such placement is relatively temporary." Ibid., GL-6.

4. JP 1 defines *COCOM* (command authority) as the

> authority of a CCDR to perform those functions of command over assigned forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction over all aspects of military operations, joint training (or in the case of [US Special Operations Command], training of assigned forces), and logistics necessary to accomplish the missions assigned to the command. It cannot be delegated or transferred.

It further defines *OPCON* as

> the command authority that may be exercised by CDRs [commanders] at any echelon at or below the level of combatant command and may be delegated within the command. When forces are transferred between combatant commands, the command relationship the gaining CDR will exercise (and the losing CDR will relinquish) over these forces must be specified by the SecDef. OPCON is inherent in COCOM and is the authority to perform those functions of command over subordinate forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission. OPCON includes authoritative direction over all aspects of military operations and joint training necessary to accomplish missions assigned to the command.

*TACON* is defined as

> the command authority over assigned or attached forces or commands, or military capability or forces made available for tasking, that is limited to the detailed direction and control of movements or maneuvers within the operational area necessary to accomplish assigned missions or tasks. TACON is inherent in OPCON and may be delegated to and exercised by CDRs at any

> echelon at or below the level of combatant command. When forces are transferred between CCDRs, the command relationship the gaining CDR will exercise (and the losing CDR will relinquish) over those forces must be specified by the SecDef.
>
> JP 1 further prescribes that support is a command authority and that
>
> a support relationship is established by a superior CDR between subordinate CDRs when one organization should aid, protect, complement, or sustain another force. Support may be exercised by CDRs at any echelon at or below the combatant command level. This includes the SecDef designating a support relationship between CCDRs as well as within a combatant command. The designation of supporting relationships is important as it conveys priorities to CDRs and staffs that are planning or executing joint operations. The support command relationship is, by design, a somewhat vague but very flexible arrangement. The establishing authority (the common superior CDR) is responsible for ensuring that both the supported CDR and supporting CDRs understand the degree of authority that the supported CDR is granted. There are four defined categories of support that a CCDR may direct over assigned or attached forces to ensure the appropriate level of support is provided to accomplish mission objectives. These include general support, mutual support, direct support, and close support.
>
> JP 1, *Doctrine for the Armed Forces of the United States*, xv–xvi.

5. JP 3-0, *Joint Operations*, III-5.

6. Lt Col Michael Kometer, *Command in Air War: Centralized versus Decentralized Control of Combat Airpower* (Maxwell AFB, AL: Air University Press, June 2007), 56, http://aupress.au.af.mil/bookinfo.asp?bid=248.

7. Command and control are fractal concepts that one can apply to all subsets of an enterprise, functions performed, levels of the organizations, and focus of the activity, whether strategic or tactical. Membership in these fractals may overlap with individual entities and groups belonging to multiple fractals dynamically. David S. Alberts and Richard E. Hayes, *Understanding Command and Control* (Washington, DC: Command and Control Research Program Publications, 2006), 9, http://www.dodccrp.org/files/Alberts_UC2.pdf.

8. Ibid., v.

9. Ibid., 75.

10. Ibid., 76.

11. Ibid., 113.

12. A variety of lessons learned documents emphasize this idea, to include United States Joint Forces Command, *Joint Operations: Insights and Best Practices*, 3rd ed. (Suffolk, VA: Joint Training Division, Joint Warfighting Center, United States Joint Forces Command, 12 January 2011), 6, https://jko.harmonieweb.org/coi/JointTrainingDivision/Documents/Insights_3rd_edition_Jan_12_2011.pdf.

13. The term *unity of effort* is defined as "coordination and cooperation toward common objectives, even if the participants are not necessarily part of the same command or organization—the product of successful unified action." JP 1, *Doctrine for the Armed Forces of the United States*, GL-11. In the book *Understanding Command and Control*, authors David S. Alberts and

Richard E. Hayes use the term *unity of purpose* instead of *unity of effort* because they feel it is a more accurate description of what one can actually achieve. This paper uses the terms interchangeably.

14. United States Joint Forces Command, *Joint Operations*, 6, 24.

15. Ibid., 6, 20.

16. David S. Alberts and Richard E. Hayes, *Power to the Edge: Command and Control in the Information Age* (Washington, DC: Command and Control Research Program, 2003).

17. The common influences were developed from analysis of the seven selected operational examples as well as from other sources, including Lt Col Clint Hinote, *Centralized Control and Decentralized Execution: A Catchphrase in Crisis?*, Research Paper 2009-1 (Maxwell AFB, AL: Air Force Research Institute, March 2009), 59–64, http://aupress.au.af.mil/digital/pdf/paper/ap_0006_hinote_centralized_control_decentralized_execution.pdf; AFDD 1, *Air Force Basic Doctrine, Organization, and Command* 14 October 2011, chaps. 2–5, http://www.e-publishing.af.mil/shared/media/epubs/AFDD1.pdf; and United States Joint Forces Command, *Joint Operations*, 17.

18. Hinote, *Centralized Control and Decentralized Execution*, 59–60.

19. Ibid., 61.

20. AFDD 1, *Air Force Basic Doctrine, Organization, and Command*, 39.

21. For a detailed description of each of these unique characteristics, see ibid., chaps. 4 and 5; and AFDD 2, *Operations and Organization,* 3 April 2007, chaps. 1 and 2, http://www.e-publishing.af.mil/shared/media/epubs/AFDD2.pdf.

22. Gen Gary Luck, USA, Retired, and Col Mike Findlay, USA, Retired, *Insights and Best Practices: Air Component Integration in the Joint Force*, Focus Paper no. 6 (Suffolk, VA: Joint Warfighting Center, United States Joint Forces Command, 20 March 2009), 11, https://jko.harmonieweb.org/coi/JointTrainingDivision/Documents/6 Air Integration Insights Paper 20 Mar 09.pdf.

23. Since World War II, the term *penny packets* has meant parceling out airpower to ground forces. The use of penny packets serves the individual ground commander, but it prevents air commanders from concentrating airpower to support important ground operations or to strike strategic targets.

24. Kometer, *Command in Air War*, 62.

25. Luck and Findlay, *Insights and Best Practices: Air Component Integration in the Joint Force*, 22.

26. "The supported commander is given access to supporting capabilities and has the authority to provide general direction, designate and prioritize missions, targets, or objectives, and other actions for coordination and efficiency (to include requesting liaison and directing of reporting requirements). . . . The supporting commander is responsible to both ascertain and satisfy the needs of the supported commander within the priorities directed by the establishing authorities." For more information on best practices of supported and supporting commanders, see United States Joint Forces Command, *Joint Operations*, 29–30.

27. Ibid., 29.

28. Lt Col Jeffrey Hukill, USAF, Retired, and Dr. Daniel R. Mortensen, "Developing Flexible Command and Control of Airpower," *Air and Space Power Journal* 25, no. 1 (Spring 2011): 57–58, http://www.airpower.maxwell.af.mil/airchronicles/apj/2011/2011-1/2011_1_03_hukill_mortensen.pdf; and United States Joint Forces Command, *Joint Operations*, 16–17.

29. Office of Air Force Lessons Learned (USAF/A9L), "Integration of Airpower in Operational Level Planning," Lessons Learned Report (Washington, DC: USAF/A9L, 22 August 2008), 1, 16.

30. The term *air component coordination element* (ACCE) changed to *joint air component coordination element* (JACCE). JP 3-30, *Command and Control for Joint Air Operations*, 12 January 2010, I-2–II-2, http://www.dtic.mil/doctrine/new_pubs/jp3_30.pdf.

31. AFDD 1, *Air Force Basic Doctrine, Organization, and Command*, 14 October 2011, 97–98.

32. Ibid., 99.

33. *Direct support* is defined as "a mission requiring a force to support another specific force and authorizing it to answer directly to the supported force's request for assistance." JP 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 8 November 2010 (as amended through 15 February 2012), 98, http://www.dtic.mil/doctrine/new_pubs/jp1_02.pdf.

34. United States Joint Forces Command, *The Joint Operating Environment, 2010* (Suffolk, VA: Joint Futures Group [J59], United States Joint Forces Command, 18 February 2010), 4, http://www.jfcom.mil/newslink/storyarchive/2010/JOE_2010_o.pdf.

APPENDIX A

# Proceedings of the Airpower Command and Control Workshop

## Air Force Research Institute
## Maxwell Air Force Base, Alabama
## 30 November–1 December 2010

## 7 January 2011

## Introduction and Background

Increasingly complex security environments will require the Air Force to provide not only forces—ready and able to deploy quickly around the globe—but also the command and control (C2) architecture for those forces and operations.[1] The Air Force's theater-level C2 model worked well in the major combat phases of Operations Enduring Freedom and Iraqi Freedom with the overall theater operations under the close direction of the combatant commander (CCDR).[2] However, as air operations evolved into other missions across the range of military activities, seams developed that hindered the integration of airpower into the supported commands.[3] The seams arose due to the lack of Airmen with command authority at the joint task force (JTF)-level, the lack of the full range of Air Force planning expertise present below the theater commander of Air Force forces / joint functional air component commander level (COMAFFOR/JFACC), and lack of Air Force representation on JTF staffs to advocate the proper employment of airpower.[4]

To relook at C2 of airpower within the Air Force, the chief of staff of the Air Force (CSAF) asked the Air Force Research Institute (AFRI) to host an event that focuses on C2 of airpower at the subtheater level.[5] The results of the event will support the CSAF's agenda at CORONA South (2011).[6]

On 30 November–1 December 2010, AFRI conducted the Airpower Command and Control Workshop at Maxwell AFB, Alabama. The overall focus of the workshop was not to solve today's challenges but to be forward-looking. While recent experiences informed the discussions and generated ideas, the overarching purpose of the workshop was to develop recommendations on how the USAF could create a C2 element below the CCDR level.

## Methodology

Over 40 Air Force C2 experts (active duty military, civilian, and contractor) participated in the two-day workshop. Participants, primarily colonels and lieutenant colonels, were from Headquarters USAF, major command, component numbered-air-force (C-NAF), and wing levels. The two-day workshop

focused on generating open discussions on the subject of Air Force C2, with the purpose of answering the following research questions:

1. What conditions would suggest the need for the Air Force to provide a C2 element below the CCDR level?
2. What C2 options should be available to the Air Force when supporting multiple joint force commanders (JFC)? When answering this question, things to consider are:
    - What aspects of control should be maintained at the CCDR level?
    - Who goes to the JTF level, with what staff?
    - What should the command relationships look like?
3. What organizational changes are required to facilitate the control of airpower below the theater level in a rapidly evolving expeditionary environment?
    - What equipment is needed and where?
4. What are the leader development (experience, education, and training) implications?

The workshop was opened by Lt Gen Allen Peck, Air University commander, followed by welcoming remarks by AFRI director Gen John Shaud, USAF, retired, and discussion-setting presentations on C2 in historical and doctrinal contexts. The attendees were divided into two independent research groups, each tasked with answering the four conference questions. The two groups provided a manageable size to encourage discussion and allowed the development of two independent sets of answers. Note that while the two groups worked independently, their answers to the four questions were similar.

Each facilitated breakout group consisted of approximately 20 individuals and utilized a recorder to capture conference data. Each group facilitator encouraged the open exchange of ideas, kept participants on track with the assigned questions, and created a nonattribution environment supporting participation by all attendees regardless of rank.

Both days concluded with a plenary session where each group presented its findings to the specific research questions.

Attendees questioned the presenter to challenge ideas in order to clarify and refine the answers/recommendations.

## Problem

Not all future operations will resemble current operations in Afghanistan and Iraq, but certain attributes are likely to characterize future environments. These attributes include simultaneous combinations of offensive, defensive, and stability or civil-support operations conducted in a highly integrated, networked, and distributed environment under the control of multiple JTFs in a single CCDR's area of responsibility (AOR). Effective operations in this environment may require commanders empowered with decision-making authority to be at lower organizational levels to provide optimal span of control, unity of command, unity of effort, and tactical f exibility.[7] While Air Force and joint doctrine describe the possible need to create these lower-level command structures, the Air Force has chosen to organize, train, and equip itself for only one model—the theater COMAFFOR/JFACC model with joint air component coordination element (JACCE) support at the subtheater or staff level. Without an Air Force C2 construct below the CCDR level, the Air Force is unable to seamlessly integrate with other subtheater C2 structures. In addition, a single point of failure and a potential bottleneck during periods of intensive operations is created. Distributing Air Force C2 increases redundancy and operational f exibility while retaining full conformity with the tenet of centralized control.

The four workshop questions were designed to develop recommendations on how the USAF could create a C2 element below the CCDR level. The questions address this problem by first looking at conditions when a subtheater command element is appropriate, examining what command relationships are required for such a command element, identifying needed organizational and equipment changes, and focusing on the leader development implications. Recommendations and areas for further research were developed for each question.

## Questions, Recommendations, and Areas for Further Research

### *Question #1: What conditions would suggest the need for the Air Force to provide a C2 element below the CCDR level?*

#### Recommendations

Participants overwhelmingly agreed that the Air Force's foundational concept should be to provide a commander with appropriate supporting control elements *anytime* a subtheater organization, such as a JTF with defined airpower requirements, is created. Providing a subtheater C2 element will:

- Provide a physical command presence for the Air Force.
- Enable joint planning processes.
- More easily build trust with subtheater JFC and staff, sister services, and coalition partners.
- Make available knowledge of airpower employment and capabilities to the subtheater JFC.
- Demonstrate a proactive approach.
- Provide the theater COMAFFOR/CFACC with "eyes and ears" at the subtheater level, resulting in improved operational planning and execution.

Actual operations would determine the command relationships, required command authorities, and scale and scope of the C2 element. Not all operations would require an Air Force commander with robust organic control capabilities. The following questions were developed to help a commander decide the type of subtheater C2 element needed:

- Does the JTF have defined air, space, and cyber requirements?
- What is the nature and expected duration of the operation?
- What is the appropriate span of control, unity of command, and tactical f exibility needed for the effective use of airpower capabilities?
- Where should operational flexibility be retained to meet JFC requirements?

- Where should planning and execution integration take place?
- Based upon asset capability and availability, which airpower assets can be dedicated to the JTF?
- What technology requirements are required and available for this C2 element?
- Has trust been established between joint and service commanders?

**Areas for Further Research**

- Define Air Force policy and doctrine that describe the concept of providing a COMAFFOR with appropriate supporting control elements *anytime* a subtheater organization, such as a JTF, with defined airpower requirements is created.
- Develop a decision matrix to guide commanders in determining the appropriate command relationships, required command authorities, and scale and scope of the subtheater C2 element.

***Question #2: What C2 options should be available to the Air Force when supporting multiple JFCs? When answering this question things to consider are:***

- ***What aspects of control should be maintained at the CCDR level?***
- ***Who goes to the JTF level, with what staff?***
- ***What should the command relationships look like?***

**Recommendations**

A variety of C2 options were discussed. All options were focused on the desire to balance the proper degree of centralization versus decentralization. The goal was to preserve f exibility at the strategic and operational levels of war while increasing tactical f exibility and helping to increase the tempo of operations. Additionally, the discussions centered on the idea that the Air Force needs C2 capabilities to support simultaneous global, theater, and subtheater operations. To balance these demands and maintain unity of command, unity of effort, and

the proper span of control, the Air Force should design structures that place commanders who control elements of Air Force capability at various organizational levels. Two points were constantly emphasized during the discussion: no matter what type of C2 structure is developed, command relationships must be determined and clearly defined early in any operation, and Airmen should always work for an Airman.

The following four options were the most developed during the workshop and leveraged work already done by the Lemay Center for Air Force Doctrine Development and Education. The answers to the seven questions in recommendation number one will assist a commander in determining which option is best for the operations they are conducting.

**Option 1: Theater COMAFFOR/JFACC model**. The current theater COMAFFOR/JFACC model with JACCEs is appropriate if an Air Force commander at the subtheater level is not required. A theater air operations center (AOC) with its equipment and personnel would provide the control capability for the commander. Operational control (OPCON) of USAF forces would be retained with the theater COMAFFOR (see fig. A.1).

JACCEs would act as liaisons for the COMAFFOR/JFACC and facilitate joint planning to ensure proper airpower support.

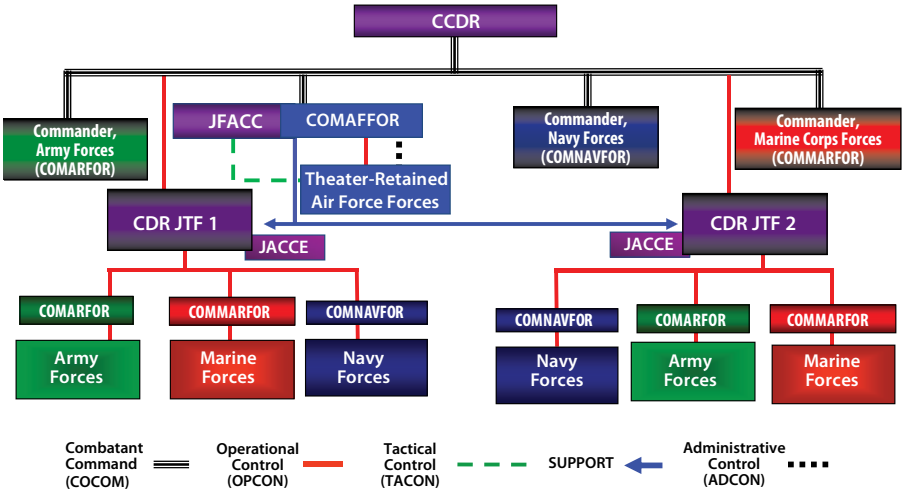


**Figure A.1. Option 1: Single-theater COMAFFOR/JFACC supporting multiple JTFs**. (Diagram developed at the Curtis E. LeMay Center for Doctrine Development and Education, Maxwell AFB, AL.)

The JACCE does not have any command authority in either the operational branch or the administrative branch of the chain of command. This model is effective for planning and executing global and theater missions; however, it may be less successful when span of control and tactical f exibility are concerns. This organizational model promotes unity of command and unity of effort at the CCDR level and is optimized for responding to the AOR-wide priorities of the CCDR.

**Option 2: Air Force Forces in direct support of a JTF**. A second option places a C2 element at the JTF level, and the CCDR decides not to attach forces to an established JTF. An appropriately sized expeditionary unit composed of all Air Force forces physically present within the JTF commander's area of operations can be designated in direct support of the JTF commander (see fig. A.2).[8] Since the forces are essentially dedicated to the JTF commander under a single Air Force commander, this construct provides unity of effort at the JTF level. Unity of command is retained at the CCDR level by the theater COMAFFOR, unlike when forces are attached to a JTF. This arrangement allows the theater COMAFFOR to retain the authority and f exibility to shift those forces as required in response to CCDR direction without having to first regain control from the JTF commander. A challenge to implementing this idea is the need to create an organizational construct for the new intermediate expeditionary unit. At present, there is no established Air Force echelon of command for a multiwing expeditionary unit below the numbered air force (NAF) level. Historically, the correct designation should be an air division. Resurrecting this concept as a provisional unit designation for expeditionary operations would be very useful. An expeditionary air division in direct support of a JTF commander would provide unity of effort at the JTF level while retaining unity of command and effort at the CCDR level.

**Option 3: Attaching forces to a JTF**. If the CCDR decides to attach forces, such as an air and space expeditionary task force (AETF), to a JTF, the AETF commander would be designated as the COMAFFOR for those assigned forces (see fig. A.3). If the JTF already has a JACCE assigned, the JACCE can be dual-hatted as the COMAFFOR, be retained as a separate position, or eliminated. Through reachback operations the AETF

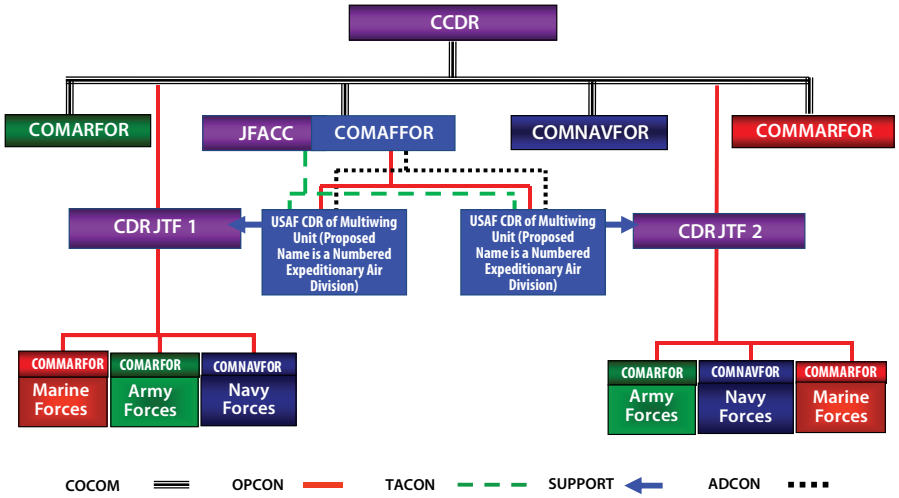


**Figure A.2. Option 2: Air Force forces in direct support of a JTF**. (Diagram developed at the Curtis E. LeMay Center for Doctrine Development and Education, Maxwell AFB, AL.)

can leverage capabilities at the theater AOC and AFFOR staff or organizations outside of the CCDRs' AOR. However, the tailored AETF C2 capability must provide the AETF commander, who is the JTF COMAFFOR and perhaps the JFACC, with enough capability to employ airpower in accordance with the JTF commander's orders as well as the ability to prepare and sustain the forces to carry out those orders.

Unity of command and unity of effort for attached Air Force forces will be at the JTF level. Command of global and theater forces not attached to the JTF but supporting the JTF will remain at or above the theater JFACC level. This arrangement will allow for unity of command and unity of effort of forces that routinely swing throughout the theater and around the globe. If needed, the CCDR has the authority to reassign forces attached to a JTF to address higher theater priorities.

Personnel currently used only on the JACCE staff can support the JTF COMAFFOR/JFACC when one is established. Personnel who have performed JACCE staff duties must be identified in the personnel system so that they can be assigned to a newly established JTF or to replace already deployed personnel during extended operations. These members should possess

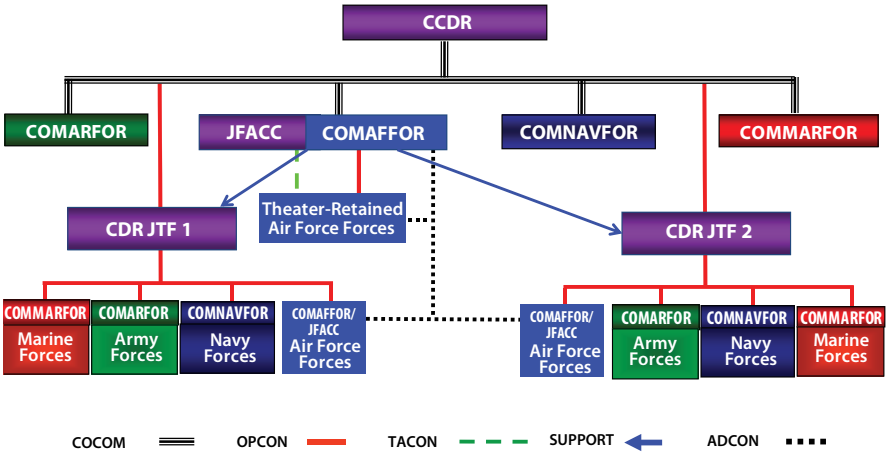


**Figure A.3. Option 3: Air Force forces attached to a JTF**. (Diagram developed at the Curtis E. LeMay Center for Doctrine Development and Education, Maxwell AFB, AL.)

the expertise needed to apply the full range of Air Force capabilities to support a potential JTF. They must receive qualification and currency training for credibility and readiness once the JTF is established to perform strictly JACCE duties or JTF COMAFFOR/JFACC duties. Using unit type codes (UTC), subtheater JACCE/COMAFFOR modules can be prebuilt to further expedite the deployment of qualified personnel.

Of note was the discussion about why from a cultural perspective the Air Force is hesitant to attach forces to a JTF. Most of the discussion centered on trust and efficiencies. The feeling was that many in the Air Force do not see a JTF commander as joint. If the JTF commander is from the Army, there was great concern that a ground force commander would not employ air forces properly. The concern was the JTF commander would employ airpower from a ground-centric perspective rather than from a joint perspective. Also, the discussion focused on the manning and equipment efficiencies gained from centralized C2.

The general consensus of the attendees was that the best way to build trust and inform a non–Air Force JTF commander regarding the effective way to employ airpower was to have an Air Force commander at his side. Also, efficiency should never be discussed without talking about effectiveness. While strong

centralization of airpower may be very efficient depending on the operational environment, it is not always the most effective.

**Option 3 (Light): Attaching forces to a JTF with tactical control (TACON) of those forces passed to the theater JFACC**. This concept is similar to option number 3. The major difference is that TACON of the JTF-attached Air Force forces are passed back to the theater JFACC for execution because the JTF-level COMAFFOR does not have a large enough A-staff, sufficient planning tools, or communications capability to execute JTF missions (see fig. A.4).

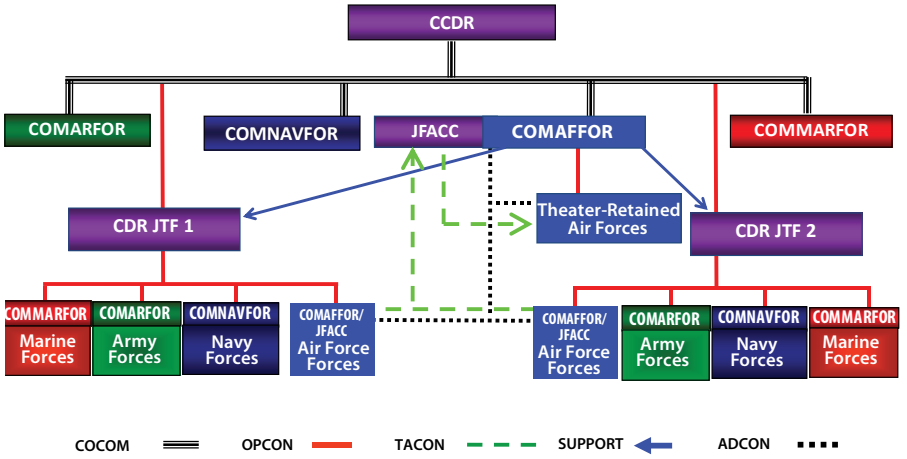


**Figure A.4. Option 3 (light): Air Force forces attached to a JTF with TACON of those forces passed to a theater JFACC**. (Diagram developed at the Curtis E. LeMay Center for Doctrine Development and Education, Maxwell AFB, AL.)

Lacking these capabilities, the JTF-level COMAFFOR would rely on the theater AOC capabilities for mission execution. This situation could occur when the JTF is first established or if the JTF mission is of limited scope and planned duration. As with option 3, this option would place unity of command and effort for attached Air Force forces at the JTF level. Command of global and theater forces not attached to the JTF but supporting the JTF will remain at the theater JFACC level.

**Areas for Further Research**

- Refine the four proposed subtheater C2 options. Along with command relationships, determine the staff composition for each option. Also, identify each option's strengths and weaknesses.
- Develop in detail the proposed intermediate-level organization between the wing and NAF levels described in options 2, 3, and 3 light.

***Question #3: What organizational changes are required to facilitate the control of airpower below the theater level in a rapidly evolving expeditionary environment?***

- ***What equipment is needed and where?***

**Recommendations**

The consensus of the attendees was that the Air Force must develop scalable C2 capabilities to support the full range of military operations. C2 capabilities will be integrated and will enable all Air Force core functions across air, space, and cyberspace domains. It is estimated this concept would not require much additional funding. What it would require is an integrated USAF C2 planning, programming, and budgeting effort. The key challenge is that the Air Force has not defined a core operational and tactical requirement for deployable, scalable C2 capability. Without integrated defined requirements, various functional mission areas are pursuing similar capability independently. This approach leads to interoperability problems along with wasteful spending due to overlapping development efforts. An AETF C2 concept of operation (CONOPS) should be developed. This CONOPS should designate a lead agency that is organized and equipped to develop integrated C2 requirements. The CONOPS would be the strategy document that the C2 core function master plan is based upon. A clearly defined C2 strategy will go a long way in helping to develop integrated requirements that support the full range of military operations.

The four C2 options discussed in the previous question provide a useful framework to help describe the deployable and

scalable C2 capabilities the Air Force should develop (see fig. A.5). Supporting the options with C2 capability should be thought of as growing the C2 capacity over time based upon operational demands. These C2 options may be employed in ways other than a time-phased approach; however, the time approach is useful to present the ideas. Also, note that other services such as the Marines have already developed a deployable and scalable C2 capability. There may be economy of scales gained by leveraging the existing Marine capability.

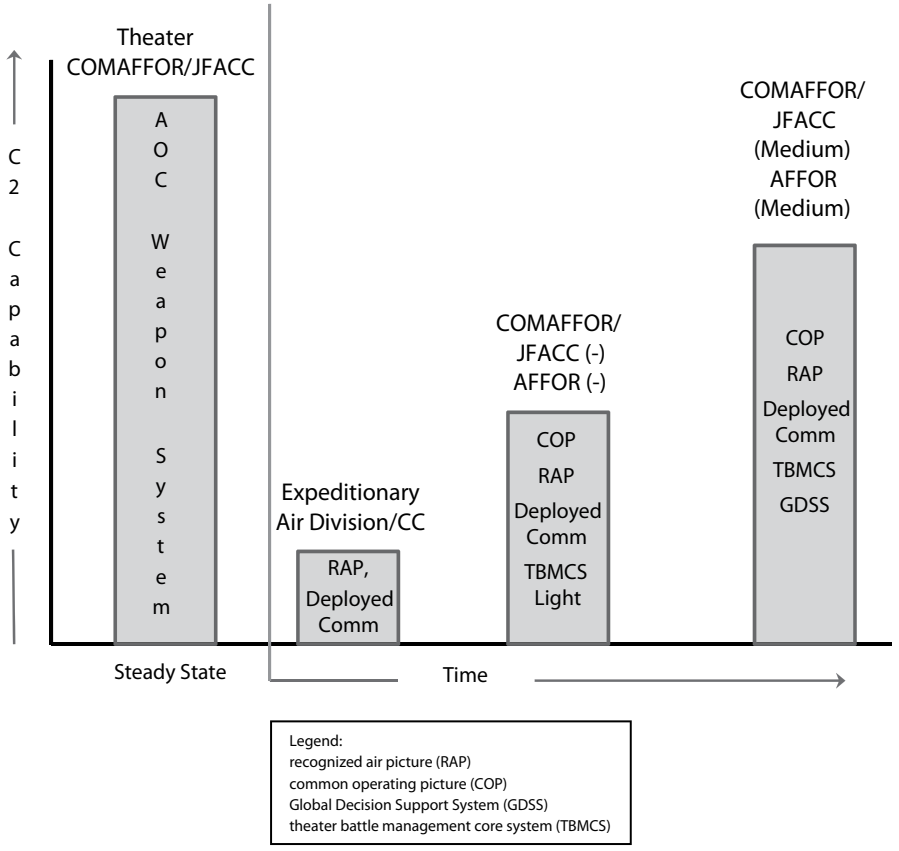


**Figure A.5. Scalable Air Force C2 options**. (Diagram developed by attendees at a breakout session of the Airpower Command and Control Workshop, AFRI, Maxwell AFB, AL, 30 Nov–1 Dec 2010.)

The theater COMAFFOR/JFACC model (option 1) requires the greatest C2 capability. The C2 capability is provided by the AOC weapon system. The AOC is a standing organization available to a CCDR 24 hours a day, 365 days a year. The AOC is the foundation for all Air Force C2. It is manned for day-to-day operations during Phase 0 and Phase 1.[9] For other types of operations, the AOC staff will require augmentation to complete the additional tasks. The rapid augmentation team (RAT) provides immediate augmentation with follow-on support from the air reserve component (ARC) with the appropriate activation. RATs are currently being developed and can be used to supplement all command echelons. The Air Force must fully fund, identify, and train personnel for the RATs. Otherwise the foundation for all Air Force C2 will not effectively support CCDR requirements. If JACCEs are established, they would require basic secure/nonsecure communications capability to support their liaison duties.

Moving along the time scale, if at the start of an operation/crisis response the CCDR establishes a JTF based upon the operating environment, the C2 element described in option 2 might be the most appropriate. This option would allow for a timely creation of an Air Force commander forward along with a need for a small staff and basic communications requirement. Manning this organization would be available by adjusting current UTCs and augmentation from the RAT and with ARC support. This intermediate-level commander would need a recognized air picture (RAP) capability along with basic deployable communications. It is envisioned that this command element would provide inputs into air tasking order (ATO) development that is done at the theater level. As previously mentioned, the Air Force needs to create this intermediate-level organization.

As a JTF matures and forces are attached, option 3 light and option 3 become useful. Option 3 light would be an intermediate step prior to option 3 as staff, communications capability, and forces are built up in the operating area. These options would require the capability to establish a deployable AOC. The estimate is that the deployable AOC would need to be scalable from one to two tents for option 3 light and up to five tents for option 3. Option 3 light would need the same capabilities as

option 2, along with the ability to input into the ATO with a theater battle management core system (TBMCS) light, to develop a common operating picture, and to use more developed communications. In addition to these characteristics, option 3 requires a full TBMCS, extensive communication, and global decision support system (GDSS) functionality, as well as larger staffs. Personnel for these two options would come from existing UTCs and RATs with ARC support.

A constant item for discussion was how to effectively integrate the various subtheater C2 organizations into a JTF structure. One idea that the attendees thought had merit is to exploit the existing theater air control system (TACS). The reality is that in many operations an Army corps and division headquarters are likely to be the core of a JTF headquarters. Using existing Air Force organizational structures that are already integrated with these Army units might be a logical choice. Discussion centered on the possibility of assigning O-7s as corps air liaison officers (ALO) and O-6s as division ALOs. These key Air Force leadership positions should be command screened and can act as commanders within a JTF once it is established. These commanders would have habitual relationships established within the corps/division headquarters, and there would be four standing echelons capable of responding.

During the breakout sessions most of the discussion on this question centered on incremental organizational changes. However, during one session the discussion centered on larger, more sweeping changes. The ideas dealt with a major Air Force reorganization. The concepts from this discussion would be a good place to start a debate on a strategic long-term plan for the Air Force. The main points of this discussion are as follows.

The Air Force's current organization and C2 structure resulted from evolution and not from design. A correct approach to improving C2 at subtheater levels should start with a full functional analysis of our current C2 structure and a design to change it. From this analysis, a corporate Air Force reorganization can occur to reduce the redundant overhead that presently exists in our current cross-functional major commands. That each of these commands owns a portion of the program

objective memorandum (POM) planning creates competition with each other for resources. The proposed reorganization would replace the eight major commands with two war-fighting operational major commands: the Air Force Global Command and the Air Force Forces Command.

Air Force Global Command would have six or more functional NAFs for each global responsibility. There would be one NAF each for space, nuclear operations, special operations, cyber, long-range strike, transportation, and so forth.

Air Force Forces Command would have all the traditional deployable theater forces divided into 10 standing expeditionary air forces. That would include all the fighters, some of the long-range strike, tankers, and C-130s to get an appropriate force presentation mix. Each would have a two-star headquarters and a staff that was prepared to plan and execute when deployed down range. Each NAF would have several lead wings that would have the capability to set up and operate a C2 structure when deployed down range. This reorganized structure would return POM planning to the Air Staff.

### Areas for Further Research

- Develop an air and space expeditionary task force C2 CONOPS.
- Determine which organization should be organized and equipped to be the lead agency that develops integrated C2 requirements.
- Define in greater detail the actual staff, planning/execution tools, communications capability, and other equipment needs for each subtheater C2 option described above.
- Determine if modifications to the TACS structure would provide a useful organizational construct to integrate Air Force subtheater C2 with a JTF.
- Begin a long-term study on major Air Force reorganization to meet future challenges.

### *Question #4: What are the leader development (experience, education, and training) implications?*

#### Recommendations

There was overwhelming consensus from the attendees that the Air Force needs to adjust its leader development process to develop capable subtheater COMAFFORs/JFACCs. Depending on the nature of the operation, this position would most likely be at the one- or two-star general officer level. A force development strategy must be developed to tie together the education, training, and experience needed to fill the proposed subtheater C2 elements. This strategy must emphasize several things.

First, the Air Force must identify a cohort of individuals that will someday become commanders at the subtheater level and then deliberately develop them. This process should begin at preaccession training and education, with reinforcement at education and training events throughout their careers. Although this pool will be substantial early on, it will shrink as the careers of these personnel under consideration by the Air Force progress and as early development, continued screening, and tracking occur.

Second, to enhance experiential learning, the service must emphasize the value of candidates' operational assignments—such as tours at an AOC; on an Air Force forces or a CCDR staff; or at a contingency response group, air support operations group, or air support operations squadron—which would round out the administrative control (ADCON) experience acquired as Air Force wing commanders. Although important, ADCON experience does not imbue an individual with skill sets for commanding and controlling airpower at the operational level of war.

Third, the Air Force must change the normal assignment path for command by forming a structure that allows personnel to step away from typical career paths without limiting their opportunities. Instead of insisting on the two traditional command tours, the service should allow them one group or wing command (O-6 level) and then an equivalent operational-type assignment (e.g., AOC division chief, Air Force forces staff, commander of an air support operations group, etc.). This

change would signal that the Air Force values these positions and would allow people time to gain both ADCON and operational command experience within a normal career time frame.

Fourth, the service should review course curricula to ensure emphasis on the importance of operations. Where gaps exist, it should adjust the scheduling and content of current training and education curricula. For example, the wing commanders' course taught at the Ira C. Eaker Center for Professional Development, Maxwell AFB, Alabama, could be expanded beyond its coverage of ADCON duties to include command at the subtheater level. Also, it was recommended that a course similar to the canceled Command and Control Warrior Advanced Course (C2WAC) that was taught at the 505th Command and Control Wing be developed to teach these advanced concepts. Further, the Air Force should review and adjust the timing of course offerings within individuals' careers. Allowing recently graduated wing commanders, for instance, to attend the JFACC course would help prepare them to command at both the subtheater and theater levels.

Finally, the Air Force personnel system needs an effective tracking mechanism to identify people with the training, education, and experience for command at the subtheater level. The complex and uncertain global environment demands that the service identify and track people who will fill subtheater C2 elements at a moment's notice. Currently the Air Force has no easy way to gather this information. It was suggested that special experience identifiers like the enlisted force uses could help solve this problem.

### Areas for Future Research

- Develop an operational commander force development strategy that would prepare individuals to command and control airpower at the subtheater and CCDR levels.

## Conclusion

The nature of modern military operations will increasingly be joint, coalition, distributed, complex, and global. The workshop consensus was that these conditions will require f exible C2 of

airpower with appropriate decision authority at the correct level of command. The major problem identified by the group is that the Air Force is not organized, trained, or equipped to meet this need at the subtheater level. The Air Force must fix this problem by first realizing a problem exists, and it must chart a course to remedy the issues. The recommendations from the 40 C2 subject matter experts are a step in the right direction. The recommendations are focused on one goal: the need to place an Airman with command authority with supporting control structures at the subtheater level. These ideas must be further refined and tested through war gaming to ensure the correct actions are made.

**Notes**

1. The DOD definition of *command and control*, used for workshop discussions, is the "exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. Command and control functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures—employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission." See Joint Publication (JP) 1-02, *DOD Dictionary of Military and Associated Terms*, 12 April 2001, as amended through 31 July 2010, 84.

2. For the purposes of this paper, the terms *theater level* and *theater-level* COMAFFOR/JFACC are synonymous with the terms *CCDR level* and *CCDR-level* COMAFFOR/JFACC.

3. For the purposes of this paper, the term *airpower* includes air, space, and cyberspace capabilities.

4. Office of Air Force Lessons Learned (USAF/A9L), "Focus Area: Air Force Innovations for the Joint Fight; Role of the Air Component Coordination Element," Lessons Learned Report (Washington, DC: USAF/A9L, 22 June 2010). See also Office of Air Force Lessons Learned (USAF/A9L), "Integration of Airpower in Operational Level Planning," Lessons Learned Report (Washington, DC: USAF/A9L, 22 August 2008).

5. *Subtheater* includes any organization below the CCDR level. The most common type of subtheater organization is a JTF.

6. CORONA South was held February 2011 at Offutt AFB, NE.

7. *Span of control* as used herein refers to the "desired reach of the JFC's authority and direction over assigned or attached forces [that] vary depending on the mission and the JFC's ability to C2 the actions required. Span of control is based on many factors including the number of subordinates, number of activities, range of weapon systems, force capabilities, the size and complexity of the operational area, and the method used to control operations (centralized or decentralized)." See JP 1, *Doctrine for the Armed Forces of*

*the United States*, 2 May 2007, incorporating change 1, 20 March 2009, iv–19, para. 14b. JP 1 states that *unity of command* is "accomplished by establishing a joint force, assigning a mission, or objective(s) to the designated JFC, establishing command relationships, assigning and/or attaching appropriate forces to the joint force, and empowering the JFC with sufficient authority over the forces to accomplish the assigned mission (ibid., II-3, para. 2c)." *Unity of effort* is defined as a "coordination and cooperation toward common objectives, even if the participants are not necessarily part of the same command or organization—the product of successful unified action." See JP 1-02, *Department of Defense Dictionary of Military and Associated Terms*, 489.

8. The DOD defines *direct support* as "a mission requiring a force to support another specific force and authorizing it to answer directly to the supported force's request for assistance (ibid., 138)."

9. Phases 0 and 1 are part of a six-phase planning model described in JP 3-0, *Joint Operations,* 17 September 2006, incorporating change 2, 22 March 2010, iv-27–iv-28. In Phase 0 (Shape), these preliminary functions are "joint and multinational operations, inclusive of normal and routine military activities, and various interagency activities performed to dissuade or deter potential adversaries and to assure or solidify relationships with friends and allies." Planning in Phase 1 (Deter) is intended to dissuade "undesirable adversary action by demonstrating the capabilities and resolve of the joint force. It differs from deterrence that occurs in the shape phase in that it is largely characterized by preparatory actions that specifically support or facilitate the execution of subsequent phases of the operation/campaign (ibid)."

APPENDIX B

# Operational Examples

## Introduction

This appendix contains the results of the analysis of the seven operational examples. The analysis *does not* provide a historical case study of each example. Rather, the analysis takes a focused look at Air Force command and control (C2) structures and processes to identify problems that indicate the need for increased adaptability. The analysis uses the three fundamental C2 elements—allocation of decisions, patterns of interaction, and distribution of information—to evaluate the C2 of Air Force capabilities at the global, theater, and subtheater levels during each example. (The introduction describes the fundamental elements of C2 in greater detail.) The results from each analysis are grouped under the appropriate fundamental C2 element. After completing a review of each individual case, the research team analyzed and then synthesized the results to develop recommendations on how to improve Air Force C2 adaptability across the range of military operations. The synthesized results answer the Air Force chief of staff tasking and are presented in the main body of the paper.

Example 1

# Counterinsurgency Phase of Operations Enduring Freedom and Iraqi Freedom

The research team selected the counterinsurgency phase of Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) because they highlight the challenges of C2 of Air Force capabilities in support of land forces engaged in distributed land operations involved in a counterinsurgency fight. While unique in some ways, most of the Air Force C2 challenges are similar for each of these operations. Due to this similarity, the results of the analysis focus on problems common to both operations. Challenges unique to a specific operation are identified separately.

The time period analyzed for OEF is from 1 April 2002 to 1 January 2011. This period covers the beginning of the counterinsurgency fight through the alignment of US and North Atlantic Treaty Organization (NATO) forces under the International Security Assistance Force (ISAF) and the creation of a subtheater Air Force commander in Afghanistan. The time period analyzed for OIF is from the end of major combat operations (1 May 2003) to the transition of the mission to Operation New Dawn (1 September 2010). The principal sources used for the analysis consist of interviews and joint and Air Force lessons learned documents. The following are observations discovered from the analysis using three fundamental C2 elements as described in the model that Dr. David Alberts and Dr. Richard Hayes developed (discussed in the introduction of this paper): allocation of decisions, patterns of interaction, and distribution of information.[1]

## Allocation of Decisions

A recurring theme identified during interviews and in various Air Force and joint lessons learned reports is the need for the Air Force to create an echelon of command with decision authority below the combatant commander (CCDR) level when supporting a joint task force (JTF). As operations transitioned from major combat to counterinsurgency (COIN) operations,

two JTFs were created to conduct operations in Iraq and Afghanistan and were led by four-star general joint force commanders (JFC). Until November 2010 the senior Airman at the JTF level was a liaison officer (LNO) with a small supporting staff. This liaison element is called an air component coordination element (ACCE), and it acts as the combined forces air component commander's (CFACC) primary representative to the JTF commanders to facilitate interaction among the respective staffs. The ACCE concept worked well during the major combat phase of OIF when the joint force did not have a command element below the CCDR level. However, with the creation of a joint echelon of command at the subtheater level, the effectiveness of the ACCE concept came into question. Without command authority, it was questionable to the JTF commander and staff whether the ACCE director could make commitments on behalf of the CFACC. The lack of an Air Force commander at the JTF level with the authority to make decisions impacted the integration of Air Force assets into JTF plans. The absence of an Air Force commander at the JTF level gave the impression to the JFC and his staff that the Air Force was not fully committed to supporting operations. The rank of the ACCE director was increased to O-8 in an attempt to boost his influence. Although the JFCs in Iraq and Afghanistan respected the increased rank, without command authorities the effectiveness of the ACCE still suffered.[2]

Lack of command authority also impacted the ACCE's ability to reduce span of control issues for US Central Command's (USCENTCOM) theater commander of Air Force forces (COMAFFOR)/CFACC. The single Air Force component's staff at the CCDR level worked with at least three separate JFC staffs (OEF, OIF, and CENTCOM) to prioritize Air Force capabilities across the entire CENTCOM area of operations. Without command authority, the ACCE director could not consolidate operations within his assigned joint operating area. Making the ACCE director a commander with appropriate command authorities would create an intermediate echelon of command between the multiple air expeditionary wings and the COMAFFOR. Creating this echelon of command would reduce the COMAFFOR's C2 challenges by creating command in depth.[3] The recent establishment of subtheater command elements in both Iraq and

Afghanistan is a step toward codifying the concept of command in depth.[3] This new command structure must be evaluated, and best practices and lessons learned should be recorded.

Another issue impacting allocation of decisions was the misunderstanding of command relationships among Air Force and joint personnel. For example, for many years the support command relationship was not utilized to its full potential during the COIN operations in OEF and OIF. During the COIN phase of OEF and OIF, the Central Command commander (CENTCOM/CC) designated a support relationship between his senior Airman, the COMAFFOR/CFACC, and the JTFs in Iraq and Afghanistan. Specifically, the COMAFFOR/CFACC was the supporting commander to the two JTFs. The problem was that the details of the supporting/supported relationship were not fully understood by all parties involved. A lack of an establishing directive created a void in guidance. The void in guidance impacted both the supporting and the supported commanders by causing confusion about the level of expected support. Friction occurred due to the lack of clear guidance on items such as the senior commander's intent, priorities, and acceptable risk, as well as the allocated forces and resources dedicated to the supported/supporting relationship. The friction was intensified as organizational structures, missions, and personnel assigned changed over time. Recognizing this need, the CENTCOM/CC created an establishing directive that defines the supported/supporting relationship between the theater COMAFFOR/CFACC and the JTFs in Iraq and Afghanistan. The directive's guidance allows the theater COMAFFOR/CFACC to size the force and establishes organizational structures required to command and control Air Force capabilities when operating in support of the supported commander.[4] This guidance reduces ambiguity for supported and supporting commanders, their staffs, and their subordinate commanders. While the problem is fixed now, this lesson must not be forgotten. The publication of an establishing directive as soon as a support command relationship is established improves joint operations.

In addition, confusion exists with command relationships in regard to space capabilities. First, various reports and interviews

suggest that space system command relationships are organized, trained, and equipped for one type of C2 model when in reality they are employed in different ways.[5] The standard space C2 model for space control forces consists of the joint functional component commander (JFCC) for space (dual-hatted as the Fourteenth Air Force commander) exercising operational control (OPCON) and tactical control (TACON) on behalf of the commander, United States Strategic Command (USSTRATCOM). JFCC Space will provide direct support to a theater CCDR such as the CENTCOM/CC. Many in the space community resist any change to this model because it is seen as a violation of the tenet of centralized control. However, the reality of operations in CENTCOM has created the need to send TACON of some space capabilities to the CENTCOM commander, with the CFACC exercising control. Ad hoc arrangements are now made to support the adjustment to the standard space C2 model.[6] Organizing, training, and equipping to a more adaptable C2 model would prevent the reliance on ad hoc arrangements.

Also, many space personnel at the action officer level do not fully understand or appreciate command relationships, command authorities, or support relationships. Therefore, they don't know who to work with in a joint environment and don't understand how all aspects of air, space, and cyberspace fit together to achieve joint objectives. Not knowing who someone works for in the chain of command has led to well-intentioned action officers going directly to deployed units/personnel and bypassing operational level C2. Additionally, it has led to a lack of understanding regarding OPCON and TACON relationships. This is especially true with regard to the employment of space weapon systems. In the Joint Space Operations Center (JSPOC), personnel who arrive with only missile operations for their space experience have not typically worked in a geographic combatant theater or with personnel new to the Air Force.[7]

Finally, many of the Air Force capabilities used to support operations during the COIN phase of OEF and OIF are low in density but high in demand (LD/HD). Effective employment of these LD/HD capabilities requires an appropriate prioritization process. During OEF and OIF the prioritized decisions were usually made at a centralized level in order to match limited resources against global, theater, and subtheater demands.

The preestablished prioritized list along with decision authorities should pass to lower execution levels to ensure the agile use of capabilities to address the highest current priorities, thus improving speed of action. Clearly communicating preestablished priorities to lower execution levels did not always happen. For example, a lack of clear priorities hindered the flexibility of multimission space platforms. As operational dynamics changed during mission execution, it was unclear at times who should control the space platform. The confusion caused delays or prevented the use of the capability.[8]

## Patterns of Interaction

The lack of Air Force C2 elements at subtheater organization levels and the lack of confidence and trust between commanders and between staffs impacted personnel interaction during OEF and OIF. These two issues impeded vertical and horizontal integration of Air Force capabilities with joint partners.

The lack of subtheater C2 elements prevented effective interaction between commanders and staffs, which in turn created organizational integration seams across the CENTCOM area of responsibility. While the theater COMAFFOR/CFACC model provided flexible responsiveness across multiple theaters of operation, it also created integration seams between the COMAFFOR/CFACC and the JTF commanders in Iraq and Afghanistan.[9] The theater COMAFFOR/CFACC primarily looked to the CENTCOM commander (its OPCON headquarters [HQ]) for direction vice horizontally to the JTF (the supported commander). Insufficient liaison and coordination elements were deployed to the JTF HQs and subordinate elements to close the integration seam.[10] With operational-level airpower planning not adequately represented with the supported JTF commander, the Air Force was removed from direct integration with the JTFs. Consequently, the theater COMAFFOR/CFACC structure put heavy reliance on the ACCE, elements of the theater air control system (TACS), and LNOs to bridge C2 gaps. The problem is that the ACCE, the TACS, and the LNOs are not properly organized, trained, or equipped to close the organizational integration seams between the theater and JTF levels.

The ACCE directors reported that although they were able to advocate for the proper use of airpower, they were perceived as having limited credibility given their lack of command authority over the airpower in-theater.[11] Also, ACCE staffs have not always been effectively manned with the broad range of expertise needed to support JTF planning.

The TACS problems occurred because the system is not fully capable of supporting the widely dispersed ground operations that occurred in Iraq and Afghanistan. In this dispersed environment, the majority of operational planning takes place at the lower echelons of the ground component and is often not coordinated with other surface units in adjoining areas. Airpower representation at lower Army echelons is limited to joint terminal air controllers and tactical air control parties. Although experts at close air support, these teams do not have the education or the experience to advise and present airpower's entire spectrum of capabilities to the ground commanders. Further, these teams are not in contact with the combined air operations center (CAOC), which is where the operational-level expertise resides and where operational-level airpower planning takes place.[12]

Also, lack of effective interaction between elements of the TACS and ground forces is due to the lack of predeployment exercise participation. Operations tempo and funding issues prevent systemwide TACS participation in these predeployment exercises. Therefore, when TACS elements are deployed to a contingency and are required to operate as a system, disconnects occur, creating confusion from conflicting interpretations of roles and responsibilities. Flight crews are not familiar with TACS capabilities and duties due to infrequent training with TACS elements.[13]

The LNO problem also deals with challenges with interagency integration. The nature of COIN operations in OEF and OIF has required constant integration of Air Force capabilities with interagency partners. Operational-level airpower planners are not fully prepared to work with interagency representatives to integrate airpower's capabilities, nor are they empowered to establish clear lines of responsibility.[14]

Finally, in addition to the lack of subtheater C2 elements, the lack of trust and confidence between commanders and

between staffs hindered interaction. Trust and confidence between commanders and between staffs were strong coming out of the major combat phase of OIF. However, as organizational structures changed and forces rotated home, the confidence and trust developed during 2002 and 2003 through personal relationships and shared experiences began to dissipate. Personnel and headquarters rotation policies did not allow for the establishment of long-term relationships between some commanders and key staff members.[15] In addition, the organizational integration seam discussed earlier prevented the close contact, trust, and relationship building between senior Airmen and the JTF commanders in Iraq and Afghanistan.[16] The perceived lack of Air Force presence at the subtheater level greatly impeded the development of trust between both commanders and staffs.[17]

The Air Force made changes to its C2 structures to address the concerns described above. Creating subtheater commanders in Iraq and Afghanistan as well as adding a broad range of Air Force planning expertise to the TACS structure at the Army division and brigade levels improved patterns of interaction. The goal is for the Air Force to organize, train, and equip to the new mission requirement so that similar efforts in the future will not take years to put into action.

## Distribution of Information

Three main problems affected the distribution of information during the COIN phase of OEF and OIF: classification of information restricting exchange of information, communications equipment capability, and the lack of a standard joint lexicon of operational terms.

The first problem deals with classification issues that affected the exchange of information. For example, the classification level of a new space system restricted access to information, impacting the C2 of that system.[18] Only three people were authorized through appropriate security protocols to access the new system: two operators and the commander.[19] It is difficult to effectively exchange information when only two operators are allowed to know about a system. Establishing security authorizations during system development will permit C2 elements to

effectively integrate the system's capabilities into joint operations. Also, intelligence, surveillance, and reconnaissance (ISR) classification issues limited the ability to conduct effective training for elements of the TACS. At times, RC-135 Rivet Joint operators were restricted from passing targeting information directly to other ISR assets, such as the E-3C Airborne Warning and Control System (AWACS) or E-8C Joint Surveillance Target Attack Radar System (JSTARS), due to classification issues.[20]

The second problem inhibiting the effective flow of information deals with communications equipment capability. Problems with effective communications equipment exist within the TACS structure. Upgrades to fighters, bombers, remotely piloted aircraft (RPA), and airborne ISR platforms have outpaced the ability of the control and reporting center (CRC) to integrate information sent by those platforms. As a result, the CRC systems, sensors, and shooters are no longer on the same sheet of music. Future systems such as the Global Hawk Block 40, F-35 Joint Strike Fighter, and the future bomber will only widen the gaps unless TACS upgrades are soon addressed. Future C2 communication systems must be expandable and provide coverage throughout the entire controlled airspace. Lack of radars and a linked picture decreases battlespace awareness.[21] Also, in OEF and OIF all TACS elements, including the AOC, experienced integration problems with other service and coalition C2 systems. The lack of common digital data links and the inability of systems to accept transmission formats have hampered integrated war-fighting C2.[22]

Finally, a standard lexicon is required for effective distribution of information. The services define some terms differently, which causes confusion when the services communicate with each other. For example, the services interpret and use the terms *priorities of support*, *priorities of effort*, *weight of effort*, and *apportionment* differently, causing confusion. How various joint capabilities are used depends on the interpretation of these terms. A land component commander may focus on priorities as part of mission-type orders, while the CFACC will normally look for CCDR-directed weight-of-effort and apportionment guidance. The CCDR provides priorities of support and effort to the force and apportionment guidance to the theater CFACC.

Priorities of support may address "who" has priority among the forces (e.g., a JTF), while priority of effort may address "what" has priority (e.g., disrupting a network). Weight of effort is synonymous to apportionment and differs from priority, particularly from an Airman's viewpoint. For instance, it is possible to assign low weight of effort to the number one priority of effort based on adversary capabilities. (As an example, air defense / air superiority could be a high priority for the CCDR, but because of minimal adversary capability, the CCDR may direct the joint force air component commander [JFACC] to give it little to no weight of effort in apportionment guidance.) These terms must be consistently understood and consistently used by both the CCDR and the components, especially during personnel changeovers to reinforce the lexicon with new personnel.[23]

## Summary

The theater COMAFFOR/CFACC model worked well in the major combat phases of Operations Enduring Freedom and Iraqi Freedom, with overall theater operations under close direction of the CCDR. However, as the mission in Iraq and Afghanistan evolved into counterinsurgency operations, C2 seams developed that hindered the integration of airpower into the supported commands. These seams arose due to the lack of Airmen with command authority at the JTF level, a less-than-full range of Air Force planning expertise below the theater COMAFFOR/CFACC level, and the absence of Air Force representation on JTF staffs.

Not all future operations will resemble the current ones in Afghanistan and Iraq, but certain attributes are likely to characterize them, such as continuous, simultaneous combinations of offensive, defensive, and stability or civil-support operations conducted in a highly integrated, networked, and distributed environment under the control of a JTF. Effective operations in this environment may call for the presence of commanders empowered with decision-making authority at lower organizational levels—individuals who can provide optimal span of control, unity of command, and tactical flexibility. Although Air Force and joint doctrine describe the possibility of creating these lower-level command structures, the Air Force

has chosen to organize, train, and equip itself for one model—the theater COMAFFOR/CFACC model with JACCE support at the subtheater or staff level. The theater COMAFFOR/CFACC model prepares the Air Force to fully support global and theater operations. Now, as the idea of subtheater C2 becomes truly viable, it must develop a concept of operations, organize forces, train new commanders, and identify equipment necessary to control units at this lower level. The process has begun with the creation of subtheater commanders in Iraq and Afghanistan and the sending of planners to echelons below the CCDR level. Codifying the best practices from these experiences is a priority.

**Notes**

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2. Office of Air Force Lessons Learned (USAF/A9L), "Focus Area: Air Force Innovations for the Joint Fight; Role of the Air Component Coordination Element," Lessons Learned Report (Washington, DC: HQ USAF, Studies and Analyses, Assessments, Lessons Learned, 22 June 2010), 4–5.

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4. Ibid., 52.

5. USAF/A9L, "Enduring Airpower Lessons from OEF/OIF: Space Command Relationships," Lessons Learned Report (Washington, DC: HQ USAF, Studies and Analyses, Assessments, Lessons Learned, 5–9 January 2009), 4–5.

6. Ibid., 3.

7. Ibid., 10.

8. Ibid., 7–8.

9. Ibid., 8.

10. Gen Gary Luck, USA, Retired, and Col Mike Findlay, USA, Retired, *Insights and Best Practices: Air Component Integration in the Joint Force*, Focus Paper no. 6 (Suffolk, VA: Joint Warfighting Center, United States Joint Forces Command, 20 March 2009), 3–4, https://jko.harmonieweb.org/coi/JointTrainingDivision/Documents/6 Air Integration Insights Paper 20 Mar 09.pdf.

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12. Ibid., 18–19.

13. Luck and Findlay, *Insights and Best Practices: Air Component Integration in the Joint Force*, 16.

14. USAF/A9L, "Integration of Airpower," 10.

15. USAF/A9L, "Enduring Lessons From OEF/OIF," 49.
16. USAF/A9L, "Integration of Airpower," 19.
17. Ibid., 1.
18. USAF/A9L, "Enduring Airpower Lessons from OEF/OIF: Space Command Relationships," 8.
19. Ibid., 8.
20. USAF/A9L, "Integration of Airpower," 35–36.
21. Ibid., 30.
22. USAF/A9L, "Focus Area: Air Force Innovations for the Joint Fight Role," 32.
23. Luck and Findlay, *Insights and Best Practices: Air Component Integration in the Joint Force*, 10–11.

Example 2

# Major Combat Phase of Operation Iraqi Freedom

The research team selected the major combat phase of Operation Iraqi Freedom for analysis because it covers a major conventional operation with the use of a large US ground force. This phase of OIF lasted from 19 March 2003 to 1 May 2003. This time period covers the beginning of the coalition campaign conducted against Saddam Hussein to the time when Pres. George W. Bush declared major combat operations complete. The sources for the analysis consist of interviews and joint and Air Force lessons learned documents. The following results of the analysis describe issues which impacted the three fundamental elements of C2: allocation of decisions, patterns of interaction, and distribution of information.

## Allocation of Decisions

During this operation clear command relationships established the proper allocation of decision authority among commanders, staffs, and partners. Following joint doctrine, the command relationships (combatant command [COCOM], OPCON, TACON, and support) sustained a C2 design that included service and functional components.[1] These relationships clearly defined the level of authority commanders had over attached or supporting forces. Noteworthy was the use of the support command authority. The CENTCOM plan for OIF, Operation Plan (OPLAN) 1003V, clearly defined the supporting and supported relationships between the components. From the 1003V plan the air component built a detailed plan that described its supporting relationship with the other components. This supporting plan, which included a joint air apportionment plan, specified the level of support the supporting commanders would receive from the air component.[2] These planning efforts enhanced the horizontal integration of assets, which improved agility and speed of action in the delivery of effects.

The ACCE concept, used for the first time, worked well for the major combat portion of OIF. The ACCE is a liaison organization that is the CFACC's primary representative to a commander and facilitates interaction among the respective staffs. The ACCE construct worked well because the ACCE was not filling a subtheater command element void. Unlike the JTF-led operations during the COIN phase of OIF, the integration of joint operations was conducted between service and component commanders at the geographic CCDR level. A CCDR-led operation without JTFs did not require a subtheater Air Force commander. The decision authority for each ACCE was clear. The ACCE, acting as a liaison for the CFACC, helped facilitate the integration of capability between the already established COMAFFOR/CFACC and other commanders.

Not only were ACCEs instituted during OIF, a concept of command in depth was also introduced to make manageable the span of control supporting operations in Iraq, Afghanistan, and the Horn of Africa (HOA). When the CAOC at Al Udeid Air Base (AUAB) became fully operational in February 2003, the C2 of OEF and HOA operations shifted from Prince Sultan Air Base (PSAB) to Al Udeid. The CAOC at AUAB was led by the Central Command Air Forces' (CENTAF) deputy CFACC. The deputy CFACC was delegated appropriate command authorities.[3] These were deconflicted with the authorities residing with the COMAFFOR/CFACC leading operations in Iraq. Command in depth worked well because of the clearly defined decision authorities between the COMAFFOR/CFACC at PSAB and the deputy CFACC at AUAB.

## Patterns of Interaction

Successful interaction between partners produced effective vertical and horizontal integration of assets during planning and execution. Various means enabled this successful interaction. CENTCOM performed a forcing function by conducting "synchronization conferences" (sync conferences) every four to six weeks from the spring of 2002 until the spring of 2003. The conferences, hosted by the CENTCOM planning staff, served to integrate the planning efforts of CENTCOM and its components—CENTAF (Air Force), MARCENT (Marine Forces Central

Command), NAVCENT (Navy Forces Central Command), ARCENT (Army Forces Central Command), and SOCCENT (Special Operations Component Central Command). The goal was to utilize the planning expertise available in each component staff to integrate all the forces into one joint campaign plan. The resulting plan was known as 1003V, published in October 2003.[4]

During operations execution, secure video teleconferences held twice a day anchored the integration effort. The video teleconferences were chaired by the CENTCOM commander, attended by all the component commanders, and supported by all the staffs. Planning, execution, assessment, and decision making were all joint efforts. The development of trust was a positive byproduct of the joint interaction between the CENTCOM and component staffs.[5]

During the major combat phase of OIF, ACCEs were attached to headquarters that lacked USAF or CFACC representation to enable interaction between partners that may not have occurred otherwise. The ACCEs were attached to the coalition forces land component commander (CFLCC), Combined Force Maritime Component Command (CFMCC), Combined Force Special Operations Command (CFSOC), and CENTCOM. The ACCE was in place to facilitate coordination and communication between the theater CFACC and the other commanders. The location of an ACCE at the CFLCC headquarters was particularly critical because it was the only Air Force integration element present. The ACCE at the CFLCC headquarters enabled positive interaction that created effective integration of Air Force assets with land forces.[6]

Interaction between senior commanders that built trust and confidence was another key item that led to effective vertical and horizontal integration. The positive relationship between commanders created a climate that allowed trusting interaction between CENTCOM, components, and other supporting staffs. This environment of trust was forged under fire in OEF by the same leadership team. The following statement, made to Congress by Lt Gen Daniel Leaf on 21 October 2003, captures the positive interaction between commanders:

> The secret to success in OIF was the working relationship between the Coalition Forces Air Component Commander, General Michael Moseley, Coalition Forces Land Component Commander, Lieutenant General Da-

> vid McKiernan, Coalition Forces Maritime Component Commander, Vice Admiral Timothy Keating, and the Commander of Special Operations, Brigadier General Gary Harrell. This team of commanders demonstrated the understanding and appreciation for the missions and assigned tasks of each service in coalition warfare. . . . Conceptual interoperability is when we foster teamwork. . . . The commanders in OIF balanced their individual perspectives to achieve the objectives established by the President.[7]

The research team identified one area of concern in relation to patterns of interaction. The theater's Air Force staff was too small to conduct the major combat phase of OIF without a large influx of personnel to support the CAOC. Planning estimates put the number of personnel required to man the CAOC for major combat operations at approximately 1,350. In the summer of 2002, the PSAB CAOC was manned with approximately 350 personnel.[8] Working with Air Combat Command (ACC) (Twelfth and Eighth Air Forces), United States Air Forces in Europe (USAFE) (32d Air Operations Squadron), and the air reserve component (152d and 157th Air Operations Groups), CENTAF identified the trained and experienced USAF personnel required to fully man the CAOC for major combat operations. Support from the US Navy was also vital, as it provided a cadre of trained personnel to fill key positions, including the deputy CFACC. CENTAF also identified and sourced the required equipment to enable new and improved communications links with the increased wing and group headquarters that were deployed to theater. While the Air Force was successful in supporting the increased CAOC manning for this phase of the operation, sustaining this level of effort during continuous operations proved difficult. Designing a C2 structure that assumes manning that might not be available is predestined to have vertical and horizontal integration challenges. The "skip echelon" concept implemented by the Air Force in the 1990s eliminated air divisions, and subsequent changes made numbered air forces (NAF) too small to provide adequate organized, trained, and equipped support. The elimination of air divisions and the reduced NAF manning limited robust, flexible C2 across the range of military operations. This limitation impacted the C2 design during the COIN phase of both OEF and OIF.

## Distribution of Information

Overall, the distribution of information was effective during the major combat phase of OIF. During planning and execution, commanders, staffs, and subordinates had the processes, infrastructure, and access to information needed to conduct the operation. These items were not in place by accident. It took hard work by all partners to develop the elements needed for the effective sharing of information.

One example that illustrates the effective distribution of information is the "kill box" construct used to support air and ground integration. Information was effectively shared when kill boxes were opened and closed. The effective flow of information allowed for the employment of joint fires against the enemy as he reacted to joint force maneuver. Air Force assets identified the enemy as he moved out of a defensive position. Once the enemy was identified, the information was passed to appropriate C2 elements, which in turn passed information to selected joint forces cleared to attack the moving targets. The effective distribution of current information provided for coordination between fires, maneuver, and reconnaissance elements.

The one notable exception to the effective distribution of information was due to US information security policies and technology limitations that hindered the integration of coalition partners into planning and execution processes. Planning information was posted primarily on US-only systems, to which coalition partners were not allowed access because doing so would expose sensitive, US-only national security information. Although information systems offered sufficient capability for sharing information within the coalition, information sharing between these systems and the equivalent-level US-only system was difficult because of security concerns. Alternative means were developed to overcome this deficiency. However, the manual nature of some of these processes caused the transfer of data to fall behind the pace of combat operations, and some partners did not obtain the access they needed for effective planning.[9] Information systems such as the Combined Enterprise Regional Information Exchange System (CENTRIXS) provided for coalition information exchange at the secret releasable level. This network, and others to a lesser degree,

provided a common operating picture (COP), e-mail, Web dissemination, and full collaboration capability within the network domain. Although the systems offered sufficient capability for sharing information within the coalition, information sharing between these systems and the equivalent-level US-only systems proved difficult.

## Summary

Overall, the major combat phase of OIF is a successful example of how to design an effective C2 structure in support of a large conventional joint and coalition campaign. The existing Air Force C2 system fits the nature of the operation. This conclusion does not mean that everything was perfect. In large, complex operations, some problems always occur. However, the effective balance of decision allocation, patterns of interaction, and distribution of information allowed for commanders and staffs to develop timely solutions when problems occurred.

### Notes

1. US Joint Forces Command, "Joint Lessons Learned: Operation Iraqi Freedom Major Combat Operations," coordinating draft (Norfolk, VA: US Joint Forces Command, 1 March 2004), 79.
2. USAF/A9L, "Enduring Lessons From OEF/OIF," 36.
3. Ibid., 43.
4. Ibid., 98–99.
5. Ibid., 47–48.
6. Ibid., 41–42.
7. Statement by Lt Gen Daniel P. Leaf, Vice Commander, Air Force Space Command, before the United States House Armed Services Committee, Terrorism, Unconventional Threats, and Capabilities Subcommittee, 108th Cong., 1st sess., 21 Oct 2003.
8. Ibid., 19.
9. US Joint Forces Command, "Joint Lessons Learned: Operation Iraqi Freedom Major Combat Operations," 61.

Example 3

# Hurricane Katrina Disaster Relief

The research team chose the Hurricane Katrina relief effort for the humanitarian aid and disaster relief case study. The team selected Katrina because of the scale of interagency cooperation required and the use of Air Force capabilities in support of domestic relief efforts. This operation fits in the category of crisis response and limited contingency operations within the range of military operations.[1] The time period covered by this analysis is 23 August to 24 September 2005, with joint and Air Force lessons learned documents being the primary sources used for the analysis. The following results of the analysis describe issues which impacted the three fundamental C2 elements: allocation of decisions, patterns of interaction, and distribution of information.

## Situation

On Monday, 29 August 2005, Hurricane Katrina made landfall just east of New Orleans, Louisiana. Damage along the Gulf Coast overwhelmed municipal and state disaster-response capabilities, requiring an unprecedented need to establish civil order, evacuate endangered populations, and provide humanitarian relief.[2] The Pentagon's response to Hurricane Katrina was the largest deployment of military forces for a civil-support mission in US history.[3] The Air Force team was comprised of active duty, Air National Guard (ANG), Air Force Reserve, and Civil Air Patrol volunteers from the Air Force Auxiliary. The Air Force team provided disaster response and humanitarian relief efforts on a scale never before seen.[4]

On 31 August, two days after Katrina's landfall, Louisiana governor Kathleen Blanco asked for 40,000 federal troops.[5] Once the governors of the affected states requested federal assistance, the Federal Emergency Management Agency (FEMA) tapped the Department of Defense (DOD) for military assistance. The US Northern Command (USNORTHCOM) set up JTF Katrina under Lt Gen Russell L. Honoré, the commander of the First US Army, at Camp Shelby, Mississippi. Maj Gen M. Scott Mayes, commander of the USAF First Air Force, served as the task force's

JFACC. General Mayes established the 1st Aerospace Expeditionary Task Force–Katrina at Tyndall AFB, Florida. The task force set up various air expeditionary groups for the massive operation.

From 23 August to 24 September, around 6,700 total active duty, Reserve, and Guard Airmen took part in search and rescue (SAR), logistics, medical, relief, and other operations. The Air Force total force team aeromedically evacuated 3,806 people, airlifted 29,661 displaced Americans, and handled 12,258 short tons of relief supplies.[6] Despite the following C2 issues brought to light by the rescue mission, Airmen across the Air Force family saved countless lives.

## Allocation of Decision

Decision rights belong to individuals or organizations that are given the authority and responsibility to make choices between possible options. Unclear command relationships created decision authority confusion, undermining unity of effort and total force presentation. This confusion of command authorities affected the timeliness of decisions and distribution of information during the relief effort. Three issues impacted the allocation of decision: clear, consistent intent; effective communication; and community interaction.

Clear guidance did not exist across functions, organizations, or echelons. The National Response Plan (NRP), COCOM plan, and Air Force plan did not fully address the challenge across echelons, which revealed operational seams.[7] The NRP has a decentralized concept that is designed to centralize as problems arise. During Katrina relief operations, decisions were made at the lowest possible level and elevated only when that level became overwhelmed. While the NRP readily addresses this and other broad issues, it lacks sufficient detail to guide the creation of operational plans.[8] The NRP's shortcomings were compounded by supporting COCOM and AF concept plans, which in themselves lacked sufficient detail and clear links to the concepts in the NRP.[9] As a result, a chasm developed between the "what" and "how" of conducting a disaster response.[10]

The operation revealed immaturities and misunderstandings within the COCOM C2 structure, which had been formalized

within NORTHCOM Concept Plan (CONPLAN) 2002 and with component commander guidance.[11] In the CONPLAN, ACC was tasked to provide the JFACC, but the COCOM never fully "credentialed" the JFACC.[12] The reason was that under ACC the First Air Force was not sized to support NORTHCOM as the JFACC in civil support operations. It lacked the manning, organization, training, and equipment necessary to plan and coordinate ISR activities, SAR missions, and aeromedical evacuation operations.[13] The hollow air operations center delayed AF primary means to effectively communicate and coordinate efforts for vertical and horizontal integration of planning and execution throughout the joint operations area (JOA).

First Air Force experienced the full impact of undeveloped concept plans on communication. The DOD lacked the visibility into Title 32 disaster response efforts, resulting in two assets being tasked for the same mission.[14] The active duty Air Force and ANG would often respond to the same disaster area with the same capability.[15] Additionally, the Air Force Warfighting Headquarters (WFHQ) construct assumed that it would take 72 hours to fully augment a WFHQ staff. This slow startup hampered the initial response of First Air Force.[16] Without a full HQ and staff, it had no effective means to control operations.

The final concept to appreciate is how communities of interest in an operation function both independently and in concert. There were two separate chains of command, one for the National Guard under state command and one for those under federal command.[17] Issues were inherent due to duties that Airmen performed under a variety of *United States Code* (*USC*) title authorities. Total force legal issues regarding chain of command for composite units and accounting for all personnel were problematic.[18] The Air Force had no procedures in place and no single mechanism to account for all personnel in the JOA.[19] This problem arose across Air Force active duty, Reserve, and National Guard components. The ANG Crisis Action Team (CAT) did not have a requirement to track Guard members that were not in a Title 10 status.[20] The state's initial response to the situation was with state active duty and Title 32 forces, which complied with existing guidance.[21] The Louisiana governor then requested federal support after determining that state capabilities had been exceeded.[22] While this scalable approach ensured

that crises were addressed at the lowest possible echelon, it also presented situational awareness challenges for Title 10 forces that were integrated into ongoing operations.[23]

The Total Force concept views Air Force active duty, Reserve, and National Guard components as a single entity for force presentation, but command relationships vary between these forces, causing confusion. For example, the 347th Expeditionary Rescue Group was comprised of Title 10, Title 32, and Air Force reservists in civilian status. Its commander, however, exercised legal authority over only the Title 10 and Air Force reservists.[24] The lack of a clear chain of command will cause C2 confusion, delaying operation execution.

Force presentation processes were hindered by the nonstandard methods used to rapidly deploy AF personnel. In the rapid response, Airmen were "pushed" to the JOA rather than "pulled" via formal requests for forces (RFF). Processes were complicated by the bureaucracy of individual state governments; National Guard units; and local, state, and federal agencies. Thus, response to official RFFs lacked timeliness. While quick responders enhanced mission effectiveness at the tactical level, they created problems with unity of command and unity of effort, resulting in inefficiencies and duplicate efforts. At the time, NORTHCOM was not directed to develop time-phased force deployment data for this type of contingency, which resulted in ad hoc personnel and equipment deployment tasking. Also, unit movements were not initially backfilled into the Joint Operation Planning and Execution System, thereby degrading the situational awareness of those individuals charged with deployment oversight.[25]

## Patterns of Interaction

Patterns of interaction focus on who needs to interact, how they do so, and what types of transactions occur during this process. The objective of examining these patterns is to ensure that all those involved across functions, organizations, and echelons understand the guidance and are working in concert toward the desired end state.[26] The unity of effort between Air Force and civilian entities suffered because of Air Force leaders' unfamiliarity with the Air Force National Security and Emergency Preparedness Agency (AFNSEP) concept.[27] The AFNSEP

was created as a conduit between civilian leadership and Air Force commanders during military support to civil authority operations. The problem was that Air Force leaders at the operational and tactical levels were generally unfamiliar with the AFNSEP concept and didn't know how to leverage the deployed AFNSEP emergency preparedness liaison officers (EPLO).[28] One of the reasons for this lack of knowledge was that the EPLOs did not practice with higher headquarters prior to the disaster. The use of liaison officers at the proper channels with proper direct liaison authorized (DIRLAUTH) could have smoothed operations and aided coordination and cooperation toward common objectives.

Proper planning with well-placed LNOs could have prevented planning confusion and execution delays. For example, once the Federal Aviation Administration lifted restrictions on RPAs, liaisons at government and nongovernment agencies could have improved the tasking of the assets and information processing.[29] Civilian decision makers from government and nongovernment agencies at the local, state, and federal levels were mostly unfamiliar with military ISR asset capabilities. As a result, they were unable to clearly articulate their ISR requirements.[30] NORTHCOM and JTF Katrina did not develop a C2 relationship for ISR processing, exploitation, and dissemination assets, resulting in disjointed efforts to satisfy customer needs.[31]

Additionally, the Air Force commander did not have an aeromedical evacuation medical planner liaison on staff to coordinate with the Air Mobility Command (AMC) CAT, thus compromising visibility for the JFACC. Although some real-time tracking of aircraft was available via the Blue Force Tracker, the lack of equipment for ARC assets and the UH-1Ns prevented the most efficient use of rescue resources during SAR operations.

## Distribution of Information

The means were not available to effectively distribute information between partners throughout the operation. Broken communication channels impeded access between AF and civilian entities, hindering unity of effort and delaying rescue efforts. For example, NORTHCOM, First Air Force, and CATs conducted routine operations on classified networks, thus limiting

access to civilian authorities.[32] Much of the disaster imagery was posted on the Secret Internet Protocol Router Network (SIPRNET) even when the information had been declassified; this blocked direct access from command centers using commercial-civil Internet systems.[33] There was not a single COP on the unclassified side for all interested parties to work with.

The Global Broadcast Service (GBS) proved immensely valuable in transmitting wideband video and digital imagery, thus enhancing situational awareness within the JOA and providing actionable rescue data for SAR crews.[34] However, problems arose from the system's inability to accept and then simultaneously broadcast locally acquired information to scores of distant users. This limitation hindered information exchange between stovepiped systems.[35] Limited GBS resources precluded Eagle Vision commercial imagery distribution to JTF Katrina, NORTHCOM, and other subscribers.[36] Eagle Vision was the means to provide unclassified commercial space imagery for situational awareness and rescue efforts.

Overreliance on fixed communications infrastructure susceptible to storm damage amplified communications challenges in the course of operations. For example, Internet-based software for processing patient movements was not accessible to civilian medical personnel due to the destroyed infrastructure.[37] Communication between parties is critical to establishing initial situational assessment (location of survivors, condition of infrastructure, participating rescue and recovery organizations, security conditions, etc.) and to ensuring that efforts are not duplicated among participating organizations. Communication capabilities need to be robust to adapt to deterioration of infrastructure.

Finally, the Air Force active component lacked visibility of the National Guard's aeromedical evacuation operations. Confusion between the Guard's and the active Air Force component's tracking systems caused problems with patient in-transit visibility and duplication of evacuation efforts.[38]

## Summary

The Air Force C2 model needs to be adaptable enough to fully support JFC requirements during domestic relief efforts. During the Hurricane Katrina relief, operational agility and speed

of action were hampered by a breakdown in guidance and planning. Processes need to be established and developed through exercises and civil policies to create unity of effort not only within the Air Force but also between military and civilian entities. The Air Force needs a single mechanism to account for Airmen under multiple *USC* title authorities. LNOs need to be strategically placed and trained to aid in the communication process to carry out the exercised procedures. CONUS Air Force systems need an interoperability capability to interact with civilian response elements to create a single COP. Finally, standards should be established to enable the appropriate level and quality of communication, information exchange, and collaboration required for success.

**Notes**

1. A crisis response or limited contingency operation can be a single small-scale, limited-duration operation or a significant part of a major operation of extended duration involving combat. The associated general strategic and operational objectives are to protect US interests and prevent surprise attack or further conflict. A limited contingency operation in response to a crisis includes all of those operations for which the joint operation planning process is required and a contingency or crisis action plan is developed. The level of complexity, duration, and resources depends on the circumstances. Included are operations to ensure the safety of American citizens and US interests while maintaining and improving US ability to operate with multinational partners to deter the hostile ambitions of potential aggressors (e.g., JTF Shining Hope in the spring of 1999 to support refugee humanitarian relief for hundreds of thousands of Albanians fleeing their homes in Kosovo). Many such operations involve a combination of military forces and capabilities in close cooperation with other-government (non-DOD), intergovernmental, and nongovernmental organizations. A crisis may prompt the conduct of foreign humanitarian assistance, combat support, noncombatant evacuation operations, peace operations, strikes, raids, or recovery operations. Joint Publication (JP) 1, *Doctrine for the Armed Forces of the United States*, 2 May 2007, incorporating change 1, 20 March 2009, I-17, http://www.dtic.mil/doctrine/new_pubs/jp1.pdf.

2. USAF/A9L, "Air Force Support to Hurricane Katrina/Rita Relief Operations, August–September 2005" (Washington, DC: HQ USAF, Studies and Analyses, Assessments, Lessons Learned, n.d.), 1.

3. Sgt Sara Wood, "DoD Leaders Report on Hurricane Response," American Forces Press Service, 10 November 2005, http://www.defense.gov/News/NewsArticle.aspx?ID=18332; and USAF Director of Mobility Forces, "Joint Task Forces Katrina and Rita," After action report, 18 October 2005, app. B, "Mobility Metrics Overview."

4. USAF/A9L, "Air Force Support to Hurricane Katrina/Rita Relief Operations," 1.

5. Douglas Brinkley, *The Great Deluge* (New York: HarperCollins, 2006), 633.

6. USAF/A9L, "Air Force Support to Hurricane Katrina/Rita Relief Operations," 1.
7. Ibid., 2.
8. Ibid., 9.
9. Ibid.
10. Ibid.
11. Ibid.
12. Ibid., 13.
13. Ibid., 10.
14. USAF/A9L, "Top 10 Hurricane Katrina Lessons Learned for AF CAT [Crisis Action Team]" (Washington, DC: HQ USAF, Studies and Analyses, Assessments, Lessons Learned, 17 August 2007), 1.
15. Ibid.
16. USAF/A9L, "Air Force Support to Hurricane Katrina/Rita Relief Operations," 10.
17. Ibid., 4.
18. Ibid.
19. USAF/A9L, "Top 10 Hurricane Katrina Lessons Learned," 1.
20. Ibid.
21. USAF/A9L, "Air Force Support to Hurricane Katrina/Rita Relief Operations," 13.
22. Ibid.
23. Ibid.
24. Ibid., 13–14.
25. Ibid., 10.
26. JP 1, *Doctrine for the Armed Forces of the United States*, IV-16. *Commander's intent* is defined as "a concise expression of the purpose of the operation and the military end state (ibid.)." Alberts and Hayes use the term *command intent* to describe this concept since, in their opinion, there is no longer a single commander present in any reasonably large operations. David S. Alberts and Richard F. Hayes, *Understanding Command and Control* (Washington, DC: Office of the Assistant Secretary of Defense for Networks and Information Integration, CCRP Publication Series, 2006), 88.
27. USAF/A9L, "Top 10 Hurricane Katrina Lessons Learned," 1.
28. Ibid.
29. Ibid.
30. Ibid.
31. Ibid.
32. USAF/A9L, "Air Force Support to Hurricane Katrina/Rita Relief Operations," 16.
33. Joint Center for Operational Analysis, "Hurricane Katrina Lessons Learned," *Quarterly Bulletin* 8, no. 2 (June 2006).
34. USAF/A9L, "Air Force Support to Hurricane Katrina/Rita Relief Operations," 16.
35. Ibid.
36. Ibid., 3.
37. Ibid., 16.
38. USAF/A9L, "Top 10 Hurricane Katrina Lessons Learned," 1.

Example 4

# Operation Allied Force

## Introduction

Operation Allied Force (OAF) was a unique NATO air campaign that lasted 78 days (24 March–10 June 1999) and included aircraft from six NATO nations (United States, France, United Kingdom, Germany, Italy, and the Netherlands).[1] Not guided by normal military doctrine, the operation used cumbersome C2 structures to support operations.

OAF, often referred to as the "air war over Serbia," was a watershed operation in the alliance's history. It represented a significant departure from NATO's exclusive Cold War focus as a defensive alliance. NATO had developed a foundation of C2 structures in a defensive focus. However, OAF was an offensive air campaign, and NATO was not fully prepared militarily and politically to undertake such an operation. As a result, OAF helped shape NATO's subsequent post–Cold War evolution of capabilities and thought.[2] Gen John Jumper, USAFE commander, opined that for over 50 years NATO had been a collective defensive alliance, yet now it found itself conducting an offensive air campaign out of area.[3]

From the very beginning of OAF, NATO planned on limited and restricted use of airpower as the sole means to achieve its objectives. This decision created an unexpected operational environment by placing airpower as the "supported" force. This environment required new thinking about the employment of airpower (doctrine, tactics, techniques, and procedures) to ensure that the distinctive capabilities and competencies of joint and allied air forces were effectively employed to achieve both political and military objectives.[4]

NATO assumed that OAF, by taking a gradualist approach, would result in the same success as the earlier Operation Deliberate Force (1995). Therefore, the alliance (North Atlantic Council) prepared for a very short conflict defined by limited objectives and a narrowly defined target list containing approximately 50 fixed targets. NATO and US planning followed

accordingly with C2 structures based on operations lasting only a few days.[5]

The military objectives of OAF were clear. However, the significant differences in perspectives among the NATO alliance created operational challenges. These differences, centered on the national political level, resulted in short-term military objectives and political adjustments to target lists. In addition, the entire air campaign was overshadowed by NATO's strong aversion to casualties and concerns over public reactions.[6]

The United States and NATO conducted separate but parallel planning efforts. However, US planning was restricted to the United States only due to operational security concerns and disclosure limitations of US classified information. This eventually led to the generation of US-only air tasking orders (ATO), which essentially split the air campaign into US and NATO forces. As a result, NATO had to generate its own ATOs that could be viewed by both US and NATO air forces.

The strategy of specifically targeted, yet limited, operations failed to bring Milosevic to the negotiating table. Moreover, the allies did not have plans or options for escalating and extending the air campaign. The very nature of OAF limited the alliance's ability to conduct a decisive operation from the onset.[7] The initial air campaign did not produce the desired results. As the air campaign escalated, challenges to the United States and NATO grew.

The increased Serbian attacks on the ethnic Albanians in Kosovo created a tremendous humanitarian disaster. Over 1.3 million Kosovars were displaced, and approximately 750,000 of those fled to neighboring states, creating a tide of refugees in the region. USAFE created JTF Shining Hope to conduct humanitarian assistance operations in support of US government agencies, nongovernmental agencies, and international organizations. Although it relied heavily on USAF rapid global mobility capabilities in the joint operating area, the supporting C2 structure of JTF Shining Hope was not organized as part of OAF.

While JTF Shining Hope was providing support and supplies to refugees in Albania, the USCINCEUR (Gen Wesley Clark) directed the deployment of 24 Apache attack helicopters as Task Force (TF) Hawk, along with a full command and support element, from Germany to Albania. As with JTF Shining Hope, the TF Hawk C2

structure was not developed as part of OAF, and neither were considered part of the air campaign.[8] Although TF Hawk achieved limited success, these multiple operations resulted in hundreds of aircraft, missiles, and RPAs operating in the same congested airspace in southern Europe under four C2 structures.[9]

## Command Relationships

CINCEUR, in his US role, established JTF Noble Anvil (US only) in early 1999 to support the NATO operation under the command of Admiral Ellis, who was also commander of Allied Forces Southern Europe. The air component of JTF Noble Anvil was commanded by Lt Gen Michael C. Short, who was also the commander of Allied Air Forces Southern Europe and the Sixteenth Air Force. This C2 structure, embedded within both US and NATO chains of command, was complex and was new for both the United States and NATO. Although developed to support coalition air operations, it did not take advantage of existing allied C2 structures (fig. B.1).[10]

Despite the development and approval of the combined joint task force (CJTF) concept in 1996, it was not used in OAF. NATO had not developed the required capabilities to support the CJTF concept prior to the beginning of OAF. The basic principle of the CJTF was for NATO forces to be "separable but not separate" from the alliance.[11] Because the CJTF structure was not used, the NATO forces became separate.

In his USAF role, General Short was the commander of Air Force Forces and commander of the 16th Air and Space Expeditionary Task Force. In his joint role, he was the JFACC for JTF Noble Anvil. In his NATO role as commander of Allied Air Forces Southern Europe, he was also the CFACC supported by the CAOC. As a result of his dual roles as the US JFACC and NATO CFACC, General Short established two geographically separated C2 structures, one for the United States and one for NATO, to support a single air campaign. While the operational C2 structure for OAF centered on the existing NATO chain of command, its many deviations produced both national and force application difficulties for the alliance.[12] These deviations created a C2 structure that was new to both the United States and NATO (fig. B.2).

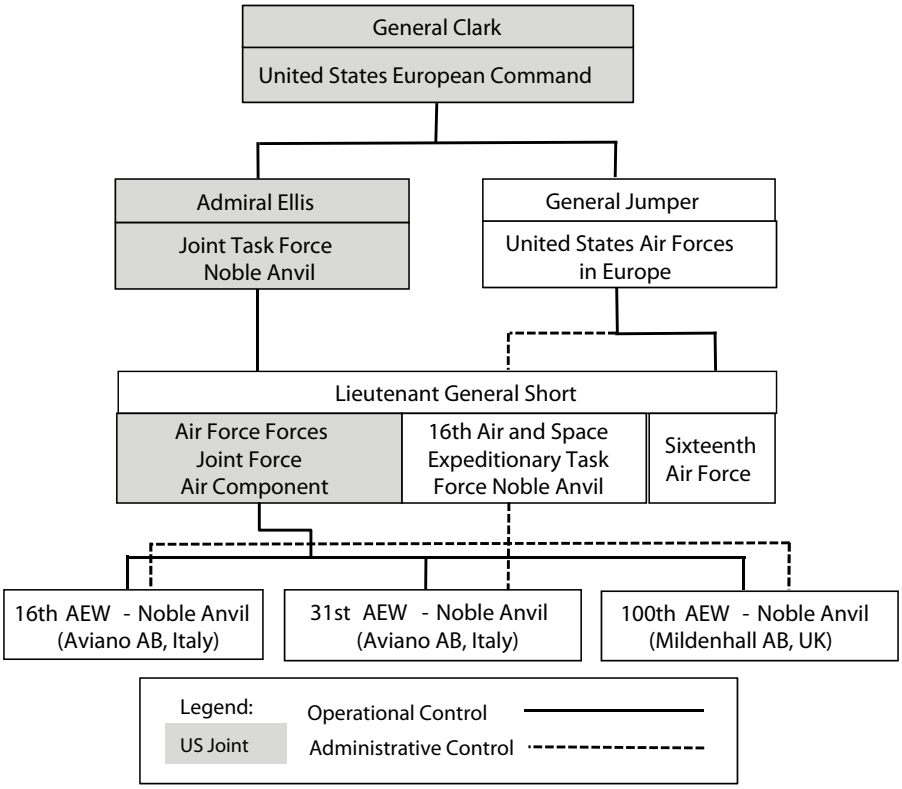


**Figure B.1. JTF Noble Anvil organizational structure (March 1999)**. (Reprinted from *Air War over Serbia: Aerospace Power in Operation Allied Force*, initial report [Washington, DC: HQ USAF, 25 April 2000], 14.)

The JFACC (CFACC if the force is international) controls the employment of airpower through a battle staff. General Short had two such staffs, and although US and NATO air battle staffs were organized differently, they functioned in a similar fashion in developing a campaign plan and producing ATOs.[13]

Given the lack of major land or maritime involvement, the command structure for OAF made General Short, the air component commander, the supported commander. Even so, General Short was restrained in his ability to plan and execute the air campaign. In fact, after the alliance had committed to an air-only campaign with limited objectives, the NATO senior leaders played a significant role in selecting and refining most air targets. In essence, most targets, due to their high political visibility

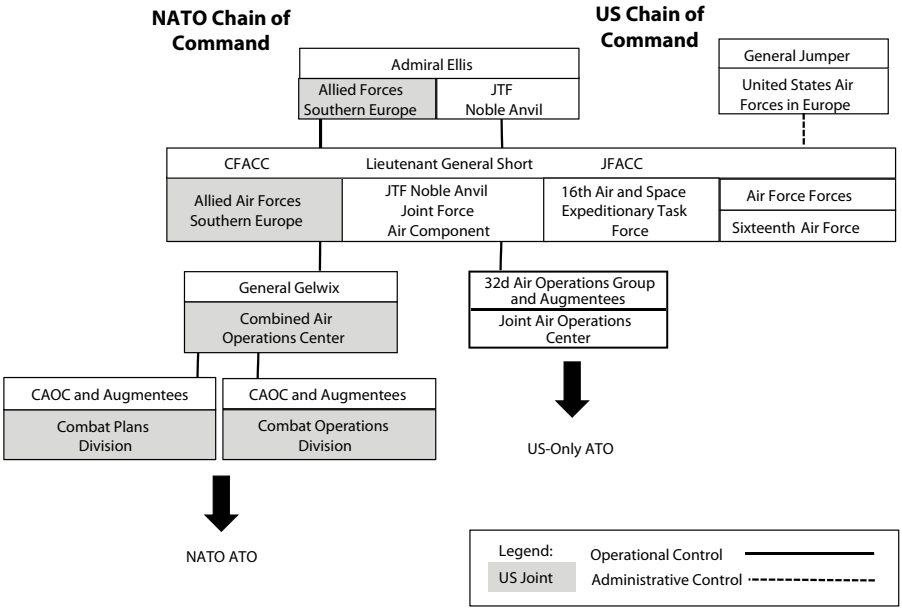


**Figure B.2. Operation Allied Force organizational structure**. (Reprinted from *Air War over Serbia: Aerospace Power in Operation Allied Force*, initial report [Washington, DC: HQ USAF, 25 April 2000], 22.)

and sensitivity, required the approval of the US national command authorities as well as the other NATO nations.[14]

The use of two separate C2 structures during OAF resulted in an overly complex process. Well-established peacetime structures, procedures, and practices were adapted as a result of both US and NATO requirements and capabilities. In addition, JTF Shining Hope and TF Hawk operated in close proximity of each other. Procedural differences for coalition aircraft, civil air traffic in the area, differing rules of engagement for the United States and its allies, and the publishing of two daily separate ATOs (US and allies) added to the C2 challenges.[15] However, despite its complexity, the NATO C2 structure provided the commander with some degree of unity of command while recognizing the challenges of controlling the capabilities of multiple nations.[16]

The initial stages of OAF did not achieve the desired political effects. The leadership escalated the air campaign and the commitment of forces at levels equivalent to a major theater war.[17]

However, despite the political, targeting, and C2 challenges, OAF allowed NATO to achieve its political objectives in Kosovo through the exclusive use of airpower to achieve desired diplomatic effects in a relatively short time.[18]

## Analysis

The following results of the analysis describe issues which impacted the three fundamental C2 elements: allocation of decisions, patterns of interaction, and distribution of information.

### Allocation of Decisions

Although General Short, as the US JFACC and NATO CFACC, was responsible for the overall air campaign, his ability to allocate decision making to the appropriate levels was severely hampered by the C2 structures. This was further complicated by the creation of two task forces (JTF Shining Hope and TF Hawk) that were not under his chain of command yet operated in his area of operations. This resulted in limited clarity of command relationships and limited the effectiveness of vertical/horizontal integration and control of airpower within the area of operations.

General Short was also constrained by extensive political and alliance restrictions on targeting.[19] The NATO target approval process resulted in a "servicing of targets lists" rather than an effects-based targeting campaign that systematically attacked target sets and enemy centers of gravity. As a result of the political nature of the targets, the air planners were required to articulate to everyone in the approval chain the weapons, impact points, anticipated casualties, and expected damage for each strike. This was a departure in procedure for a military operation, which is usually focused on achieving the desired effects to achieve the JFC's overall objectives rather than the specific details of each target.[20]

### Patterns of Interaction

Patterns of interaction were adversely affected by the need to protect the United States' sensitive information, the establishment of dual (NATO and US) C2 structures, disparate commu-

nication equipment capabilities between the United States and the allies, and the lack of trained personnel. Serious interoperability problems existed during OAF despite over 50 years of NATO training, exercises, and interoperability standards. The most glaring problem was with secure communications, the lack of which affected every aspect of the air campaign. In addition, during the 78-day campaign, manning went from a peacetime level of only 300 to over 1,400 personnel, many of whom had little or no training in CAOC operations or in the ATO process. As a result, ad hoc organizational structures were developed that impeded the transition from peacetime to war. One of the key lessons learned is that CAOCs should be deliberately organized, trained, equipped, and staffed to support a seamless transition from peacetime operations to conflict.[21] Combined, these factors framed the patterns of interaction that limited the richness, as well as the flow and rate, of information.

**Distribution of Information**

The C2 structure for OAF was bifurcated from the early stages of planning. Throughout OAF, the United States remained cautious about the information sharing and distribution of sensitive information with its NATO allies.[22] This resulted in the establishment of two separate C2 organizational structures (US and NATO) to support a single air campaign. In addition, this organizational structure created more concern and confusion in the areas of aircraft deconfliction, target assignments, and battle damage assessment.[23] Furthermore, there was little integration, hurting unity of effort in the process. Some nations believed that because of the organizational structure and limited information sharing between the United States and the allies, they were left out of the decision-making process, which minimized their involvement.[24]

One great concern of the alliance was the requirement to develop parallel ATOs, thereby complicating the coordination and distribution of information processes between the United States and NATO.[25] US forces had visibility on both the US and NATO ATOs. However, due to security concerns, the NATO air forces did not have access to the US-only ATO. Although having a dual planning track with two ATOs helped facilitate the

preservation of critical US stealth capabilities and tactics, taking this approach violated a basic tenet of C2: unity of command.[26]

## Conclusion

A key lesson learned from OAF is that future C2 structures must be optimized for coalition operations, providing, at a minimum, a basic framework for headquarters and their subordinate units, complete with appropriate communications architectures.[27] This is particularly relevant because the alliance agreed that all future operations will be conducted as part of a coalition, regardless of alliance affiliation. Furthermore, allies and coalitions will continue to rely on the United States to provide the deployable and sustainable capabilities needed to conduct an air campaign.[28]

OAF highlighted the operational challenges associated with dual C2 structures in support of coalition operations. It also showed that establishing multiple JTFs in a single area of operations, without integrated C2 structures, complicates decision making and degrades unity of command.[29] In addition, the practice of generating two separate ATOs undermines consolidated planning and centralized control of air forces.

OAF demonstrated the difficulties and personnel stresses placed on US air forces in Europe serving in multiple roles as an Air Force major command, a component of US European Command, and a force provider to NATO. Despite the short air campaign, OAF highlighted the need for theater headquarter staffs to be better prepared to transition from peacetime operations to a wartime posture.[30]

### Notes

1. NATO, "Bringing Peace and Stability to the Balkans," NATO in the Balkans briefing, NATO on-line library (Brussels: NATO Public Diplomacy Division, February 2005), 12.

2. Ibid.

3. HQ USAF, *The Air War over Serbia: Aerospace Power in Operation Allied Force* (Washington, DC: HQ USAF, 1 April 2000), 66.

4. Ibid.

5. Ibid., 5; and John E. Peters et al., *European Contributions to Operation Allied Force: Implications for Transatlantic Cooperation*, Report no. MR-1391 (Santa Monica, CA: RAND, 2001), 37.

6. Paul E. Gallis, *Kosovo: Lessons Learned from Operation* Allied Force, Congressional Research Service (CRS) Report for Congress, Order Code RL30374 (Washington, DC: CRS, 19 November 1999), http://www.au.af.mil/au/awc/awcgate/crs/rl30374.pdf.

7. Peters et al., *European Contributions to Operation Allied Force*.

8. Patrick Sheets, "Air War over Serbia," in *Lessons from Kosovo: The KFOR* [*Kosovo Force*] *Experience*, ed. Larry K. Wentz (Washington, DC: DOD, 2002), 105.

9. John Gordon, Bruce Nardulli, and Walter L. Perry, "The Operational Challenges of Task Force Hawk," *Joint Forces Quarterly* 29 (Autumn 2001–Winter 2002): 57; and HQ USAF, *Air War over Serbia*, 66.

10. Sheets, "Air War over Serbia," 100.

11. Peters et al., *European Contributions to Operation Allied Force*, 92.

12. Sheets, "Air War over Serbia," 100.

13. HQ USAF, *Air War over Serbia*, 66.

14. Ibid., 10.

15. Ibid., viii, 35.

16. Ibid., 6.

17. Ibid., vii.

18. Ibid.

19. Ibid.

20. Ibid., 10.

21. Ibid., ix.

22. Peters et al., *European Contributions to Operation Allied Force*, 39.

23. Ibid., 40.

24. RAND, *Operation Allied Force: Lessons Learned for Future Coalition Operations* (Santa Monica, CA: RAND), 2001, http://www.rand.org/pubs/research_briefs/RB72/index1.html.

25. Sheets, "Air War over Serbia," 104.

26. HQ USAF, *Air War over Serbia*, 57.

27. RAND, *Operation Allied Force*.

28. Peters et al., *European Contributions to Operation Allied Force*, 58.

29. HQ USAF, *Air War over Serbia*, 57.

30. Ibid., ix.

Example 5

# Command and Control of Cyber Operations

Cyberspace has no other purpose than to create effects in the real world. Effects are delivered through this relatively new war-fighting domain with very real consequences. Defense is required so that our Airmen are enabled to communicate and share information in a real-time joint operating environment. Offensive computer operations could be used to degrade an adversary's ability to harm our interests. Further, cyber effects can go beyond the traditional conceptualization of cyber operations: computer network defense (CND), computer network attack (CNA), and computer network exploitation (CNE) frameworks. Future C2 requirements of innovative Airmen producing cutting-edge global effects need to be taken into account as well. For example, cyber-enabled global social networking could be used to influence perceptions of international actors for purposes of mission assurance, counterproliferation, crisis escalation control, and global and regional stability. To date, unclassified discussions of cyber operations do not provide enough detail from which to discern the effectiveness of current and planned C2 structures for cyber operations.[1] Broadly, the discussions are focused around the Joint Chiefs of Staff and the United States Cyber Command (USCYBERCOM) positions. In the transitional C2 model, the COCOM Joint Cyber Center uses existing COCOM personnel from the CYBERCOM Cyber Support Element in a liaison function. USCYBERCOM's objective C2 model has CYBERCOM regional Joint Cyber Component Command providing direct support.[2]

Fundamental principles of twenty-first century C2 are perhaps best enshrined in the challenges we face in defining cyberspace C2. An appropriate C2 model for cyberspace operations will allow for unity of effort that permits the efficient allocation of resources during steady-state and contingency operations. The Air Force must posture itself in such a way as to provide a leading role for USCYBERCOM by improving its advocacy of how the Air Force can employ its human capital

and airborne and space assets to achieve effects on our adversaries via cyberspace. Through advocacy, the USAF will assure that USCYBERCOM will present operationally effective capabilities suitable for operations in the dynamic cyber environment. Through proper presentation of forces, the USAF cyber operators provide agile responses, allowing for the flexible execution of cyber missions to deliver "fires" that produce desired effects onto a target. Authorities for these missions should follow succinctly from the supported commander to the force conducting the mission.

Given the newness of the domain, there is much debate on the best way to command and control cyber operations. This appendix aims to inform the debate on how to structure USAF and joint C2 models based on a discussion of strategic-level issues and the domain's unique attributes.

## Allocation of Decisions

Although broadly articulated in Air Force Doctrine Document (AFDD) 3-12, *Cyberspace Operations*, C2 models for Air Force cyber forces require further refinement. AFDD 3-12 paints a highly centralized portrait of C2 of cyber forces, with an emphasis on global cyberspace operations. It notes that at the theater level "the boundaries within which cyberspace C2 is exercised and the priorities and restrictions on its use should be identified in coordination with the JFC, non-DOD governmental agencies, and national leadership. The potential for cyberspace effects to cause strategically important consequences may often necessitate coordination with the highest levels of US and partner nation governments."[3] This emphasis on boundaryless threats and effects as a reason for centralizing control is not conducive to a C2 model for agile and flexible DOD cyber operations that balance global and regional needs and responsibilities. Type and availability of forces/capabilities are the two factors that currently impact the JTF's decision on force assignment.[4]

Cyber attack is not a one-size-fits-all concept. There is a need to shape the command structure for cyber according to the mission at hand rather than create a one-size-fits-all structure around the technology.[5] Cyber operations do not fit into a single

rubric of "cyber attack." CNA, CND, and CNE have distinct characteristics with their own requirements and personnel issues that will be discussed in the subsequent sections.

## Offensive Cyber Operations

One issue with offensive computer operations is that there can be cascading effects and unintended consequences if the target is on an open network or closed critical infrastructure networks. Destigmatizing the use of cyberweapons is critical in being able to decentralize control of their use. Understanding network behavior requires examining relations among network events. Fixating on technology to the detriment of other characteristics that wholly compose the cyber environment creates the impression that cyber is not that connected to the real world. Refining the conceptualization of cyberspace allows for its demystification and closer alignment within the physical world.[6] Achieving this goal requires looking at cyberspace as a complex ecosystem composed of human operators ranging from the casual Internet user to the information warrior; the actual information that is stored, transmitted, and transformed; the computer code and protocols; and the physical elements on which the logical elements reside.[7] Taking this point into account helps eliminate the stigma of using offensive cyber capabilities without centralized control due to perceived fears of unpredictable second- and third-order effects.

According to researcher Neil Rowe, having a framework for designing cyberweapons that prevents unintended cascading effects is one area that could help decentralize control over their use. An ethical cyberweapon could

(1) encrypt vital information and software so that victims are unable to decrypt it;

(2) obfuscate systems via complex data machinations using reversible algorithms;

(3) deny victims access to critical information; and

(4) deceive victims to cause them to believe their systems are nonfunctioning.

Rowe further explains that "in the first two cases, reversal can be achieved by software operations by the attacker; in the third case, the attacker can restore missing data; and in the fourth case, the attacker can reveal the deception."[8] The USAF could begin by adopting some of these measures if it chooses to conduct an offensive computer network operation.

Stuxnet is a proof-of-concept attack against critical infrastructure. Rumors aside, it is unclear who launched Stuxnet—the malicious software that caused Iranian nuclear centrifuges to spin out of control.[9] However, while a well-designed cyberweapon that spread globally, it did not cause universal effects. Indeed, if Iranian claims are to be believed, its effects were reversed, and its nuclear program is back on track.[10] Thus, ethical design in cyberweapons could mitigate concern for global cascading effects, thus allowing for their decentralized control.

With this said, centralization of specific attacks against certain targets might be necessary in these sorts of missions. However, even if prescripted concepts of operations are authorized for use, the dynamic environment of cyberspace and current C2 structures do not allow for flexible responses to changing network topologies. For example, a cyber operator carrying out a USCYBERCOM-authorized mission set might have to stop the attack without completing the objective because the adversary has updated his computer system with the latest vulnerability patch. Another attack option might be available but would require circumventing the preapproved attack route. Having to go back up the chain of command to receive authorization to continue with a new attack vector could have negative effects on kinetic missions that rely on the exploitation of the adversary's information system. Allowing cyber operators to exercise flexible response would help them actively engage with changing network topologies and achieve the desired effect without losing operational advantage.

Such flexible responses, however, rely on having the right mix of operators on the offensive cyber operations team. Instead of offering "pilots," the cyber operators need to offer "strike packages." This would include not only the computer defense/offense operators but also the engineers and intelligence officers working on the same team for the same objective. Such packages

would allow decision authority for operations in the dynamic cyber environment at a lower level on the chain of command.

As current C2 models are being developed, a one-size-fits-all model for decision allocation is emerging, partially as a result of perceptions that cyberspace is a ubiquitous global domain. This flawed conception of cyberspace does not take into account that there are many cyberspaces. One must therefore consider the network topology when deciding on a C2 model. There are two types of networks topologies: (1) fixed function and closed and (2) multiple function and open. Examples of the first are industrial/critical infrastructure control networks, air traffic control, and air defense or banking networks. The second category is best characterized by the Internet at large. Operations against either kind of network must consider the political risk involved with taking the network out. Three illustrative cases of this were attacks against the Iraqi government's financial system in 2003 in the buildup to Operation Iraqi Freedom, which was called off due to fears that the effects would not be confined to Iraq.[11] During Operation Odyssey Dawn it was reported that the White House debated, and then balked at, the idea of using cyberweapons to disrupt Libyan air defenses.[12] The reluctance to mount cyber attacks against battle systems that are not connected to the Internet was attributed to US fears of setting a cyber warfare precedent that potential adversaries might follow. However, a more likely argument could be made that the political risk was less of mounting a cyber attack against a closed network, but rather that revealing the highly classified cyber warfare tools and tactics to NATO partners could put future use of these weapons at risk.

Operations on open and closed networks thus must be differentiated. The Internet is the only truly global element of cyberspace. Given its commercial and military application, its role in critical infrastructure control, and the trend of developing societies relying on it for interpersonal communications, operations within the domain need to be carefully planned and coordinated so as to avoid unintended cascading effects. For example, while the Stuxnet virus appears to have been targeting closed industrial control systems and supervisory control and data acquisition (SCADA) computer networks within the Iranian nuclear program, its effects were not isolated to Iran and quickly spread to

computer networks worldwide because of the close connectivity between SCADA networks and Internet-connected systems. Similarly, during the conflict in Kosovo, there was much discussion about targeting the bank accounts of Slobodan Milosevic's inner circle. However, the decision was made not to attack the accounts through the logical layer of cyberspace due to fears of the impact that such an attack would have on the financial markets.[13]

Operations against closed networks, such as military air defense systems during surprise air strikes or combat SAR missions, would be better suited for a more decentralized level where the prioritization of fires would be better understood, rather than being centralized at the USCYBERCOM level.

## Defensive Cyber Operations

Air Force guidance memorandum 13-2 "establishes the authority of the 24th Air Force Commander (24 AF/CC) to issue orders as needed for the operation, defense, maintenance, and control of the AF-GIG [Air Force Global Information Grid]."[14] Further, "the 24 AF/CC is the single commander responsible for the overall operation, defense, maintenance and control of the AF-GIG.)."[15] This centralized command is one area that has been identified as a prime area for decentralization. It has been noted that this construct (in the context of Air Force network operations, which above memo replaced) "is the epitome of centralized execution, with attendant operational weaknesses such as unresponsiveness to local commanders, delays in approving and implementing changes, and difficulty adapting standardized equipment and practices to unique locations. Worse, it leaves base networks paralyzed if they become isolated from higher-tier units (or, specifically, higher-level administrator accounts)."[16] In the face of a large-scale cyber attack, it is inevitable that bases would be targeted and isolated for weeks. Thus, allocation of decisions needs to be brought back down to the local base level while retaining the operating concept of generally centralizing network security.

## Innovative Strategic Uses of Cyber Power

One area that requires further refinement is the command and control of effects that are not traditionally thought of as cyber operations in the computer attack/defense paradigm. Some examples are (1) cyber-enabled unified action to integrate activities across the diplomatic, information, military, and economic instruments of power to protect the nation and promote its global interests, (2) emerging and future net-enabled operational concepts, including use of air capabilities to enable indigenous and coalition military forces as well as to promote more effective use of nonmilitary instruments of power, (3) resiliency and mission assurance needs and opportunities for military operations in contested spectrum and information (cyber) environments, (4) use of cyber-enabled global social networking to influence perceptions of international actors for purposes of assurance, counterproliferation, crisis escalation control, global stability, and regional stability, and (5) innovative uses of cyberspace and other forms of communication to enable interactions without physical presence with populations suffering from insurgencies as a means to reduce irregular warfare casualties and other adverse effects.[17] Evidence exists that the USAF is actively soliciting proposals for developing such strategic uses of cyber power. These proposals must include C2 options that permit the planning and execution at the lowest appropriate organizational level to create agility and speed of action in delivering the desired effect. The C2 design will likely require centrally planned missions that are decentralized in their execution.[18]

## Patterns of Interaction

### Unity of Effort in Response to Cyber Incidents of National Significance

Responding to an attack on critical infrastructure located within the United States would require close interagency cooperation and coordination. As of this writing, the National Cybersecurity Incident Response Plan is still being discussed; within the *Cyber Incident Annex of the National Response Framework*, the Department of Homeland Security (DHS) and DOD are both

coordinating agencies. Indeed, the cooperation between the two departments is so essential that DOD and DHS signed a memorandum of understanding to formalize and streamline levels of cooperation between the two organizations. Such cooperation was hampered in the past due to the strict control of information flows from the National Security Agency (NSA) within DOD to DHS on cyber issues. With DHS, DOD must cooperate with other federal entities when appropriate to "provide attack sensing and warning capabilities, gather and analyze information to characterize the attack and to gain attribution of the cyber threat, participate in information-sharing, offer mitigation techniques, perform network intrusion diagnosis and provide technical expertise."[19] The United States Computer Emergency Readiness Team (US-CERT) and the DOD's CERT Coordination Center serve as the primary communication channels between the two departments. Within the DOD, the overall responsibility for cybersecurity rests with USCYBERCOM.[20] Levon Anderson in *Countering State-Sponsored Cyber Attacks: Who Should Lead?* questions the current strategy of having both the DHS and DOD playing key roles in cybersecurity.[21] While the DHS does have an important role in coordinating the national defense and response to attacks on US cyberspace, Anderson identifies overlapping capabilities with DHS and DOD, such as their cyber-incident response systems. Comparing DHS and DOD, he argues that overall, DOD is better suited as the focal point for responding to organized or state-sponsored cyber attacks.[22]

The DHS's cybersecurity response system is important in coordinating the interagency planning to respond to cyber attack, since "total commitment by all responsible agencies is needed and expected to win the cyber war." However, Anderson recommends that "designating the DoD as the overall lead element during an actual attack will better facilitate overall command and control and unity of effort."[23] Therefore, the "DoD seems to be the logical choice to lead the effort against an attack," since it still has the resources to be the lead agency responsible for military responses to events threatening US cybersecurity.[24] However, the DOD's operational ability within the United States is limited to national emergencies under the Posse Comitatus Act (PCA).[25] DOD Directive (DODD) 3025.12, *Military Assis-*

*tance for Civil Disturbances* (4 Feb 1994), and DODD 5525.5, *DoD Cooperation with Civilian Law Enforcement Officials* (15 Jan 1986), also regulate law enforcement/military cooperation, largely constraining them to times of civil disturbances. Experts have suggested that the PCA is misunderstood by Soldiers and scholars since many regard it as the codification of the Founding Fathers' fear of a standing army, rather than as congressional limits on military use in domestic law enforcement.[26] Further, it is noted that DODD 5525.5 requires updating since threats to national security have changed since the directive was issued.[27] Even so, the limitation to non–law enforcement activities makes the DOD of little use as the lead actor responsible for cybersecurity in cases that do not pose a national emergency. DOD and civilian law-enforcement agencies operate under different rules of engagement. Other legal experts have noted that "before decision-makers bring our military forces to bear, the situation must be so potentially harmful (seized nuclear weapon, biological or chemical weapon of mass destruction) that the United States must react to it as if it is an act of war—not just a crime."[28] This observation is also relevant in cyberspace, thus DHS may still be the appropriate lead prior to such an emergency.

DHS has performed moderately well in its role as a main coordinator for the federal response to a major cybersecurity incident, but DOD is better suited to lead US national cybersecurity efforts in cases of national emergency. The preference for DOD to lead in any cyber attack response is largely due to prognostications about the level of damage to the United States that such an attack could inflict and the extent of resources that would be needed to respond. Thus, while at peace, DHS works well, but war will require a different lead.

### Why Decentralized Execution Is Failing: Need for Personnel

A recognized need for decentralization of the C2 of cyberspace exists. However, in the short term, decentralization of cyber forces is hampered by the lack of trained personnel. This is in part due to the problem of not having enough personnel trained in cyber operations. One solution at this early stage

has been to repatch communications officers as cyber operators. This approach has not created true cyber operators prepared for the complexities of cyber operations, as cyber operators require different skill sets from communications officers. While a communications officer may be able to set up a network and maintain it, he or she will not have the dynamic mind-set required for CNA and active defense. Thus far, it seems that while repatching has increased the quantitative numbers of cyber warriors, the quality is not sufficient for the cyber fight. Thus, there continues to be a strain on resources available for pushing cyber operations down the chain of command to the COCOM level, especially in the area of CNA.

One solution to the problem is to take a nontraditional approach to finding qualified personnel and training them. Thus far, the emphasis has been on hiring computer scientists and engineers in the dark arts of cyber or recruiting the best and the brightest minds in academia to work for the Air Force. The competition for these minds is tough, with corporations and contractors offering better salaries and other benefits than what the US government can offer.[29] Furthermore, targeting traditional computer science and engineering majors from AFIT and ACE, along with the top US universities, does not mean we would get a cyber operator who understands the principles of warfare. Thus, given the competitive environment and the unique characteristics of cyber warfare, a nontraditional approach is needed to both identify and attract skilled cyber warriors.

However, defense is a skill set that many repatched communications officers already have. Also, defense is not as exciting as attack, and sponsoring cyber attack–focused competitions may draw out some of the hackers as well as get kids in the right mind-set to deliver effects on the battlefield.

## Why Decentralized Execution Is Failing Distribution of Information

Due to the technological complexity of cyberspace, the military relies on the private sector for the hardware and software on which the domain rests. The private sector does not always understand federal security postures, and the competing pri-

orities and limited resources within government make it difficult to implement decentralized control. Further, the private sector and intelligence community's unwillingness to share information with nonmembers of their respective organizations contributes to the weakness of shared situational awareness of vulnerabilities and threats. This, combined with similar secrecy concerns within DOD, obstructs cybersecurity information sharing. Overlapping responsibilities with various DHS units, limited available resources to deal with the multitude of competing priorities, redundant capabilities in various government departments and agencies, and the lack of an integrated mechanism for coordinating response are additional variables contributing to the weaknesses in cyber C2. One solution may be to place the NSA under the command of USCYBERCOM. Information assurance and cryptography are the NSA's two main functions. Both are components of cyber operations. Reshaping the organizational culture and structure of a signals intelligence and information assurance organization—giving it a role in the fight for cyberspace—will allow the interagency to function with greater efficiency and effectiveness. While the current structure allows the federal government to respond in a somewhat decentralized manner to network threats, the above-mentioned flaws and the strength of hierarchical command structures hinder efforts to deconflict the cyber battle space and assure a whole-of-government unity of effort.

As the debates continue on what the structure of cyber command and control should like, the strategic-level issues mentioned herein should be taken into account. Especially important in this regard is deconflicting roles and responsibilities across the whole of society and destigmatizing the use of cyber capabilities. The Air Force mission is to provide global stability through the integration of air, space, and cyber. The Air Force is the only service that can not only operate tactically, locally, and globally but also use cyber as a maneuver space to improve air and space operations (tactical integrated air defense system). Airpower is also used to achieve strategic effect. Thus, the USAF is the one service that should bring its expertise to ensure the DOD gets the model for cyber C2 right based on experience—not opinion. In this way, we will be able to fly, fight, and win through the twenty-first century and beyond.

## Notes

1. Indeed, within the joint community the finalization of C2 models for cyber is in the late phases of discussion and testing.

2. Maj Gen Suzanne Vautrinot, commander, Twenty-Fourth Air Force and Air Force Network Operations (briefing, Air Force cyber, Air War College, Maxwell AFB, AL, 21 February 2012).

3. AFDD 3-12, *Cyberspace Operations*, 15 July 2010, 26.

4. Ibid., 25–26.

5. Martin Van Creveld, *On Future War* (London: Brassey's, 1991) 192.

6. David Clark, "Characterizing Cyberspace: Past, Present and Future," paper funded by the Office of Naval Research, Version 1.2, 12 March 2010, http://web.mit.edu/ecir/pdf/clark-cyberspace.pdf.

7. Ibid., 1. Note: The definition of *cyberspace* that the JCS provides in the *National Military Strategy for Cyberspace Operations* (Washington, DC: DOD, 2006) is parsimonious with Clark's character- versus purpose-driven definition. The USAF should consider embedding the JCS definition within its doctrine.

8. Neil C. Rowe et al., "Steps towards Monitoring Cyberarms Compliance," in *Proceedings of the 10th European Conference on Information Warfare and Security*, Institute of Cybernetics, Tallinn University of Technology, Tallinn, Estonia, 7–8 July 2011 (Reading, UK: Academic Publishing Limited, 2011), http://academic-conferences.org/pdfs/eciw11-cd.pdf. See also Neil C. Rowe et al., "Challenges in Monitoring Cyberarms Compliance," *International Journal of Cyber Warfare and Terrorism* 1, no. 2 (April–June 2011): 35–18.

9. For an example of a counteranalysis to the typical accusations of Israeli or US involvement, see Panayotis A. Yannakogeorgos, "Was Russia Behind Stuxnet?," *The Diplomat*, 10 December 2011, http://the-diplomat.com/2011/12/10/was-russia-behind-stuxnet.

10. Associated Press, "Iranian Leader Orders Creation of Internet Oversight Agency in Bid to Control Web," *Washington Post*, 7 March 2012.

11. John Markoff and Thom Shanker, "Halted '03 Iraq Plan Illustrates U.S. Fear of Cyberwar Risk," *New York Times*, 1 August 2009, http://www.nytimes.com/2009/08/02/us/politics/02cyber.html.

12. Eric Schmitt and Tom Shanker, "U.S. Debated Cyberwarfare in Attack Plan on Libya," *New York Times*, 17 October 2011, http://www.nytimes.com/2011/10/18/world/africa/cyber-warfare-against-libya-was-debated-by-us.html?_r=2&hp.

13. In an unclassified personal communications with the authors, a DOD official noted that the Joint Warfare Analysis Center was tasked with this mission. Although attacking the logical layer was deemed too risky, the bridges containing the fiber-optic cables that connected the Serbian senior leaders to their Swiss bank accounts were targeted for destruction to catalyze the effect of leadership decohesion by barring access to their funds.

14. Department of the Air Force, to major commands, field operating agencies, and direct reporting units, memorandum, subject: Air Force Guidance Memorandum on Command and Control of the AF-GIG, 22 February 2012.

15. Ibid.

16. 1st Lt John Cobb, "Centralized Execution, Decentralized Chaos: How the Air Force Is Poised to Lose a Cyber War," *Air and Space Power Journal* 26, no. 2 (Summer 2011): 82.

17. Personal communications with a retired Airman. (unattributed interview)

18. More information on the USAF interest in social networks can be found in Department of the Air Force, "Persona Management Software," Grant Solicitation Number RTB220610, 22 June 2010.

19. DHS, *National Response Plan: Cyber Incident Annex* (Washington, DC: DHS, December 2004), 6.

20. Stood up fully in October 2010, USCC evolved from preexisting organizations, notably JFCC–Network Warfare (NW) and JFCC–Space and Global Strike. Defending against cyber attacks was until that time the responsibility of JTF–Global Network Operations (GNO) and the Joint Information Operations Warfare Center. In June 2009, Secretary of Defense Robert Gates disestablished the JTF-GNO and JFCC-NW, headed by the NSA director and subordinate to USSTRATCOM. The operations of USCC are restricted to military cyberspace.

21. Levon Anderson, "Countering State-Sponsored Cyber Attacks: Who Should Lead?," in *Information as Power: An Anthology of Selected United States Army War College Student Papers*, vol. 2, eds. Jeffrey L. Groh, David J. Smith, Cynthia E. Ayers, and William O. Waddell (Carlisle Barracks, PA: US Army War College, 2008), 105–22, http://www.csl.army.mil/usacsl/Publications/infoaspowervol2/introandtoc.pdf.

22. Ibid., 110–14.

23. Ibid., 120.

24. Ibid., 119.

25. See 18 *USC* § 1385, "Use of Army and Air Force as posse comitatus," http://www.gpo.gov/fdsys/pkg/USCODE-2010-title18/pdf/USCODE-2010-title18-partI-chap67-sec1385.pdf.

26. Col Thomas D. Cook, *The Posse Comitatus Act: An Act in Need of a Regulatory Update*, Strategy Research Project report (Carlisle Barracks, PA: US Army War College, 2008), 13.

27. Ibid., 13.

28. Thomeas R. Lujan, "Legal Aspects of Domestic Employment of the Army," *Parameters* 27, no. 3 (Autumn 1997): 95.

29. Karen Evans and Franklin Reeder, *A Human Capital Crisis in Cybersecurity: Technical Proficiency Matters* (Washington, DC: Center for Strategic and International Studies, November 2010), 14.

Example 6

# Nuclear Command, Control, and Communications

While the nuclear arena is one of the seven selected C2 illustrations, we celebrate that there are no nuclear weapon employment operations for this study to examine. There are, however, 60-plus years of training experience to execute such a mission, which is the basis for developing and refining the nuclear command, control, and communications (NC3) systems. This system reflects the way USSTRATCOM organizes, commands, plans, controls, and executes its capabilities to achieve the president's objectives.

Communications are critical to all of this study's seven examples, but communications in a nuclear or cyber war environment face many additional challenges that are less of a problem in other settings. The requirement for robust and redundant systems to communicate reliably in an intense electromagnetic pulse (EMP) environment is critical to executing, controlling, and recalling (if necessary) nuclear forces.

## Allocation of Decisions

When compared to the other examples of this study, the nature of nuclear operations drives NC3 to fall near the centralized locus. Nuclear operations are technically complicated and have extremely high political risks with existential consequences. Initiating operations requires a decision by the president.[1] Planning for major nuclear operations is centralized to achieve the desired integrated effects, avoid known detonations, and decrease the probability of fratricide. Due to the great political risks and consequences of nuclear operations, communication with nuclear forces throughout the execution phase—particularly up to the weapons launch or weapons release point—is critical to retaining control and the ability to exercise presidential options. Many tactical decisions (such as taking off with a degraded system, making go/no-go decisions that result from a mechanical problem, or operating with fuel

limitations) that may confront executing commanders, their staffs, aircrews, missileers, and submariners can be anticipated, planned, and scripted, and appropriate authorities and responsibilities can be delegated. Real-time execution does not depend on the distribution of much new information or the allocation of additional decision authority.

## Patterns of Interaction

Effective vertical and horizontal integration are critical to the successful patterns of interaction between partners, particularly in nuclear operations. The first of the two aspects of nuclear C2 is the president perceiving a need and deciding to execute an appropriate nuclear option. That becomes the commander's intent. Control, the second aspect of C2, is facilitated by the transmission of the president's decision to implement a selected option to the nuclear forces. The options are scripted, practiced, well rehearsed, and well understood by all participants to the degree of detail required for successful execution. Participants are tested and certified on their understanding of their equipment, the plan, and their role in its execution. While the primary objective of the exercising of the various plans and options is to ensure an accurate and timely response to a command decision, those activities also build trust, confidence, and positive relationships between senior commanders and ensure effective vertical and horizontal integration.

## Distribution of Information

As mentioned before, in a nuclear environment the challenges to communication are much greater than in the other operations / mission sets:

> The nuclear environment can seriously degrade the ability of the civilian leadership to communicate with forces in the field. If nuclear weapons have already been employed by the US or an adversary, an EMP may have damaged communication systems, command centers may have been destroyed, and essential links may no longer be effective. The means must exist to exercise positive control over nuclear forces. Therefore, C2 systems supporting nuclear operations should be survivable, redundant, secure, and interoperable.[2]

During the Cold War, appropriate systems were fielded that met those standards to accomplish this task. Many of those systems have reached or exceeded end of life and need replacement. Many others will face parts obsolescence in the next decade and also require replacement. USSTRATCOM has tasked Air Force Global Strike Command (AFGSC) to lead the sustainment and modernization of its 14 NC3 systems. Unfortunately, those NC3 legacy systems are expensive to maintain, and replacement systems must compete with other Air Force and DOD priorities. Some of those programs are further delayed because of technical issues. The scope of this study does not include detailing all the programs AFGSC is working to ensure a robust and enduring NC3 capability. However, in the current and future fiscal environment, the services must work together to assess the core nuclear communications requirements; consider legacy and replacement system capabilities; sort out all NC3 capabilities, redundancies, and shortfalls; and then chart the most affordable way forward that will satisfy the demanding NC3 requirements. That path forward might include using cost-effective legacy systems, systems that the Air Force and other services currently use in nuclear and nonnuclear C2 missions, and replacement systems to fill the shortfall left by the first two categories. AFGSC and the Air Staff Strategic Deterrence and Nuclear Integration Office (AF/A10) are working these issues.

## Summary

NC3 challenges are different from most of the other mission areas of this study. There is clarity in command relationships. Nuclear operations are centrally planned. Special personnel programs continually screen nuclear enterprise personnel to ensure a high confidence in the reliability of all those involved in nuclear operations. There is effective vertical and horizontal integration of planning and execution at all echelons. The plans are exercised by all appropriate command levels to ensure the effective execution and integration of tasked forces. Relationships are built and tested, corrections are made, and trust is developed during exercises. However, one problem NC3 does often have in common with the other C2 scenarios is proper and standardized communication equipment that satisfies mission

needs. Additionally, that shortfall in NC3 communication systems is amplified by the environment that it must operate in and the requirement for an uninterrupted capability. The capability to control nuclear forces during all three phases of nuclear operations—those times before, during, and following nuclear detonations—demands an affordable but reliable solution.

**Notes**

1. "In the US, the President retains sole authority for the execution and termination of nuclear operations." AFDD 2-12, *Nuclear Operations*, 7 May 2009, 4.
2. Ibid., 13.

Example 7

# Command and Control of Space Assets

The unique characteristics of systems operating in the ultimate high ground present special considerations for the C2 of space assets. In its introduction, AFDD 3-14, *Space Operations*, acknowledges that "space power arms Airmen with permanently 'forward-deployed' satellites and adds another dimension to the joint force's ability to posture quickly and achieve battlespace superiority."[1] This "forward-deployed" concept for space forces is significant. With a few notable exceptions, the majority of space systems provide around-the-clock effects for all geographic and functional COCOMs while being controlled from ground stations in CONUS. Furthermore, those few systems that must be deployed may not necessarily be placed in the same theater as the JFCC who is requesting the effects. For example, a unit may need to deploy to Europe to achieve effects in space for a JTF in CENTCOM. In short, C2 of space forces must account for systems operating back home or even in another theater. Thus, the permanent presence of space systems in a deployed status requires formal C2 arrangements that permit the full range of services to functional and geographic COCOMs, while simultaneously providing an effective means for accomplishing the day-to-day training and equipping of space units.

## Allocation of Decisions

While ongoing space operations have been highly effective in Afghanistan, Iraq, and Libya, the current C2 framework for USAF space forces creates friction for space wings with units that are deployed in place. Administrative control (ADCON) of space forces flows from Air Force Space Command, through Fourteenth Air Force, down to the space wings and groups, and on to the operational squadrons and units. OPCON of these same units begins with the functional combatant command, STRATCOM. The Fourteenth Air Force commander is dual-hatted as the joint functional component commander for space.

The JFCC Space directly tasks operational units through the space tasking order produced by the JSPOC at Vandenberg AFB, California. Thus, TACON of space assets deployed in place skips over any command at the wing or group level.

To skip the wing and group for TACON authority with space forces overlooks Air Force doctrine: "Within the AETF, units form up as expeditionary air forces, wings, groups, squadrons, flights, detachments, or elements, as necessary to provide reasonable spans of internal control and maintain unit cohesion."[2] Thus, bombers deployed from ACC or AFGSC are assigned to expeditionary wings and groups. Tankers and transport assets from AMC that support the US Transportation Command remain under the TACON authority of home station wing, group, and squadron commanders. In contrast, space units that "deploy in place" remain under the control of home-station wings and groups that are not dual-hatted as expeditionary units and may not even have access to the space tasking order.

In light of the analytical model used for this C2 study, the space unit's TACON arrangement can be problematic in terms of allocation of decisions. For example, the 2nd Space Warning Squadron (2SWS) at Buckley AFB, Colorado, is administratively owned by the 460th Operations Group and the 460th Space Wing, assigned to Fourteenth Air Force. Yet the JFCC Space directs the 2SWS to perform missions for geographic COCOMs and JTFs via the JSPOC's space tasking order. Many of these taskings are classified and restricted from the view of the 460th wing and operations group commanders, who have ADCON of their squadrons but no operational or tactical authority.[3]

This fractured arrangement complicates space operations for several reasons. First, administrative orders given through the Space Wing from Fourteenth Air Force that support the training and equipping of space forces may conflict with operational orders given to support JTFs overseas. On one occasion, one squadron assigned to the 460th Space Wing was tasked for an operational mission during a period in which the unit had long been scheduled to stand down operations to receive equipment upgrades. Not only did these orders contradict each other, but the operations group and wing commander had no awareness of the operational orders, since they weren't part of the OPCON/TACON chain of command and, therefore, had no

need to know. Thus, the squadron commander was forced to determine which orders to follow without being able to consult the operations group or wing commander. An ideal OPCON/TACON arrangement would allow wing and group commanders to share in the decision-making process that, in this instance, the squadron commander was forced to execute alone.

Secondly, the space wing may need to provide support for its squadrons' operational taskings from other units on base. For example, if a heightened terrorist threat from Homeland Security prompted USSTRATCOM to order the 2nd Space Control Squadron to deploy to its alternate CONUS location, it could not do so without support from 460th Security Forces stationed at Buckley AFB. Yet the 460th Wing commander cannot task the 460th Mission Support Group commander to provide the security force personnel in this instance, since the wing commander is authorized to act only via the ADCON chain through Fourteenth Air Force and has no official relationship with STRATCOM. Here again, the space mission would be enhanced if wing and group commanders were given information concerning their units deployed in place and authorized to make decisions to expedite mission success.

A similarly fractured command relationship existed with the remotely piloted vehicles at Creech AFB, Nevada, until the Air Force designated the 432nd Wing dual-hatted as the 432nd Air Expeditionary Wing in 2008. Clearly, this construct, which meets the needs of the MQ-1 and MQ-9 community, would also serve space units that are deployed in place. By designating space wing and operations group commanders as expeditionary commanders, space squadrons would instantly gain commanders at the group and wing level for C2 issues related to their support of ongoing operations worldwide.

## Patterns of Interaction

Most recently, Operation Odyssey Dawn in Libya has demonstrated how effectively space assets are integrated into theater efforts. For example, from its home in Colorado, the 2SWS monitored coalition Tomahawk land-attack missile strikes against Libya to help the JTF sequence attacks in the early hours of operations. This close coordination of space assets

from afar typifies how the command and control of space will continue to support forward-deployed forces.

## Distribution of Information

During Operation Odyssey Dawn, the 2SWS worked closely with the director of space forces in-theater. Information was shared to ensure that the JTF received not only the correct type of information requested in-theater but also that such information was communicated over systems in a format appropriate for those requesting the data.

## Summary

In short, the predominance of space systems provides key effects from the home station for functional and geographic CCDRs worldwide. For successful C2 of space assets in the future, the apparatus must continue to allow space units to collaborate with deployed forces in the planning and execution phases of operations. Further, space wings should be dual-hatted as expeditionary wings to provide wing- and group-level command for OPCON and TACON of space units.

### Notes

1. AFDD 3-14, *Space Operations*, 27 November 2006, Incorporating change 1, 28 July 2011, 1.

2. AFDD 1, *Air Force Basic Doctrine, Organization, and Command*, 14 October 2011, 60.

3. Col B. Chance Saltzman (commander, 460th Operations Group) and Col Christopher J. Moss (director, Joint Space Operations Center), telephone interviews by Col Edwin Redman, USAF, 13 May 2011.

# Abbreviations

| | |
|---|---|
| 2SWS | 2nd Space Warning Squadron |
| ACC | Air Combat Command |
| ACCE | air component coordination element |
| ADCON | administrative control |
| AETF | air and space expeditionary task force |
| AFDD | Air Force doctrine document |
| AFGSC | Air Force Global Strike Command |
| AFNSEP | Air Force National Security and Emergency Preparedness Agency |
| AFRI | Air Force Research Institute |
| ALO | air liaison officer |
| AMC | Air Mobility Command |
| ANG | Air National Guard |
| AOC | air and space operations center |
| AOR | area of responsibility |
| ARC | air reserve component |
| ARCENT | Army Forces Central Command |
| ATO | air tasking order |
| AUAB | Al Udeid Air Base |
| AWACS | Airborne Warning and Control System |
| C2 | command and control |
| C2WAC | Command and Control Warrior Advanced Course |
| CAOC | combined air operations center |
| CAT | crisis action team |
| CC | commander |
| CCDR | combatant commander |
| CENTAF | Central Command Air Forces |
| CENTRIXS | Combined Enterprise Regional Information Exchange System |
| CFACC | combined force air component commander |
| CFLCC | coalition forces land component commander |
| CFMCC | Combined Force Maritime Component Command |
| CFSOC | Combined Force Special Operations Command |

| | |
|---|---|
| CJTF | combined joint task force |
| CNA | computer network attack |
| C-NAF | component numbered air force |
| CND | computer network defense |
| CNE | computer network exploitation |
| COCOM | combatant command |
| COIN | counterinsurgency |
| COMAFFOR | commander, Air Force forces |
| CONOPS | concept of operations |
| CONPLAN | concept plan |
| COP | common operating picture |
| CRC | control and reporting center |
| CSAF | chief of staff of the Air Force |
| DHS | Department of Homeland Security |
| DIRLAUTH | proper direct liaison authorized |
| DOD | Department of Defense |
| DODD | DOD directive |
| EMP | electromagnetic pulse |
| EPLO | emergency preparedness liaison officer |
| FEMA | Federal Emergency Management Agency |
| GBS | Global Broadcast Service |
| GDSS | global decision support system |
| GIG | Global Information Grid |
| GNO | global network operations |
| HOA | Horn of Africa |
| HQ | headquarters |
| ISAF | International Security Assistance Force |
| ISR | intelligence, surveillance, and reconnaissance |
| JACCE | joint air component coordination element |
| JFACC | joint force air component commander |
| JFC | joint force commander |
| JFCC | joint functional component commander |
| JOA | joint operations area |
| JP | joint publication |
| JSPOC | Joint Space Operations Center |

| | |
|---|---|
| JSTARS | Joint Surveillance Target Attack Radar System |
| JTF | joint task force |
| LD/HD | low density/high demand |
| LNO | liaison officer |
| MARCENT | Marine Forces Central Command |
| NAF | numbered air force |
| NATO | North Atlantic Treaty Organization |
| NAVCENT | Navy Forces Central Command |
| NC3 | nuclear command, control, and communications |
| NRP | National Response Plan |
| NSA | National Security Agency |
| NW | network warfare |
| OAF | Operation Allied Force |
| OEF | Operation Enduring Freedom |
| OIF | Operation Iraqi Freedom |
| OPCON | operational control |
| OPLAN | operation plan |
| PCA | Posse Comitatus Act |
| POM | program objective memorandum |
| PSAB | Prince Sultan Air Base |
| QRP | quick reaction package |
| RAP | recognized air picture |
| RAT | rapid augmentation team |
| RFF | request for forces |
| RPA | remotely piloted aircraft |
| SAR | search and rescue |
| SCADA | supervisory control and data acquisition |
| SIPRNET | Secret Internet Protocol Router Network |
| SOCCENT | Special Operations Forces Central Command |
| TACON | tactical control |
| TACS | theater air control system |
| TBMCS | theater battle management core system |
| TF | task force |

| | |
|---|---|
| USAFE | United States Air Forces in Europe |
| *USC* | *United States Code* |
| USCENTCOM | US Central Command |
| US-CERT | US Computer Emergency Readiness Team |
| USCYBERCOM | United States Cyber Command |
| USNORTHCOM | US Northern Command |
| USSTRATCOM | United States Strategic Command |
| UTC | unit type code |
| WFHQ | warfighting headquarters |

# Air Force Command and Control

## The Need for Increased Adaptability

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