

The Army's Role in Airspace Command and Control of the Warfighter's Airspace

**A Monograph
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Abstract

THE ARMY'S ROLE IN AIRSPACE COMMAND AND CONTROL OF THE
WARFIGHTER'S AIRSPACE by MAJ Randy P. James, Jr., United States Army, 48 pages.

The Army's role in the Joint Airspace Command and Control system is not adequate to support combat operations effectively on the current and future battlefields of the United States Joint Force. The current and future battlefields of the United States military require an airspace structure capable of integrating airspace among users dynamically in near real-time while operating semi-autonomously. Current joint and service specific doctrine fails to delineate who actually controls increasingly complex combat airspace and fails to establish systems for synergistic operations across the services. Because doctrine fails to establish the proper systems, current airspace command and control (AC2) systems do not possess a common air picture for near real time synchronization and deconfliction of airspace users at all echelons. Finally, the Army does not train AC2 based on the belief that this problem belongs to aviators for deconfliction as opposed to commanders for integration. By addressing these three shortcomings, the United States Army can solidify its role in the Airspace Command and Control structure of the joint force. Airspace command and control is inherently joint and must focus on integration instead of deconfliction to support the warfighter on the noncontiguous, complex battlefields of the future.

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Introduction

Over the period from September 2001 to present, combat operations and the role of Army aviation changed as the military mission shifted from major combat operations to counterinsurgency operations in support of Operation Enduring Freedom and Operation Iraqi Freedom. During this time, airspace command and control requirements increased and evolved as more systems used airspace in new ways that the established airspace command and control doctrine and structure did not anticipate. These changes included multiple supported commanders in the same Area of Operations, increased use of unmanned aerial vehicles (UAV), and amplified speed and range requirements during execution of operations. Technological advancements such as unmanned aerial vehicles and non-line of sight artillery systems as well as a shift to a noncontiguous battlefield amplified the necessity for increased command and control of potential airspace users in order to reduce fratricide events and increase the flexibility necessary on the continuously evolving battlefield. Because of the changes in the current operating environment and the advancements in technology, the density and diversity of airspace users in a given area is on the rise and increases the overall risk to airspace users. In order to cope with this situation, most units operating in the combat environment resort to the creation of ad hoc methods of airspace command and control useful only on particular portions of the battlefield.¹ Given these factors, is the Army's role in the Joint Airspace Command and Control system adequate to support combat operations effectively on the battlefields of the United States military?

This study postulates that the Army's role in the Joint Airspace Command and Control System is not adequate to support combat operations on the battlefields presented by Operation Iraqi Freedom, Operation Enduring Freedom, and anticipated in the future. The Army's role

¹ Matthew Neuenswander, "Joint Airspace Control Issues," CR Production Group, <http://www.crprogroup.com/eventnotebook/Fires%2009%20PPt/Wed/Airspace%20Management%201330/Matt%20Neuenswander.pdf> , Briefing Slides, (accessed February 13, 2010) Slide 11.

requires modification to meet the future expectations of the United States Army as well as the joint force. The current Army Airspace Command and Control systems are not adequate on the current and future battlefields for the following reasons:

1. United States joint doctrine does not effectively delineate who controls the increasingly complex airspace when services are consistently operating in airspace controlled by other services.
2. Due to a lack of integrated command and control systems, the joint force does not possess a joint common air picture that enables near real-time synchronization and deconfliction at all echelons on the battlefield.
3. Regardless of doctrine and a common air picture, the United States Army does not train airspace command and control due to the assumption that this problem belongs to aviators for deconfliction as opposed to commanders for integration.

Through a combination of these shortcomings, Army Airspace Command and Control conducted in the combat zone cannot produce a warfighter's airspace built upon synergy and coordination capable of anticipating the future challenges of the joint air space.

Scope of this Monograph

For the purposes of this monograph, the author will focus primarily on the tactical level of war as it relates to airspace command and control directly associated with the integration of Army forces into joint airspace command and control. Field Manual 1-02, *Operational Terms and Graphics*, defines the tactical level of war as, "the level of war at which battles and engagements are planned and executed to accomplish military objectives assigned to tactical units or task forces."² As a supporting effort to the accomplishment of the ground scheme of maneuver,

² U.S. Department of the Army, *Field Manual 1-02: Operational Terms and Graphics*, (Washington D.C.: U.S. Department of the Army, 2004), 1-182.

airspace command and control at the tactical level focuses on the successful integration of all assets to achieve synergy and win decisively. Additionally, because of the inherent joint aspect of airspace command and control, recommendations will focus on joint solutions for effects at the tactical level.

The Ambiguity of Joint Doctrine

Joint Publication 1-02 defines doctrine as “[f]undamental principles by which the military forces or elements thereof guide their actions in support of national objectives. It is authoritative but requires judgment in application.”³ The predicament that doctrine presents is its failure to identify the point at which prescription and judgment diverge. Additionally, doctrine requires review when the fundamental principles guiding military forces in their actions are significantly different or change to such an extent that judgment prevails over the authoritative nature of doctrine. The differences in doctrine among the varying services arise out of parochialism based upon the command and control of one’s own service. Furthermore, changes to the fundamental principles guiding services may result from changes in the operating environment, technology, or national objectives.

Doctrine: Who has control of what airspace?

Some define doctrine as “...what we believe about the best way to conduct military affairs.”⁴ Given this definition of doctrine, it is understandable that doctrine exists at multiple levels in the conduct of military affairs. Joint Publication 1-02 defines joint doctrine as the “[f]undamental principles that guide the employment of US military forces in coordinated action

³ U.S. Joint Chiefs of Staff, *Joint Publication 1-02: Department of Defense Dictionary of Military and Associated Terms*, (Washington, D.C.: U.S. Joint Chiefs of Staff, 2001), 168-169.

⁴ Dennis Drew and Don Snow, “Military Doctrine,” Air University Website, <http://www.au.af.mil/au/awc/awcgate/readings/drew1.htm> (accessed January 28, 2010). This is an excerpt

toward a common objective.”⁵ Joint doctrine is the highest level of doctrine and contains the combined doctrine of all the services along with tactics, techniques and procedures. A subset of joint doctrine is multi-service doctrine, which incorporates the collaborative doctrine of two or more services but not all services. In addition to joint and multi-service doctrine, each service maintains its own, service specific doctrine adapted to the needs of the services’ individual mission. This creation of multiple levels of doctrine causes significant ambiguity, tension, and divergence from joint doctrine resulting in less compatibility amongst the services as each tries to “control” its own airspace.

The primary source for Airspace Command and Control in the combat zone is Joint Publication 3-52, *Joint Doctrine for Airspace Control in the Combat Zone*: “This publication outlines fundamental principles, relationships, and broad operational level guidance.”⁶ This broad operational guidance presents some key issues. The most important issue is its failure to prescribe procedures for the coordination among services and personnel in command and control of airspace. According to JP 3-52, the Joint Force Commander delegates responsibility to the Joint Force Air Component Commander(JFACC) who is responsible for planning, coordinating, and monitoring all joint air operations in the prescribed area and is often the Airspace Control Authority and Area Air Defense Coordinator as well.⁷ However, “[t]he [Airspace Control Authority] does not have the authority to approve, disapprove, or deny combat operation. That authority is only vested in operational commanders.”⁸ The primary role of the Joint Force Air

on doctrine Reprinted from *Making Strategy: An Introduction to National Security Processes and Problems*, Chapter 11, August 1988, pp. 163–174. Published 1988 by Air University Press.

⁵ U.S. Joint Chiefs of Staff, *Joint Publication 1-02*, 286.

⁶ U.S. Joint Chiefs of Staff, *Joint Publication 3-52: Joint Doctrine for Airspace Control in the Combat Zone*, (Washington, D.C.: U.S. Joint Chiefs of Staff, August 2004), I-1.

⁷ Ibid, II-1.

⁸ Ibid, vii.

Component Commander is the development and publication of the airspace control system as guidance for component commanders while the Joint Force Commander defines the relationship between the Joint Force Air Component Commander and the service component commanders. Each service component commander has the responsibility and authority to develop his/her own “...detailed airspace control instructions, plans, and procedures in accordance with the airspace control plan...” to support joint operations.⁹ This produces a discrepancy among the services by creating a separate command structure from the control structure when implementing Airspace Command and Control. Joint Publication 3-52 actually foments the implementation of service specific doctrine in a combat environment by placing a requirement for each service component commander to develop his own plan within the general guidance provided by the Airspace Control Authority.

In addition to Joint Publication 3-52, Joint Publication 3-30, *Command and Control of Joint Air Operations*, reiterates the command and control structure for air operations but with a plan-centric focus for the use of combat airspace. “Joint air operations are normally conducted using centralized control. Employment of joint air operations are conducted using decentralized execution to achieve effective span of control and foster initiative, responsiveness and flexibility.”¹⁰ Given that control remains centralized and execution decentralized, the exercise of command and control at the tactical level requires the implementation of further elements to deconflict and approve the use of airspace by the component and operational commanders in control of portions of the Area of Operations in accordance with the general guidance provided by the Airspace Control Authority. However, using centralized control, the Joint Force Commander remains responsible for integrating “...the actions of assigned, attached, and

⁹ Ibid, II-2

¹⁰ U.S. Joint Chiefs of Staff, *Joint Publication 3-30: Command and Control of Joint Air Operations*, (Washington, D.C.: U.S. Joint Chiefs of Staff, June 2003), I-3.

supporting forces within the operational area.”¹¹ Given the numerous supported commanders, this becomes problematic as the noncontiguous battlefield continues to change at a rapid pace that pre-planned airspace usage cannot accommodate and centralized control cannot manage. These problems create the additional requirement for each component commander to develop procedures for conducting command and control of his assigned portion of the operational area in accordance with his own requirement and service doctrine.

The primary United States Air Force manual for airspace command and control in the combat zone is Air Force Doctrine Document (AFDD) 2-1.7, *Airspace Control in the Combat Zone*, last update in May 2005. Air Force Doctrine Document 2-1.7 states, “Constraints on the airspace in the combat zone, special missions, or the sheer demand for airspace may result in overlapping areas of airspace control.”¹² Moreover, in the introduction, Air Force Doctrine Document 2-1.7 states that this doctrine is authoritative, but not directive in order to maintain flexibility.¹³ The primary focus of the Air Force’s doctrine is on the procedures for coordination of airspace not necessarily the command of airspace and air force elements at the tactical level considered by the United States Army. With this lack of a specific command structure and the potential for overlapping areas of control, the questions of “Who makes the command decision?” and “Who is in control of the airspace?” remain open with the exception of the direct centralized command of the Joint Forces Commander. This ambiguity creates friction between the ground component commanders and the air component commanders who may have overlapping control of airspace and need rapid response on the changing battlefield.

¹¹ Ibid.

¹² U.S. Department of the Air Force, *Air Force Doctrine Document 2-1.7: Airspace Control in the Combat Zone*, (Washington, D.C.: U.S. Department of the Air Force, July 2005), 3.

¹³ Ibid, v.

For the United States Army, the primary manual for Airspace Command and Control is Field Manual 3-52, *Army Airspace Command and Control in a Combat Zone*, last updated in August of 2002. This manual attempts to delineate the Army's role in joint airspace command and control by discussing the basics of joint doctrine and then further elaborating on the organizational structure of Army airspace command and control elements as well as Army specific control measures and considerations. The failure of the Army doctrine stems from its inability to address coordination and control among elements at the tactical level and relegating this information to supplemental doctrine, Field Manual 3-52.1, *Multi-service Tactics, Techniques, and Procedures for Airspace Control*, last updated in May 2009. Field Manual 3-52 states, "[the] elements dedicated to accomplish [Army Airspace Command and Control] A2C2 tasks are located at division level and above. A2C2 elements below division level are formed on an ad hoc basis and must determine how to meet the commander's A2C2 needs."¹⁴ However, Field Manual 3-52.1 contradicts these statements and specifically delineates command and control elements below the division level to the brigade level. On the noncontiguous battlefields presented by Operations Iraqi and Enduring Freedom, Army brigade combat teams often operate separately as stand-alone entities away from the division airspace command and control elements. This battlefield dynamic requires each brigade have the ability to command and control its own airspace in order to achieve its mission.

Field Manual 3-52.1/ Air Force Doctrine Document 3-2.78, *Multi-service Tactics, Techniques, and Procedures for Airspace Control*, is a multi-service manual created by the United States Army and the United States Air Force in May 2009 that further defines airspace command and control operations among the two services with respect to the joint community.

¹⁴ U.S. Department of the Army, *Field Manual 3-52: Army Airspace Command and Control in a Combat Zone*, (Washington, D.C.: U.S. Department of the Army, August 2002), 2-8.

Field Manual 3-52.1 reiterates the doctrine of Field Manual 3-52 and Joint Publication 3-52 in relation to the command and control structure down to the division level. However, the first mention of command authority below the Joint Force Commander does not exist until depicting the airspace command and control structure at the brigade level. According to FM 3-52.1, “BCTs [Brigade Combat Teams] have authority over all Army airspace users in their AO [Area of Operations], as well as CAS [Close Air Support] aircraft in support of BCT operations.”¹⁵ Conversely, “[d]ivision AC2 remains responsible for AC2 over the entire division AO, regardless of whether the AO has been further subdivided into BCT AOs.”¹⁶ Additionally, this multi-service doctrine does not incorporate the other two services of the United States Armed Forces, the United States Navy and United States Marine Corps, while still giving authority to the brigade combat team. By placing this “authority” in the brigade combat teams’ airspace command and control elements, tension arises between the brigade level and the higher echelons of command and among service components concerning who maintains command and control as well as responsibility for assets.

Although more specific to command and control of Marine aviation and missiles, Marine Corps Warfighting Publication 3-25, *Control of Aircraft and Missiles*, focuses primarily on the employment of the Marine Air-Ground Task Force (MAGTF) as an individual, self-contained entity. According to Marine Corps Warfighting Publication 3-25, “The Marine air-ground task force’s battlespace includes all aspects of the air, surface, subsurface, space, and electro-magnetic spectrum that encompass the MAGTF’s area of influence and area of interest.”¹⁷ This definition

¹⁵ U.S. Department of the Army and Air Force, *Field Manual 3-52.1/AFTTP 3-2.78: Multi-Service Tactics, Techniques, and Procedures for Airspace Control*, (Washington, D.C.: U.S. Department of the Army and Air Force, May 2009), 13.

¹⁶ Ibid, 12.

¹⁷ U.S. Department of the Navy, *Marine Corps Warfighting Publication 3-25: Control of Aircraft and Missiles*, (Washington, D.C.: U.S. Department of the Navy, February 1998), 1-5.

of the MAGTF's battlespace essentially reserves all command and control of airspace to the United States Marine Corps within their assigned area of operations. The MAGTF aviation operates under the concept of centralized command and decentralized control with command resting at the MAGTF level but flexible enough for responsive units to maintain control during the conduct of operations.¹⁸

While working well within the Marine Corps area of operations, this concept of command and control does not specifically delineate the command and control structure outside of the assigned Marine area. Moreover, the Marine Corps concept of command and control is outside of the joint doctrinal concept of centralized control accepted by the other services that may operate in the Marine area of operations. To further complicate integration into the joint airspace control plan and foment the creation of individual service specific doctrine, Joint Publication 0-2, *Unified Action Armed Forces*, states, "[t]he MAGTF commander will retain [operational control] of organic air assets."¹⁹ Therefore, joint doctrine implicitly requires the United States Marine Corps to have its own service specific airspace command and control doctrine separate from but in support of the Joint Force Commander. However, the Marine Corps doctrine for airspace command and control adheres to decentralized control, which is in direct contradiction to joint doctrine's centralized control.

The airspace command and control doctrine of the United States Navy is altogether different from the other services in that the Navy must provide airspace command and control autonomously as well as participate as part of a joint force in support of land operations.²⁰ Navy

¹⁸ Ibid, 2-1.

¹⁹ U.S. Joint Chiefs of Staff, *Joint Publication 0-2: Unified Action Armed Forces*, (Washington, D.C., U.S. Joint Chiefs of Staff, July 2001), V-4.

²⁰ U.S. Department of the Navy, *Navy Tactics, Techniques, and Procedures 3-02.1.3: Amphibious/Expeditionary Operations Air Control*, (Washington, D.C.: U.S. Department of the Navy, September 2005), 6-1.

Tactics, Techniques and Procedures 3-02.1.3, *Amphibious/Expeditionary Operations Air Control*, provides guidance for the operation of naval airspace command and control in response to autonomous operations while operating outside of a Joint Operations Areas (JOA) as well as provides cursory guidance in accordance with Joint Publication 3-52. The basis for United States Navy doctrine is the establishment of autonomous operations of the Navy's Tactical Air Control Center (TACC) and its subordinate command and control elements. "[the TACC] is the primary air control agency within the amphibious task force/expeditionary strike group from which all air operations supporting the amphibious force are controlled."²¹ As the primary controlling agency for all Navy airspace assets, "[t]he TACC functions as the single point of contact for coordination with the Joint Force Maritime Component Commander (JFMCC) and JFACC/Combined Force Air Component Commander..."²² This relationship to the joint force requires that the Navy maintain service specific doctrine for the command and control of its airspace but does not provide the command and control relationship outside of the Navy Tactical Air Control Center area of operations.

Through a review of the joint doctrine and service specific doctrine, one can see the ambiguity, tension, and divergence associated with the base level doctrine for each service. "Airspace is inherently joint."²³ The most significant factor attributing to these discrepancies appears to be in the actual command and control relationships inside of any joint area of operations. United States joint doctrine does not effectively delineate who controls the increasingly complex airspace when services are operating outside of their own boundaries. Instead, the joint doctrine requires that each service formulate its own service specific doctrine to operate according to the limitations of its operational area and merely coordinate with the other

²¹ Ibid, 2-1.

²² Ibid, 3-1.

services in support of the Airspace Control Plan approved by the Joint Force Commander. However, on the noncontiguous battlefields presented by Operations Iraqi and Enduring Freedom, all services must operate simultaneously in airspace controlled by another service. This lack of a common joint doctrine delineating how and who controls airspace presents a challenge when services do not have a common understanding of the doctrine applied by another service.

The Doctrine: What is the definition of control among the services?

According to joint operational doctrine, there are two primary methods of control for tactical combat airspace, *positive control* and *procedural control*. The purpose of these methods of control is to provide safe, flexible, and effective integration of all participants in the airspace environment. According to Joint Publication 3-52, “Airspace control procedures provide maximum flexibility through an effective mix of positive and procedural control measures.”²⁴

Positive control of airspace implies that a higher, sole-source entity controls the operations of all airspace users in a given area through direct contact. Positive control is a form of centralized control and execution of operations. “Positive control relies on radars, other sensors, identification, friend or foe (IFF)/selective identification feature (SIF), digital data links, and other elements of the air defense system to positively identify, track and direct air assets.”²⁵ These systems provide the ability to effectively time and coordinate the use of airspace through centralized control of airspace users. “Centralized execution is better for managing scarce resources, especially those that can produce effects throughout the [area of operations].”²⁶ However, positive control significantly reduces the flexibility of airspace users due to this

²³ U.S. Department of the Army, *Field Manual 3-52.1*, 1.

²⁴ U.S. Joint Chiefs of Staff, *Joint Publication 3-52*, viii.

²⁵ U.S. Joint Chiefs of Staff, *Joint Publication 3-52*, III-4. Emphasis added by author.

centralized execution. Furthermore, the question remains, “Who is in control during positive control, the ground force commander via voice or another controlling agency via data link?”

According to Department of the Army Pamphlet 525-7-3, *The United States Army Concept Capability Plan for Airspace Command and Control*, “the primary [Army Airspace Command and Control, A2C2,] deconfliction method was to reserve airspace for each airspace user and then ensure that each airspace user stayed within their reserved airspace.”²⁷ This method of deconfliction, also known as procedural control, required extensive planning and coordination prior to execution to mitigate the risks inherent with airspace operations. However, on the ever-changing, noncontiguous battlefields of Operations Enduring Freedom and Iraqi Freedom, procedural control alone is problematic in that it does not provide the flexibility and response necessary for the modular force.

In contrast to positive control of airspace, procedural control “[r]elies on previously agreed to and distributed airspace control measures...”²⁸ These control measures consist primarily of procedures developed to provide a system of deconfliction based upon separation of systems laterally, vertically, or by time. Forms of procedural control include fire support coordination measures, coordinating altitudes, restricted operations zones, high-density airspace control zones, aircraft identification maneuvers, and rules of engagement to specify a few. Procedural control offers more flexibility than positive control but implies the acceptance of more risk as no centralized command and control entity positively controls the operations.

²⁶ U.S. Department of the Army, *Field Manual 6-0: Mission Command: Command and Control of Army Forces*, (Washington, D.C.: U.S. Department of the Army, August 2003), 2-21.

²⁷ U.S. Department of the Army, TRADOC Pamphlet 525-7-3: *The United States Army Concept Capability Plan for Airspace Command and Control for the Future Modular Force 2015-2024*, (Washington D.C.: U.S. Department of the Army, April 2009), iii.

²⁸ U.S. Joint Chiefs of Staff, *Joint Publication 3-52*, III-4.

The determination of the proper authority for the command and control of airspace users plagues the definition of positive control and provides room for interpretation of this definition. “Historically, the United States Army poorly defines the term procedural control. The Army defines positive control based upon the machines designed to track airspace users as opposed to defining positive control based upon command.”²⁹ On the other hand, many others interpret the definition of positive control to include a direct command responsibility by a controlling authority based on the requirement to direct air assets. However, the “commander” in question tends to vary from the airborne Air Battle Manager to the ground component commander depending on the situation. Additionally, with multiple levels of command decisions, the command portion of airspace command and control becomes confusing and requires integration and training to ensure safe and effective use of airspace for all users.

Owing to the noncontiguous, constantly changing battlefield and the increased number of participants in the combat airspace, Operation Iraqi Freedom and Operations Enduring Freedom redefined the procedural control term coordinating altitude in an effort to simplify the controlling agencies of airspace. “Operations Iraqi Freedom (OIF)/ Operation Enduring Freedom (OEF) operations use the term coordinating altitude as the vertical limit between airspace controlling agencies [i.e. the top of Army controlled airspace and the bottom of control and reporting center (CRC) controlled airspace].”³⁰ However, Joint Publication 3-52 defines coordinating altitude as “[a] procedural airspace control method to separate fixed- and rotary-wing aircraft by determining an altitude below which fixed-wing aircraft will normally not fly and above which rotary-wing aircraft will normally not fly.”³¹ This clarification of a commonly used procedural control

²⁹ Christopher Boetig, Army Combined Arms Center Airspace Analyst, Interview by author, Fort Leavenworth, KS, December 4, 2009.

³⁰ U.S. Department of the Army, *Field Manual 3-52.1*, 2.

³¹ U.S. Joint Chiefs of Staff, *Joint Publication 3-52*, C-B-12.

measure requires address as it complicates the understanding of control among agencies and services.

The mix of positive control and procedural control procedures offers the optimal mix of control methods. By employing both methods of control, airspace maintains a form of redundancy and allows for maximum flexibility in the execution of combat operations. Procedural control provides the ability for airspace users to conduct operations generally free from coordination with other users through prior agreed upon procedures. On the other hand, positive control provides the ability for real-time or near real-time coordination through electronic communications thereby allowing the continued coordination and changing of procedural control measures. This combination of positive and procedural control provides for increased flexibility in the operational environment in addition to an increased level of risk mitigation through direct coordination between all users.

The United States Navy and the United States Marine Corps both establish additional methods of control to compliment procedural and positive control. The Marine Corps introduces an extension of combined procedural and positive control known as *positive control by exception*. Positive control by exception is the implementation of procedural control measures as the basis for the airspace control plan with positive control implemented by exception "...where the positive control agency's information is better, or more current, than that possessed by the aviation asset."³² The United States Navy employs yet another method of control known as *advisory control*. "Advisory control consists of the monitoring of radars and radio channels in order to advise the pilot of other traffic and operational or hazardous areas. Traffic separation is the responsibility of the individual pilot, with assistance provided by the control agency."³³ In

³² U.S. Department of the Navy, Marine Corps Warfighting Publication 3-25, 4-7.

³³ U.S. Department of the Navy, Navy Tactics, Techniques, and Procedures 3-02.1.3, 8-2.

essence, advisory control exists when positive control is unnecessary but further coordination reduces risk. The advisory control method is not actually control by the definition of positive or procedural control as the pilot remains responsible without an actual controlling agency. Although these methods of control are complimentary to joint doctrine, these terms are not universal across the services.

The primary factor that determines the selection of positive, procedural, mixed, or advisory control relies upon the different parochial mentalities and organizations of the differing United States services and other airspace users. The United States Army bases operations on the concept of mission command. “Mission command is the conduct of military operations through decentralized execution based on mission orders.”³⁴ In accordance with mission command, the United States Army tends to prefer the procedural method of control but attempts to mitigate risk at the appropriate level. The Marine Corps prefers positive control by exception through decentralized control of airspace users. On the other hand, the United States Navy and United States Air Force both prefer positive control based on their exceptional airborne and surface-based air control platforms.³⁵ The overall differentiation presents itself in the determination of where the command decision and responsibility resides during the execution of operations based on the intricacies of each service component’s mission and methods of employment. Through the varying interpretations of control and the propensities of services towards positive, procedural, or mixed control of airspace, the joint airspace command and control doctrine promotes ambiguity among services as to who is in control of the airspace at any given moment.

³⁴ U.S. Department of the Army, *Field Manual 3-0: Operations*, (Washington, D.C.: U.S. Department of the Army, February 2008), 3-6.

³⁵ U.S. Department of the Navy, Marine Corps Warfighting Publication 3-25, 2-5.

Doctrine: What changes must doctrine consider in terms of control?

To understand the change of the environment, one must understand the inherent complexity associated with airspace command and control as presented in the complex, noncontiguous operational environments of Operations Iraqi Freedom and Enduring Freedom and anticipated in the future. Field Manual 3-52.1 describes complex airspace as "...airspace simultaneously used by two or more components, requiring near constant coordination among airspace users to synchronize force employment for a common objective."³⁶ However, this definition is not sufficient to define complex airspace as it is over-simplistic and neglects agencies outside of military components. The possible users of airspace include the military, other government agencies such as the Central Intelligence Agency or the Department of State, as well as commercial and civilian aviation assets. These users may further subdivide as fixed wing aircraft, rotary wing aircraft, unmanned aerial vehicles, surface fires (missiles, mortars, and artillery), and naval gunfire. All of these airspace users may occupy a given block of airspace simultaneously, which requires intensive, near real-time coordination. Furthermore, not all of these agencies adhere to the same rules and regulations. The current airspace command and control doctrine mentions the need for consideration of congested airspace from the increased number of users, but it only mentions the need for coordination while neglecting the concept of controlling the airspace.

Additionally, in a noncontiguous area of operations, one or more of a commander's subordinates do not share common boundaries.³⁷ By not sharing common boundaries, units do not provide a homogeneous structure for efficient synchronization and deconfliction of all users within the airspace. In a contiguous battlefield, operations were generally linear and required little

³⁶ U.S. Department of the Army, *Field Manual 3-52.1*, 31.

³⁷ U.S. Department of the Army, *Field Manual 1-02*, 1-133.

lateral movement thereby resulting in relatively simple airspace to control through procedural control. However, the result of a noncontiguous battlefield manifests itself in the establishment of a 360-degree battlefield, which requires near real-time synchronization.³⁸ Current doctrine does not provide for the 360-degree battlefield through neglecting the definition of command and control relationships to cope with combined areas of responsibility.

In addition to the increased number of participants and the complexity of a noncontiguous battlefield, joint doctrine does not provide a command and control structure capable of reacting to the increased pace of operations on the battlefield. Given the increased situational awareness provided by battle command systems such as Force XXI Battle Command Brigade and Below (FBCB2) and Blue Force Tracker (BFT), commanders possess an increased level of battlefield understanding not previously afforded them during operations prior to Operations Iraqi and Enduring Freedom. This heightened situational awareness and battlefield understanding increases the speed at which the battlefield changes and the speed at which commanders can and must make decisions. This increased battlefield operating tempo necessitates near real-time decision-making capability of all forces in and above the ground commander's area of operations in order to achieve synergy and mass firepower at the decisive point of battle while reducing the risk to friendly forces. According to *The United States Army Concept Capability Plan for Airspace Command and Control for the Future Modular Force 2015-2024*, "Joint doctrine does not clearly address the authorities, responsibilities and architectures necessary to link component C2 nodes for collaborative, near real time coordination and decisionmaking."³⁹

³⁸ U.S. Department of the Army, *TRADOC Pamphlet 525-7-3*, 18.

³⁹ *Ibid*, 19.

According to TRADOC Pamphlet 525-3-3, *The United States Army Functional Concept for Battle Command 2015 – 2024*, “[t]he future Modular Force will fight as a part of a networked joint force, integrated at every level, and interdependent in the joint areas of battle command, force projection, air and missile defense, sustainment, and fires.”⁴⁰ This is the complex environment presented by the battlefields of Iraq and Afghanistan and anticipated in the future. Operations Iraqi and Enduring Freedom only begin to touch on the complexity of future battlefield and airspace challenges. The complex battlefields of the future will require a joint force approach to achieve near constant, real-time coordination for the synchronization of forces in the fight. These conditions necessitate the revision of joint doctrine into a unified form that removes the parochialistic tendencies of each service. As the highest level of doctrine, joint doctrine must provide for a common doctrine among the services and remove the ambiguity established by current joint doctrine for the command and control of airspace.

The Common Air Picture: Synchronizing Airspace Command and Control

As previously stated, the operational environment posed in Operations Iraqi and Enduring Freedom changed the concept of airspace control as more users operated in the combat airspace and the speed of operations increased. Prior to Operations Iraqi and Enduring Freedom, airspace command and control focused on a plan-centric method for controlling airspace with all changes following the same process of requesting changes through numerous levels of command for review and approval at the theater level.⁴¹ This control at the theater level relies upon antiquated processes fomenting centralized control of airspace users and increases rigidity in the system of

⁴⁰ U.S. Department of the Army, *TRADOC Pamphlet 525-3-3: The United States Army Functional Concept for Battle Command 2015 – 2024*, (Washington, D.C.: U.S. Department of the Army, 30 April 2007), 8.

⁴¹ U.S. Department of the Army, *TRADOC Pamphlet 525-7-3*, 14.

operations. Due to centralized control and increased rigidity, this system for airspace control is cumbersome and consumes time unnecessarily. Moreover, the organization of the airspace command and control system does not provide a common air picture available at the user level for the dynamic integration of air assets into the ground scheme of maneuver. Through modification of the Theater Air Ground System and the establishment of a common air picture, the flexibility and unity of effort desired in joint doctrine will emerge.

The Theater Air Ground System – How did it operate prior to OIF and OEF, the legacy system?

According to Field Manual 3-52.2, *Multi-service Tactics, Techniques, and Procedures for the Theater Air Ground System*, the Theater Air Ground System “...refers to organizations, personnel, equipment, and procedures that participate in the planning and execution of all air-ground operations.”⁴² Essentially, the Theater Air Ground System encompasses all aspects of personnel and systems essential to integrate the use of airspace across and within service boundaries for the joint area of operations. The personnel assigned responsibility to integrate airspace within the Theater Air Ground System begins at the theater operational level and extends down to the tactical level of operations. The equipment of the system extends yet further down to the individual system on the battlefield to include each individual radio used by a soldier (although not specifically delineated as an airspace command and control system). The role of the Theater Air Ground System is to provide for the command and control of all airspace through providing the organizations and systems to develop a common air picture useable to make decisions on the battlefields of the United States military.

⁴² U.S. Department of the Army, Field Manual 3-52.2: *Multi-service Tactics, Techniques, and Procedures for the Theater Air Ground System*, (Washington, D.C.: U.S. Department of the Army, April 2007), i.

The Theater Air Ground System (TAGS) primarily focuses on the implementation of procedural airspace control measures through liaison and coordination at the theater level through the guidance of the Joint Force Commander. The principal TAGS element responsible for the coordination among the services is the Joint Force Air Component Commander (JFACC) often selected as the Airspace Control Authority (ACA) and the Area Air Defense Commander (AADC). With the summation of these three roles, the JFACC is responsible for the development of the "...joint air operations plan (JAOP), the daily air tasking order (ATO), and other guidance and direction, as well as responsive and integrated control system."⁴³ The JFACC accomplishes his/her role through the Joint Air Operations Center.

The Joint Air Operations Center (JAOC) is the chief focal point for coordination of the Joint Air Operations Plan in support of the strategy of the Joint Force Commander and provides five functions: strategy, combat plans, combat operations, air mobility, and intelligence surveillance and reconnaissance (ISR).⁴⁴ Component liaison officers provide the coordination point between service components and the Joint Forces Air Component Commander for establishing the pre-planned basis of the airspace control plan (ACP). The component liaisons include the Army Battlefield Coordination Detachment (BCD), Naval Amphibious and Liaison Element (NALE), Special Operations Liaison Element (SOLE), Marine Liaison Element (MARLO), Air Mobility Element (AME), Army Air and Missile Defense Command (AAMDC), Air Force Liaison Element (AFLE), Space Liaison Officer (SLO), and other elements to include international organizations, non-governmental organizations, and other government agencies.⁴⁵ "These officers possess the authority to represent their component commander on time-sensitive

⁴³ Ibid, I-3.

⁴⁴ Ibid, I-4.

⁴⁵ U.S. Joint Chiefs of Staff, *Joint Publication 3-30*, II-7 – II-8.

and critical issues.”⁴⁶ The concept of the Joint Air Operations Center directly supports the concept of centralized control with decentralized execution advocated by Joint Publication 3-30. However, the Joint Air Operations Center is successful in the accomplishment of pre-planned airspace coordination and is not capable of providing near real-time coordination due to a primary focus on procedural control disseminated in the form of airspace control documents.

Essentially, the Joint Air Operations Center provides the coordination and products necessary to establish procedures prior to current operations through specific coordination products. The base document for the airspace control system is the Airspace Control Plan (ACP), which provides specific planning guidance and procedures for the joint operations area.⁴⁷ The Airspace Control Plan drives all future mission planning and execution as the base set of rules. The execution of the Joint Air Operations Plan comes from the daily Air Tasking Order (ATO). The ATO document tasks and disseminates “...to components, subordinate units, and C2 agencies projected sorties, capabilities, and/or forces to targets and specific missions.”⁴⁸ In other words, the ATO provides the specific, approved mission list for the time-period covered by the order, usually a twenty-four hour window. To manage and deconflict airspace for approved missions, the JAOC produces the Airspace Control Order (ACO) that provides the specific details of airspace coordination measures and fire support coordination measures, forms of procedural controls.⁴⁹ To amend or supplement the ATO, the JAOC also produces Special Instructions (SPINS) to provide clarification such as Rules of Engagement (ROE). However, while this process is relatively elaborate yet successful for airspace control, the planning and establishment of these documents and processes result in the publishing of procedural control measures for

⁴⁶ U.S. Department of the Army, *Field Manual 3-52.2*, I-4.

⁴⁷ Ibid, III-3.

⁴⁸ Ibid.

⁴⁹ Ibid.

targets and missions that provide a lead time greater than what is necessary on the current and future battlefield.

While the procedures for each operational environment vary according to the established Airspace Control Plan, requesting the use of airspace, planned or unplanned, generally follows a common pattern. During planning, each service requests reservations of blocks of airspace to facilitate the accomplishment of their assigned mission through its own chain of command to its liaison officer at the Joint Air Operations Center. Within each service specific airspace control organization, the higher echelon organization coordinates, approves/disapproves, and forwards the airspace request until arrival at the Joint Air Operations Center. This process utilizes the airspace control means request (ACMREQ) to request airspace digitally with a backup process of voice communication. An ACMREQ is a "...United States message text format (USMTF) approved message to request that a specific volume of airspace be reserved for a specific mission or operation."⁵⁰ The Airspace Control Plan delineates the specific procedures for the submission of the ACMREQ with an approved ACMREQ resulting in the inclusion of an airspace control measure into the Airspace Control Order.⁵¹ These airspace control measures are procedural controls and, as stated earlier, procedural controls reserve blocks of airspace to certain users only. These procedural controls severely limit the amount of airspace available in the area of operations and reduce flexibility across the area of operations.

Mindful of the airspace control system documents listed above, the Joint Air Operations Center continues to operate based on centralized control with decentralized execution. In support of the implementation of the Joint Air Operations Plan, each service component provides its own airspace control system to control the airspace assigned to them by the Airspace Control Plan.

⁵⁰ Ibid.

⁵¹ Ibid, III-7.

The basic airspace control organizations in the Theater Air Ground System are the Air Force Theater Air Control System (TACS), the Marine Air Command and Control System (MACCS), the Navy Tactical Air Control System (NTACS), and the Army Air-Ground System (AAGS).⁵² However, decentralized execution of the Theater Air Ground System poses the continued problem of who is in control of aircraft outside of the established procedural controls portrayed by the ATO while each individual system focuses on service specific requirements for procedural and positive control (according to their own doctrine) within their assigned areas of responsibility. While providing knowledge of ongoing missions, the value of this system and its corresponding documents is the establishment of the base plan from which to execute changes to air operations based on unused or amendable airspace and/or airspace assets. Additionally, since these documents originate at the theater level, all components and subordinate units have access to the same centralized, coordinated airspace control system from which to request changes or support throughout mission execution, greatly increasing unity of effort. The overall significance is the establishment of a preplanned common air picture greater than twenty-four hours in advance. According to COL(R) Curtis V. Neal, “[t]he TACS/AAGS is a ‘stovepipe’ system that is satisfactory for rapid management, planning and deconfliction. However, it was not designed for real-time (or near-real-time) coordination, deconfliction, and control of all tactical air operations and fires or to quickly execute complex processes that require joint integration of airspace control, intelligence, targeting, and fires.”⁵³ Given the complex airspace challenges associated with a noncontiguous, fast-paced battlefield, this system does not provide the reaction time or the flexibility necessary for the battlefields of Operations Iraqi and Enduring Freedom.

⁵² Ibid, III-3.

⁵³ Curtis V. Neal, "JAGC²: A Concept for Future Battlefield Air-Ground integration," *FA Journal* 11, No. 6 (NOV-DEC 2006): 13-17. *General OneFile*. Web. (accessed April 8, 2010).

Essentially, the Theater Air Ground System works through a centralized approval process with decentralized execution according to the procedures established by the Airspace Control Plan and its supporting documents. The benefits of the Theater Air Ground System are its ability to provide a predicted common air picture, deconfliction of missions prior to execution, and an assessment of available airspace and assets for ongoing missions. The detriments of the system are its untimely response of up to twenty minutes⁵⁴, inflexibility due to reserved airspace, and inability to portray an accurate common air picture to all users as the battlefield changes. Even though this system has deficiencies, it is still necessary to have a process for processing a baseline common air picture. In its current form, the Theater Air Ground System resembles a successful planning arrangement but requires revision to reflect a system capable of coping with a rapidly changing battlefield. This revision requires doctrine and processes to incorporate the proper Airspace Control System to process “legacy” ACMREQ along with a new process for coping with near real-time adjustments to a common air picture. The key to this new process is dissemination of the common air picture to all echelons rapidly and accurately to enhance effectiveness in the complex and ambiguous environments existing in Operations Iraqi and Enduring Freedom and anticipated in the future.

The Theater Air Ground System – How does it operate during Operations Iraqi and Enduring Freedom?

On the current battlefield of Operations Iraqi and Enduring Freedom, the main system for the employment of the Air Tasking Order for the Joint Forces Air Component Commander is the Air Force’s Theater Air Control System. While the legacy process still produces the Airspace Control Documents, the actual execution of airspace command and control follows an approach

⁵⁴ Ibid.

different from that provided in doctrine. “During major combat operations [Airborne Warning and Control System] AWACS and the [Control and Reporting Center] CRC combine to provide the air picture and control the CFACC requires for air superiority.”⁵⁵ The Airborne Warning and Control System is “...an integrated Air Force [Battle Management Command and Control] BMC2 platform providing early warning, surveillance, battle management, target detection and tracking, and weapons control functions” and is directly subordinate to the JFACC.⁵⁶ The AWACS is an airborne platform of the United States Air Force that uses radar and its communication assets to be the controlling and coordination element for the Joint Air Operations Center’s decentralized execution of airspace command and control. Additionally, the Control and Reporting Center (CRC) is a ground-based element with similar capabilities that “allows for the flexibility in the decentralization and delegation of battle management capability and authority” and subordinate to the Joint Air Operations Center.⁵⁷ Together, these two systems provide redundant radar coverage and decentralized control for all assets above the coordinating altitude by creating a real-time air picture. However, these systems will not normally control/deconflict airspace in an area smaller than 10 x 10 nautical miles.⁵⁸ In the case of the United States Army and other ground forces, numerous users requiring control operate below the coordinating altitude and occupy areas smaller than 10 x 10 nautical miles.

During Operations Iraqi and Enduring Freedom, the Airspace Control Authority allowed Army Airspace Command and Control (AC2) elements to manage airspace below the

⁵⁵ Center for Army Lessons Learned, *OIF-OEF Airspace Command and Control Collection and Analysis Team Initial Impressions Report 07-14*, (Fort Leavenworth: Center for Army Lessons Learned, November 2006), 5.

⁵⁶ U.S. Department of the Army, *Field Manual 3-52.2*, V-10. Emphasis added by the author.

⁵⁷ Ibid. Emphasis added by the author.

⁵⁸ Center for Army Lessons Learned, *OIF-OEF Initial Impressions Report 07-14*, 5.

coordinating altitude and in areas not normally controlled by the CRC.⁵⁹ Though effective at the joint level, the discrepancy lies in the established Airspace Command and Control system instituted by the Army. “The term [Airspace Command and Control] AC2 does not denote Army ownership or command over activities within that airspace.”⁶⁰ Therefore, the Army AC2 elements do not have doctrinal authority to command/control assets in the area and deconfliction is advisory only.⁶¹ Additionally, United States Army tactical units do not possess the proper personnel organization and material assets to perform such a task adequately. In Operation Iraqi Freedom, 4th Infantry Division’s “...[Army Airspace Command and Control] element responsible for the airspace below the coordinating altitude in the [Multi-National Division – Baghdad] area of operations skillfully combined equipment, sensors, training and their own [tactics, techniques, and procedures] to create a useable low altitude air picture and near real-time coordination capability.”⁶² However, ingenuity made the creation of a low-level air picture possible not organization and equipment designed for this task. Additionally, the low-level air picture created by the 4th Infantry Division was not compatible with CRC systems and did not create a common air picture for all users. The control of low-level airspace requires doctrine, organization, and equipping to properly control low-level airspace in real-time or near real-time.

Below the division level, all brigade combat teams (with the exception of sustainment brigades) possess an organic Air Defense Airspace Management/Brigade Aviation Element (ADAM/BAE) specifically tasked to integrate the airspace command and control plan for the division.⁶³ As the primary integrator of airspace and subject matter experts, the ADAM/BAE

⁵⁹ Ibid.

⁶⁰ U.S. Department of the Army, *Field Manual 3-52.2*, IV-6.

⁶¹ Center for Army Lessons Learned, OIF-OEF Initial Impressions Report 07-14, 5.

⁶² Ibid.

⁶³ U.S. Department of the Army, *Field Manual 3-52.1*, 12.

makes recommendations to the commander on airspace deconfliction and the proper employment of air assets. The ADAM/BAE consists of a combination of air defense artillery and aviation branch officers, warrant officers, noncommissioned officers, and enlisted soldiers whose focus remains airspace coordination while continuing to conduct basic branch activities. The ADAM/BAE coordinates directly with other members of the brigade staff including the fires cell, the Air Force Air Liaison Officer (ALO) and Tactical Air Control Party (TACP), and unmanned aerial vehicle operators.⁶⁴ However, the primary means of coordination and deconfliction used by the ADAM/BAE to forces outside of the brigade is voice communication/internet chat with limited visibility provided by the Theater Air Integration System (TAIS). The primary difficulty in using the ADAM/BAE resides in the lack of a common low-level air picture usable throughout the brigade combat team. The ADAM/BAE provides position reporting and deconfliction based on a limited scope through continued ad hoc methods established at the division level. Therefore, while the ADAM/BAE is extremely useful for its intended purpose, it suffers the same detriments posed by the ad hoc methods used at the division level but with a more narrowed capacity.

The Theater Air Ground System – How should it operate on future battlefields?

According to Joint Vision 2020, “[i]nteroperability is a mandate for the joint force of 2020... Information systems and equipment that enable a common relevant operational picture must work from shared networks accessible by any appropriately cleared participant.”⁶⁵ The emphasis of Joint Vision 2020 concerning interoperability stresses not only equipment but also the procedures and organizations that allow decision-makers to understand each other’s

⁶⁴ Ibid.

⁶⁵ “Joint Vision 2020: America’s Military – Preparing for Tomorrow,” *Joint Forces Quarterly*, (Summer 2000), 65.

capabilities and constraints. The battlefields of the future will require closer coordination among service elements supported by the proper equipment to emphasize speed, flexibility, and synergy in the execution of operations.

The Theater Air Ground System must address the organization for commanding and controlling airspace down to the lowest usable level. Major General Peter M. Vangjel, the Multi-National Corps – Iraq Effects Coordinator 2005 – 2006, stated, “[a] cultural change is needed: the airspace deconfliction and fires guys and the TACP [tactical air control party] all need to sit together in the brigade TOC [tactical operations center].”⁶⁶ The current organization for airspace command and control in the combat zone relies on liaison element coordination up to the theater level, centralized command and control with decentralized execution. However, to operate on the joint level, units must have the capability to act in a joint manner by combining airspace control elements of the primary users on the future battlefield down to the tactical level.

The Joint Air-Ground Integration Cell (JAGIC) is the Army and Air Force current proposal for creating a joint cell at the division level capable of integrating airspace for the ground component commander. The description of the JAGIC as of November 2008 developed by the Joint Army-Air Force mission analysis working group is:

A modular and scalable cell designed to fully integrate and coordinate fires and air operations over and within the division commander’s [Area of Operations]. The JAGIC collocates decision making authorities from the land and air components with the highest level of situational awareness to support the maneuver commander’s concept of operations, JFACC objectives and intent, and requirements of JFC designated authorities; e.g. ACA, AADC, etc. This cell collaborates to more effectively execute the mission and reduce risk at the lowest tactical levels.⁶⁷

⁶⁶ Rupert Pengelley, “Under Control: Addressing Aerial Congestion in Operational Areas,” *Jane’s International Defence Review*, March 4, 2010, (Document provided by Combined Arms Research Library).

⁶⁷ Matthew Neuenswander, “Joint Airspace Control Issues,” CR Production Group, Slide 6.

Essentially, the concept of the JAGIC is to enhance the liaison chain from the division level to the theater level. To do this, the Airspace Control Authority delegates responsibility for an area of operations down to an expanded airspace control element at the division level that possesses enhanced situational awareness.

The proposed robust organization of the JAGIC incorporates many more specialized coordination functions than previous division airspace command and control systems. Current division AC2 elements only consist of liaison elements for the Air and Support Operations Center, Tactical Air Control Party, Fires Cell, and Air and Missile Defense. However, JAGIC proposes the inclusion of an Air Mobility Liaison Officer, all Army AC2 assets, an Intelligence Cell, a Special Operations Liaison, and a Joint ISR (intelligence, surveillance, and reconnaissance) Cell as well as the ability to incorporate other assets based on necessity.⁶⁸ The JAGIC provides a cell that replicates the majority of the Joint Air Operations Center that can maintain a joint common air picture over an Army division's Area of Operations. Although the JAGIC would not replace any presently established airspace command and control structure, it would streamline the coordination process and remove inter-service parochialism.

After thorough review of the doctrinal Airspace Command and Control Organization and the implementation on the battlefields of Operations Iraqi and Enduring Freedom, several key detriments present themselves. First, the legacy airspace command and control system provides a system dependent upon procedural controls and not capable of reacting to the rapidity at which current and future battlefield change. While the legacy system provides a pseudo common air picture, the common air picture from these methods is often obsolete at the point of

⁶⁸ "JOINT AIR GROUND CONTROL CELL: A Concept for Joint Integrated Air-Ground C2 Operations," Briefing slides with commentary, February 10, 2009, Accessed on the Army Battle Command Knowledge System: Army Airspace Command and Control Forum (Accessed March 14, 2010), Slide 7.

implementation. Additionally, the legacy system focuses on centralized control at the theater level with decentralized execution but fails to delineate a command and control structure capable of near real-time coordination among airspace users. Secondly, during Operations Iraqi and Enduring Freedom, the ACA delegates control authority from the joint/theater level to the Army Airspace Command and Control elements for airspace below the coordinating altitude. However, the Army AC2 elements do not possess the proper organization for providing a common low-level air picture usable throughout the theater. This organizational flaw results in the creation of ad hoc organizational and operational constructs at the division and brigade levels to overcome capability gaps for providing a usable low-level common air picture. Finally, the legacy and current airspace command and control structures focus primarily on airspace deconfliction vice integration. The lack of proper doctrine and organization result in the less than optimal integration of airspace through an inability to provide a low-level common air picture integrated with the theater common air picture.

Training for Airspace Command and Control

I think that there is something to the expression 'born to lead'. But there are many people who have the potential for leadership, just as there are probably many people born with the potential to be great artists that never have the opportunity or the training for the full development of their talents. I think leadership is a product of native ability plus environment. By environment, I mean training and the opportunity to exercise leadership.⁶⁹

GEN Dwight D. Eisenhower

Like all other aspects of training for combat, Airspace Command and Control requires training in order to be effective. On January 28, 2010, at the 2010 Army Aviation Senior Leaders Conference, Major General James M. Milano, Commanding General of the U.S. Armor Center, emphatically stated, “[c]onducting training of air integration at the home station before getting to

⁶⁹ U.S. Department of the Army, *DA Pamphlet 600-65: Leadership Statements and Quotes*, (Washington, D.C., U.S. Department of the Army, November 1985), 8.

theater is an important issue."⁷⁰ Airspace Command and Control is inherently complex with the addition of the third dimension to the battlefield and requires intense training for two major reasons. The first major reason is to prevent fratricide to airspace users during combat operations through neglecting to ensure airspace is clear for operations. As congestion increases on the battlefield, the chances of a mid-air collision and fratricide increase exponentially. The second reason to conduct airspace command and control is to achieve synergy among all airspace users by massing all available assets to achieve the commander's mission. Airspace command and control is not only about deconfliction but also integration.

Why does the military not train AC2?

According to Mr. Chris Boetig , an airspace analyst at the Combined Arms Center, Fort Leavenworth, the reason most people do not train airspace command and control is because AC2 is a process done for "negative effect". "Most people view airspace command and control as a process to prevent a collision between airspace users and not as a method to achieve synergy on the battlefield."⁷¹ Consequently, commanders often rely on aviators providing their own deconfliction of airspace based on seeing and avoiding potential hazards. Following this logic, AC2 focuses only on reducing the negative effects achieved through a lack of command and control of airspace users. This negative connotation prevents the actual integration of airspace users as a combat multiplier in the accomplishment of the commander's mission.

In addition to the lack of desire to conduct AC2, often people believe in the "Big Sky, Little Bullet" theory of AC2. The "Big Sky, Little Bullet" theory asserts that due to the vast size of airspace and minimal size of an airspace user, the chances of impact are essentially negligible.

⁷⁰ Jenny Stripling, "Army leaders discuss air-ground integration future, challenges at Fort Rucker," January 29, 2010, <http://www.army.mil/-news/2010/01/29/33792-army-leaders-discuss-air-ground-integration-future-challenges-at-fort-rucker/>, (accessed March 14, 2010).

In contrast to this theory, the effects of airspace user collisions often produce catastrophic results leading to senseless loss of life and equipment. Two such examples are the accidental shoot down of two UH-60 Black Hawk helicopters in Operation Desert Storm and the mid-air collision of an OH-58D Kiowa helicopter and a Raven Unmanned Aerial Vehicle in November 2004 during Operation Iraqi Freedom.⁷² As more airspace users conduct combat operations, the sky becomes significantly smaller and the risk of fratricide increases.

Besides decisions not to train AC2, the material and organization necessary for conducting airspace command and control at all levels presents a challenge to accomplishing effective training for all users. Most hands-on training exercises in the United States military occur at the brigade level and below. While combat training centers provide training for brigade level units, no full-scale training environment is available to train all echelons of airspace command and control at the joint level. Furthermore, when units conduct AC2 training at combat training centers, the restrictions placed on units creates unrealistic environments that do not truly train or challenge the brigade airspace control elements. By the very nature of its size and scope, the exercise of joint airspace command and control requires relegation to computer simulation. Therefore, most of the joint airspace command and control structure only receives training on paper prior to execution in actual combat operations.

Who needs to train AC2?

While understanding airspace command and control is essential for all soldiers, in-depth training of AC2 is more suitable for those directly responsible for airspace integration. Those directly responsible for airspace integration include commanders (at all levels), doctrinal airspace managers, and personnel responsible for operating aircraft/munitions in combat airspace. These

⁷¹ Chris Boetig, interview by the author.

categories present different reasons for necessitating training on airspace command and control based on their roles on the battlefield.

The first category requiring in-depth training of airspace command and control is the group the author labels as the commanders. AC2 is inherently a commander issue at all levels. According to Field Manual 6-0, *Mission Command: Command and Control of Army Forces*, “[c]ommanders use the activities of *visualizing* the battlespace, *describing* their commander’s visualization to subordinates, *directing* actions to achieve results, and *leading* the command to mission accomplishment as their decisionmaking methodology throughout the operations process.”⁷³ Commanders are responsible for the synchronization and integration of assets to achieve results in combat. It is essential for commanders to understand the capabilities and limitations of assets for proper employment during combat operations. Additionally, commanders have the responsibility to assess and mitigate risk during combat operations.⁷⁴ By training airspace command and control, commanders can better understand how to integrate all forces effectively while minimizing risk to friendly forces.

Doctrine delineates specific roles for airspace managers and liaisons as the primary managers of airspace. Although every service has its own doctrine for airspace command and control, all services provide specific airspace command and control elements to serve as staff members for supporting the commanders in their decision making process. These elements must be intimately familiar with airspace management and support the commander during the execution of his mission. Joint Publication 3-52 emphasized the importance of trained airspace command and control elements by stating, “[e]ffective liaison and coordination may directly

⁷² Andrew T. Liebeknecht, “Airspace...Big Sky, Little Bullet,” *Flight Fax*, September 2006, 21.

⁷³ U.S. Department of the Army, *Field Manual 6-0*, 4-0 – 4-1.

⁷⁴ *Ibid*, 2-19.

relate to the success of the campaign or operation.”⁷⁵ Airspace managers and liaison elements must conduct training to effectively support the commander’s decision-making process during all phases of combat operations.

Finally, the primary users of combat airspace must execute operations to support the commanders’ plans. The primary users of combat airspace include field artillery, air defense artillery, manned aviation assets, and unmanned aviation assets. During the execution of operations, these assets implement commanders’ decisions through decentralized execution. As users of airspace, these assets integrate airspace on a constantly changing battlefield and provide the commander flexibility during combat operations. Additionally, airspace users must understand airspace management in order to minimize risk while on the battlefield by implementing procedures properly. Without proper training, airspace users can negate the efforts of the planning staff and commanders’ risk mitigation procedures. Essentially, airspace users are the concrete representation of proper airspace command and control systems.

Conclusion and Recommendations

Joint Publication 1-02, Department of Defense Dictionary of Military and Associated Terms defines airspace control in the combat zone as “[a] process used to increase combat effectiveness by promoting the safe, efficient and flexible use of airspace.”⁷⁶ The Army’s role in Joint Airspace Command and Control (AC2) requires revision to anticipate future challenges associated with providing effective combat aviation response to the warfighter conducting combat operations. On the modern battlefield, an exorbitant number of participants in the warfighter’s airspace exist including military manned and unmanned aircraft, direct and indirect fire weapon systems, as well as civilian aircraft, and the number of these participants continues to increase.

⁷⁵ U.S. Joint Chiefs of Staff, *Joint Publication 3-52*, I-3.

⁷⁶ U.S. Joint Chiefs of Staff, *Joint Publication 1-02*, 24.

All of these systems require synchronization in order to reduce the risk of dangerous encounters between elements using airspace. In order to maximize the effectiveness of AC2 in the warfighter's airspace, the Army must coordinate internally and externally to establish a unified approach to airspace command and control that capitalizes on the inherently joint aspect of airspace.

United States joint doctrine does not effectively delineate who controls the increasingly complex airspace when services are consistently operating in airspace controlled by other services. Current joint airspace command and control doctrine focuses on centralized control with decentralized execution but does not provide a command and control structure at the tactical level of command. Furthermore, joint doctrine encourages the development of service specific doctrine for the decentralized execution of combat airspace command and control. In addition to separating the services, doctrine also provides ambiguously interpreted terminology to define the term control. The primary discrepancy occurs in the definition of positive control and its inference of command responsibility. To cope with this discrepancy during Operations Iraqi and Enduring Freedom, the Airspace Control Authority further divided the airspace into service component responsibilities for implementation of "control." Essentially, joint doctrine neglects the requirement of joint operations by separating the services into components with often-incompatible service specific doctrine not suitable for complex airspace command and control on a noncontiguous battlefield.

In order to be adequate, joint doctrine requires revision in accordance with a joint vision that specifically delineates command and control in a joint environment. While the United States Army and the United States Air Force created multi-service doctrine for combat AC2, joint doctrine must incorporate all services and remove service parochialism. As the preeminent doctrine of the United States Military, *Joint Publication 3-52: Joint Doctrine for Airspace*

Control in the Combat Zone should remove the allusion to service specific areas of operation. As stated earlier, “airspace is inherently joint.”⁷⁷ During the removal of service specific areas of operation, joint doctrine should provide command and control systems based on various types of operations (air, land, sea, amphibious, etc.) and phases of combat operations that delineate command responsibility to the tactical level. In addition to providing a command structure, joint doctrine must provide a clear definition for the term positive control. Positive control implies a command responsibility and requires definition as such. Airspace Command and Control is a joint endeavor that requires a joint approach as opposed to a parochial one in order to succeed on the current and future battlefield.

In addition to doctrinal concerns, the joint force does not possess a joint common air picture within the Theater Air Ground System that enables near real-time synchronization and deconfliction at all echelons on the battlefield. The legacy airspace command and control system focuses on the implementation of procedural controls to provide a joint common air picture more than twenty-four hours in advance of operations. To develop this air picture, the legacy system emphasized the use of liaison officer for coordination at the theater level to provide pre-planned airspace coordination measures and fire support coordination measures. However, this system provides a “stove-pipe system” not capable of providing near real-time deconfliction and integration of airspace due to cumbersome procedures and the lack of proper organization at all echelons. Additionally, the legacy system continues to focus on centralized control of airspace at the theater level with a diminished level of situational awareness. During Operations Iraqi and Enduring Freedom, units resorted to ad hoc structures to provide some semblance of near real-time coordination through innovative implementation of equipment and personnel. This ingenuity provided a rudimentary system to create a low-level air picture. However, this low-level air

⁷⁷ U.S. Department of the Army, *Field Manual 3-52.1*, 1.

picture is not compatible throughout the joint force. The United States Army and the United States Air Force proposed the creation of a Joint Air Ground Integration Cell (JAGIC), complete with associated personnel and equipment, to help mitigate this issue at the division level, but the concept remains under review. Without a joint common air picture, airspace command and control systems cannot effectively conduct near real-time deconfliction and integration of airspace.

The Theater Air Ground System requires improvement in order to provide a joint common operating picture thereby allowing effective decentralized execution. The legacy system continues to provide an effective means for pre-planned coordination of airspace during combat operations. In addition to maintaining the legacy system, the joint force should incorporate the JAGIC at the division level as recommended. However, the joint force must also consider the creation of a Brigade Air Ground Integration Cell (BAGIC)⁷⁸ due to the noncontiguous battlefield and the potential for brigades to operate semi-autonomously. Given the organization of the modular force, the implementation of a BAGIC requires only a slight modification to the ADAM/BAE. The modification would require inclusion of staff elements from the fires cell, intelligence cell, the Air Force Air Liaison Officer, and an Unmanned Aerial System warrant officer under control of the ADAM/BAE. The JAGIC and BAGIC reside as a subordinate cell managed by the Operations Section. By incorporating the JAGIC and BAGIC, the Army and Air Force systems create a joint common air picture at the division and brigade levels that is compatible with existing theater level assets. Additionally, creation of these two cells provides the means to provide decentralized control and execution of air assets and direct liaison capability

⁷⁸ The Brigade Air Ground Integration Cell (BAGIC) is a term discussed with Mr. Chris Boetig during the author's interview on December 4, 2009. Although not necessarily stated, the discussion alluded to the consideration of this concept.

among all echelons of command. The joint common air picture provides the situational awareness necessary to integrate airspace across a joint environment.

Regardless of the effects of implementing the above recommendations, the United States Army does not train airspace command and control due to the assumption that this problem belongs to aviators for deconfliction as opposed to commanders for integration. However, through a lack of training on airspace management, risk increases and integration decreases during the conduct of combat operations.

Training is an essential part of preparing for combat operations. Airspace command and control requires thorough training for all commanders, doctrinal airspace managers, and airspace users to the operator level. While aviators receive training on airspace management and deconfliction, they are not the sole integrators of airspace. Airspace command and control focuses primarily on risk reduction and integration of assets for successful combat operations, a commander's responsibility. Commanders at all echelons from company commanders to the Joint Force Commander require training on airspace command and control. During all pre-command courses, the Army must provide training on airspace integration and deconfliction to provide commanders with the knowledge to synchronize and direct all assets for the accomplishment of the mission. The Army should divide this training into tiers based upon levels of experience in order to address this issue at multiple levels. Airspace command and control is an integral component in the commander's decision-making processes and requires development. In addition to the commander, all airspace managers require training that prepares them to integrate airspace at all echelons. To train all airspace managers to a common standard, the United States military should develop a Joint Air Ground Integration school and require all airspace managers to attend this course prior to combat. During this course, airspace managers should take part in various levels of simulation exercises that require integration at all echelons of the airspace command and control system. Incorporation of the JAGIC and BAGIC during these exercises would validate

their usage as well as train all airspace command and control elements to a common standard. By training airspace command and control, risk decreases and integration increases.

The Army's role in the Joint Airspace Command and Control system is not adequate to support combat operations effectively on the current and future battlefields of the United States Joint Force. United States joint doctrine must effectively delineate who controls the increasingly complex airspace presented by Operations Iraqi and Enduring Freedom as well as future battlefields requiring interdependency among the services. By integrating joint structures at the brigade level and higher echelons, the Army can aid in the creation of a joint common air picture at all altitudes that enables near real-time synchronization and deconfliction of air assets for synergistic accomplishment of combat operations. Training on new doctrine and organizations creates the environment for removing inter-service rivalry and parochialism while increasing joint unity of effort. Airspace command and control is inherently joint and focuses on integration instead of deconfliction.

Appendix A: Considerations for an Airspace Control Plan⁷⁹

1. Purpose

This appendix provides an example of the topics to consider when developing an ACP.

2. Airspace Control Plan Topics

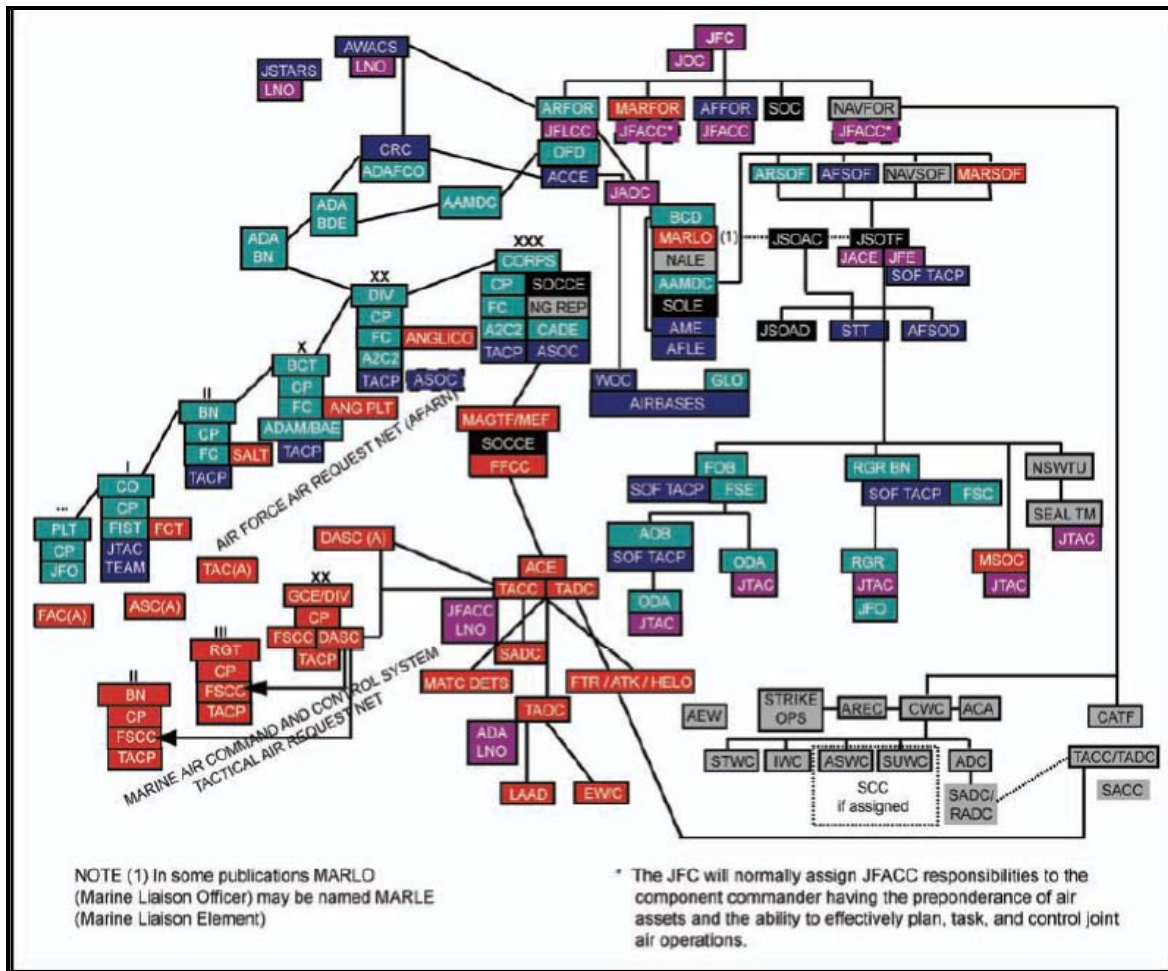
Every ACP will be different and must be based on the objectives of the military operations, the capabilities and limitations of both friendly and enemy forces, and the contributions and complexities introduced by HN and multinational forces, as well as the access required to the airspace by nonbelligerent aircraft. ACP topics include:

- a. Description of the conditions under which the guidance and procedures in the ACP are applicable (e.g., the exercise, OPLAN, OPORD, military operation).
- b. Description of the operational area within which the ACP applies.
- c. Appointment of the ACA; location of ACA headquarters (HQ) (if required).
- d. List of the capabilities that exist within the joint force and in the operational area that provide airspace control (ground sites, airborne capability) and the means of communicating with those airspace control elements.
- e. Description of the duties and responsibilities of:
 - (1) The ACA.
 - (2) Each airspace user within the joint force (to include requirements for liaison to and coordination with the ACA).
 - (3) Each element used in the ACS (site, facility, or airborne platform) and agency specific duties. The plan should delineate whether the agency provides procedural or positive control and its assigned sector.
- f. Description of the interface between commanders and coordination elements and the procedures adopted to coordinate and deconflict air defense and operational requirements.
- g. Description of the interface with the Federal Aviation Administration, HN ATC System, and/or ICAO.

⁷⁹ U.S. Joint Chiefs of Staff, *Joint Publication 3-52*, A-1 – A-3. This entire appendix is a verbatim replica from Appendix A of Joint Publication 3-52. The purpose is to allow the reader to understand the initial process to develop an Airspace Control Plan, the base document for airspace command and control, in an area of operations.

- h. Description of the interface among the tactical air control system(s) and the elements within those systems for ATC.
- i. If operations include forces from other nations, description of the interfaces between US and multinational forces to coordinate and deconflict airspace requirements.
- j. Plans to provide for continuity of airspace control operations under degraded conditions (alternate HQ, alternatives for key radar or C2 nodes, and other required capabilities).
- k. Description of the positive ACMs and procedures for the joint force.
- l. Description of the procedures to propose, approve, modify, and promulgate each procedural ACM available for use within the operational area (i.e., HIDACZ, JEZ, FEZ, MEZ, MRR, coordinating altitude, air refueling tracks, corridors, ROZs, and other appropriate procedures).
- m. Description of IFF/SIF procedures.
- n. Description of orbit procedures with retrograde plans.
- o. Description of procedures and systems to compile and promulgate the ACO that provides airspace control procedures and/or guidance in effect for a specified time period. The ACO would normally contain:
 - (1) Modifications to guidance and/or procedures contained in the ACP.
 - (2) Active or current IFF/SIF procedures.
 - (3) Location and procedures associated with active procedural ACMs (HIDACZ, JEZ, FEZ, MEZ, MRR, coordinating altitude, corridors, ROZs, and other appropriate procedures).
 - (4) Procedures for entering and transiting active ROZs (e.g., AOA).
 - (5) Location of active orbit areas.
 - (6) Active UAV launch, recovery, and mission areas.
 - (7) Launch and impact ROZs for surface-to-surface missiles.
 - (8) FSCMs, both restrictive and permissive (e.g., fire support coordination lines, nofire areas, restrictive-fire areas, free-fire areas).
 - (9) Applicable ground force control measures (e.g., battle positions, engagement areas, air axes of advance).
- p. Description of the interface with agencies/commands providing intertheater air mobility support for the purpose of coordinating and distributing airspace control information/procedures.

Appendix B: Theater Air Ground System Diagram⁸⁰



⁸⁰ U.S. Department of the Army, *Field Manual 3-52.2*, B-1. This diagram is a replica of the Theater Air Ground System currently operating in the United States Military with associated lines of request. This system depicts the centralized control of the legacy TAGS architecture and the associated complications of the system.

Bibliography

- Boetig, Christopher, Army Combined Arms Center Airspace Analyst. Interview by author, December 4, 2009, Fort Leavenworth, KS.
- Drew, Dennis and Don Snow. "Military Doctrine." *Air University*. August 1988.
<http://www.au.af.mil/au/awc/awcgate/readings/drew1.html> (accessed January 28, 2010).
- "Joint Vision 2020: America's Military – Preparing for Tomorrow." *Joint Forces Quarterly*, (Summer 2000), 57 – 76.
- "JOINT AIR GROUND CONTROL CELL: A Concept for Joint Integrated Air-Ground C2 Operations," Briefing slides with commentary, February 10, 2009, Accessed on the Army Battle Command Knowledge System: Army Airspace Command and Control Forum (accessed March 14, 2010).
- Liebeknecht, Andrew T. "Airspace...Big Sky, Little Bullet." *Flight Fax*, September 2006, 21.
- Neal, Curtis V. "JAGC²: A Concept for Future Battlefield Air-Ground integration." *FA Journal* 11, No. 6 (Nov-Dec 2006): 13-17. *General OneFile*. Web. (accessed April 8, 2010).
- Neuenschwander, Matthew. "Joint Airspace Control Issues." *CR Production Group*.
<http://www.crprogroup.com/eventnotebook/Fires%2009%20PPt/Wed/Airspace%20Management%201330/Matt%20Neuenschwander.pdf> (accessed February 13, 2010).
- Pengelley, Rupert. "Under Control: Addressing Aerial Congestion in Operational Areas." *Jane's International Defence Review*, March 4, 2010 (Document provided by Combined Arms Research Library).
- Stripling, Jenny. "Army leaders discuss air-ground integration future, challenges at Fort Rucker." January 29, 2010. <http://www.army.mil/-news/2010/01/29/33792-army-leaders-discuss-air-ground-integration-future-challenges-at-fort-rucker/> (accessed March 14, 2010).
- U.S. Center for Army Lessons Learned. OIF-OEF Airspace Command and Control Collection and Analysis Team Initial Impressions Report 07-14, (Fort Leavenworth: Center for Army Lessons Learned), November 2006.
- U.S. Department of the Air Force. AFDD 2-1.7: Airspace Control in the Combat Zone. Washington, D.C.: U.S. Department of the Air Force, July 2005.

U.S. Department of the Army and Air Force. FM 3-52.1/AFTTP 3-2.78: Multi-service Tactics, Techniques, and Procedures for Airspace Control. Washington, D.C.: U.S. Department of the Army and Air Force, May 2009.

U.S. Department of the Army, Department of the Army Pamphlet 600-65: Leadership Statements and Quotes. Washington, D.C.: U.S. Department of the Army, November 1985.

_____. Field Manual 1-02: Operational Terms and Graphics. Washington, D.C.: U.S. Department of the Army, September 2004.

_____. *Field Manual 3-0: Operations*. Washington, D.C.: U.S. Department of the Army, February 2008.

_____. Field Manual 3-52: Army Airspace Command and Control in a Combat Zone. Washington, D.C.: U.S. Department of the Army, August 2002.

_____. Field Manual 6-0: Mission Command: Command and Control of Army Forces. Washington, D.C.: U.S. Department of the Army, August 2003.

_____. TRADOC Pamphlet 525-7-3: The United States Army Concept Capability Plan for Airspace Command and Control for the Modular Force 2015-2024. Washington, D.C.: U.S. Department of the Army, April 20, 2009.

U.S. Department of the Army, Marine Corps, Navy, and Air Force. *FM 3-52.2/NTTP 3-56.2 / AFTTP(I) 3-2.17: Multi-service Tactics, Techniques, and Procedures for the Theater Air Ground System*. Washington, D.C.: U.S. Department of the Army, Marine Corps, Navy, and Air Force, April 2007.

U.S. Department of the Navy. Marine Corps Warfighting Publication 3-25: Control of Aircraft and Missiles. Washington, D.C.: U.S. Department of the Navy, February 1998.

_____. Navy Tactics Techniques and Procedures 3-02.1.3: Amphibious/Expeditionary Operations Air Control. Washington, D.C.: U.S. Department of the Navy, September 2005.

_____. *NDP 6: Naval Command and Control*. Washington, D.C.: U.S. Department of the Navy, May 1995.

U.S. Joint Chiefs of Staff . Joint Publication 3-52: Joint Doctrine for Airspace Control in the Combat Zone. Washington, D.C.: U.S. Joint Chiefs of Staff , August 2004.

U.S. Joint Chiefs of Staff. Joint Publication 0-2: Unified Action Armed Forces. Washington, D.C.: U.S. Joint Chiefs of Staff, July 2001.

_____. Joint Publication 1-02: Department of Defense Dictionary of Military and Associated *Terms*. Washington, D.C.: U.S. Joint Chiefs of Staff, April 2001 (amended through October 2009).

_____. Joint Publication 3-30: Command and Control for Joint Air Operations. Washington, D.C.: U.S. Joint Chiefs of Staff, June 2003.