The Adequacy of Procedural Control as the Basis of Army Airspace Command and Control (A2C2) Doctrine

A Monograph
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ABSTRACT

THE ADEQUACY OF PROCEDURAL CONTROL AS THE BASIS OF ARMY AIRSPACE COMMAND AND CONTROL (A2C2) DOCTRINE by MAJ Kenneth T. Royar, USA, 57 pages.

There is consensus within the U.S. Army that the Army Airspace Command and Control (A2C2) system is ineffective in coordinating airspace users to accomplish assigned missions. The two comprehensive studies completed within the past decade cite the basic reasons for its failure as the Army's inability to follow its own doctrine. However, critically lacking within the studies is an analysis of the validity of the doctrine itself. The current basis of A2C2 doctrine is the primary reliance upon procedural control, essentially de-conflicting airspace through the use of graphical control measures. The question this monograph addresses is not how should the Army improve its current A2C2 doctrine, but should the Army continue to rely primarily on procedural control as the basis of its A2C2 doctrine?

In determining the validity of procedural control as the basis for A2C2 doctrine, this monograph is divided into three major sections. The first section addresses what current A2C2 doctrine is and why it came to rely on procedural control. The second section examines the Army's adherence to current A2C2 doctrine based on the Army's Title 10 responsibilities to organize, train and equip its forces.

The third section evaluates the adequacy of procedural control if it were properly organized, trained and equipped. *TRADOC Pamphlet 525-5, Force XXI Operations* provides the criteria against which procedural control is examined: compatibility with joint operations; inter-connectivity within Army and joint systems; adequacy for current battle command systems; and adequacy for operations with higher tempos.

The monograph concludes that while the environment that the Army operates in has changed since the end of the Cold War, the Army should continue to rely on procedural control as the basis of its A2C2 system. Procedural control measures alone cannot meet the demands of the Army as envisioned by *TRADOC Pamphlet 525-5*, but they provide a sound basis for airspace management given today's resources. The monograph does not provide definitive solutions to the problems identified, but does recommend the direction in which A2C2 doctrine should move in order to meet the changing environment.

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CHAPTER ONE
INTRODUCTION

There is consensus within the U.S. Army that the Army Airspace Command and Control (A2C2) system is ineffective in coordinating airspace users to accomplish assigned missions.[1] The two major studies in the past decade cite three basic reasons for its failure: first, A2C2 doctrine is not well understood; second, the Army does not resource the system in accordance with its doctrine; and finally, the Army fails to adequately train A2C2.[2] However, critically lacking within the studies is an analysis of the validity of the doctrine itself. The current basis of A2C2 doctrine is the primary reliance upon procedural control, essentially de-conflicting airspace through the use of graphical control measures. The question this monograph addresses is not how should the Army improve its current A2C2 doctrine, but should the Army continue to rely primarily on procedural control as the basis of its A2C2 doctrine?

Field Manual 100-5, Operations, defines the role of doctrine as "the statement of how America's Army, as part of the joint team, intends to conduct war and operations other than war."[3] The inherent problem with doctrine is its ability to accurately provide the best guidelines on how to execute military operations in a changing environment. What was written as doctrine one day, may or may not be adequate the next due to changes within the military operational environment. The perpetual dilemma for the doctrine writer is how to determine which changes are significant and which are not. If it is determined that the environment in which the Army is expected to operate has significantly

changed, then it is incumbent upon the organization to adequately evaluate its doctrine in light of the new changes.

Training and Doctrine Command Pamphlet 525-5, Force XXI Operations, proposes the Army is in the midst of a significant change in its environment. It suggests two broad major changes to the environment in which the military must operate. It clearly defines the change from the monolithic threat of the Cold War to the threat of multiple crises. Additionally, it realizes the rapid change in the environment as a result of the information age.[4] Although written over five years ago, both of these changes in the environment have proven to be the case. Recent events have born both of these changes to be true: the United States is actively involved in numerous military operations against distinct and separate threats, and the information age provides different means to the military to face those threats. Consequently, a significant change in the environment is here – and in order for the Army to achieve maximum effectiveness, it must evaluate its current doctrine.

Army Airspace Command and Control (A2C2) doctrine needs evaluation in the light of these changes. Last updated in 1987, the capstone manual for A2C2, *FM 100-103, Army Airspace Command and Control in a Combat Zone*, was written prior to the end of the Cold War. It is important to recognize the mere age of the manual does not invalidate the concepts of the manual itself, but points out a review of the doctrine is necessary. *TRADOC Pamphlet 525-72, Army Airspace Command and Control (A2C2)*, concurs with this assessment by noting "TRADOC and Army proponents should update and revise all doctrinal

publications and tactics, techniques, and procedures manuals that pertain to this concept."[5] It further defines the need to update A2C2 doctrine due to specific changes taking place in the management of airspace.

TRADOC Pamphlet 525-72 highlights three reasons compelling a re-evaluation of A2C2 doctrine at this time.[6] The first reason is the increase in complexity of managing airspace in a joint and multi-national environment. The second reason is the sheer increase in the use of airspace for military purposes (e.g. the dramatic increase in the number of Unmanned Aerial Vehicles used). Lastly, it identifies the increase in information technology and how technology may impact the management of airspace.

Unfortunately, as the operational concept for A2C2, *TRADOC Pamphlet 525-72* does not provide any substantive analysis of whether the current doctrine is adequate. It merely addresses the need to update A2C2 doctrine in view of the changes it describes. However, since its publication in June of 1996, there has been no significant analysis of whether the current A2C2 doctrine remains adequate for the Army into the twenty-first Century or not.

The ramifications of an ineffective airspace control system on the battlefield are enormous and potentially affect all battlefield operating systems. The negative effects of poor airspace control fall into two general categories. There is always the possibility of fratricide. Equally important, is the inability to achieve the benefit of a particular weapon system because of the fear of fratricide. Both can adversely effect mission accomplishment.

History is replete with catastrophic fratricide incidents that occur due to

poor airspace command and control. Robert Barrow commented in the March-April 1990 issue of *Air Defense Artillery*, "in World War II, during the Sicily campaign, the Allied Air Forces suffered terrible fratricide losses in an attempted airborne operation. Of the 144 planes participating in the assault, 23 never returned and 37 suffered severe damage as a result of friendly fire."[7] Unfortunately, fratricide is still a problem facing today's Army. During the Brigade Task Force XXI rotation at the National Training Center in 1997, only one Longbow Apache was shot down – a result of fratricide.[8] In both cases, procedural control was used. Can the Army afford the loss of a single weapon system or life due to fratricide given today's limited resources?

An equally important issue, is the inability to get fires at the time and place needed due to the fear of fratricide. Too often, units cannot receive indirect fire, not because an air platform is in the way, but because the firing batteries do not know where the air platforms are. There are numerous examples within the past several years, where artillery batteries were prohibited from firing during live fire exercises at the National Training Center because they were unsure of where the aviation units were.[9]

Due to the potentially negative effects of poor airspace management, A2C2 is an Army issue and not just an Army Aviation issue. The mismanagement of airspace can equally effect the soldier on the ground as well as the soldier in the air. Consequently, A2C2 is an Army issue and not merely an Army Aviation issue as recognized by the fact that the proponent for A2C2 is the Combined Arms Center and not the Aviation Center. A sound doctrinal basis for

A2C2 is the first and most important step in managing airspace for the good of the entire Army.

In determining the validity of procedural control as the primary basis of A2C2 doctrine, this monograph is divided into three major sections. The first section addresses what current A2C2 doctrine is and why it came to rely on procedural control. It also provides the framework for understanding how procedural control fits into the overall Army Air-Ground System (AAGS) and the other joint airspace management systems.

The second section examines the Army's adherence to current A2C2 doctrine and in particular, procedural control. Before evaluating the adequacy of procedural control in the next section, it is critical to understand what flaws, if any, are attributable to either poor organization, training, or equipping of the current A2C2 doctrine as opposed to any flaws of the doctrine itself.

The third section evaluates the adequacy of procedural control if it were properly organized, trained and equipped given today's force structure and technology. Although there does not exist any clearly established criteria to measure the effectiveness of A2C2 against, *TRADOC Pamphlet 525-5* provides the closest measure of what our future doctrine should do. This section measures the adequacy of procedural control against four criteria:

1. Is procedural control compatible with joint operations?
2. Does procedural control adequately allow for inter-connectivity within Army and joint systems?
3. Is procedural control adequate for current battle command

systems?

4. Is procedural control adequate for operations with higher tempos?

Finally, the monograph concludes with the answer to the question of whether the Army should continue to rely on procedural control as the basis for its A2C2 doctrine. While the paper will not provide a definitive solution to problems identified, it will recommend the direction in which A2C2 doctrine should move in order to meet the changing environment.

The environment in which the Army operates is changing, and in order for the military to be the most effective, our doctrine must adapt to those changes. This not only requires us to refine our current doctrine, but also to question the very validity of its' underlying basis. Such an evaluation of procedural control as the basis for A2C2 doctrine is warranted.

CHAPTER TWO
CURRENT A2C2 DOCTRINE AND ITS PERCEIVED PROBLEMS

Doctrine provides the foundation for how the Army intends to wage war.[10] Often though, what the Army intends to do does not materialize. The theory behind the plan does not translate into reality. A2C2 doctrine often does not translate into execution as it was intended.[11] Before evaluating the adequacy of procedural control as the basis for A2C2 doctrine, a thorough understanding of current doctrine, as well as its perceived problems, is needed. This chapter provides the answer to how the Army intends to conduct airspace command and control: the theoretical basis for A2C2 doctrine. In doing so, it answers two basic questions: what is current A2C2 doctrine and what are the perceived problems associated with it?

In answering those questions, this chapter is divided into four major sections. The first three sections define A2C2 doctrine in terms of its purpose, its general design and an explanation of why the Army came to rely on procedural control. The last section of this chapter describes perceived shortcomings of A2C2 doctrine as described by the Army.

A2C2 doctrine affects all battlefield operating systems. Consequently, doctrine affecting A2C2 is found in numerous manuals. The capstone A2C2 manual, *FM 100-103*, *Army Airspace Command and Control in a Combat Zone*, is currently under revision.[12] For the purpose of clarity, all references to doctrine are to approved doctrinal publications unless otherwise noted.

The Purpose of A2C2

Army Airspace Command and Control is defined in *FM 100-103* as "those

actions that ensure the synchronized use of airspace and enhance the command and control of those forces using airspace."[13] Unfortunately, the definition does not clearly state the real purpose of the A2C2 system. It provides the "method" of enhanced command and control, but not its ultimate "purpose". A better definition of A2C2 is found in *FM 101-5-1, Operational Terms and Graphics*. It defines A2C2 as "the Army's application of airspace control to coordinate airspace users for concurrent employment in the accomplishment of assigned missions."[14] This definition provides a valid "purpose" for the system.

Effective airspace command and control is not an end unto itself. How well the United States military can synchronize airspace has no intrinsic value, it is merely a means to an end. The ultimate purpose of A2C2 is how effective use of airspace can contribute to mission accomplishment. *Joint Publication 3-52, Doctrine for Joint Airspace Control in the Combat Zone*, acknowledges this by noting "the primary objective of combat zone airspace control is to maximize the effectiveness of combat operations."[15] The term combat operations, implies not only those actions taken in the air, but those operations on both the ground and in the air. Therefore, A2C2 doctrine must be viewed in the larger context of how it affects all combat operations.

If the current Army Chief of Staff, General Eric Shinseki, is correct, the Army will always fight as part of the joint system and more often than not as part of a combined system as well.[16] This necessitates the need for Army doctrinal concepts to be nested with joint doctrinal concepts. Therefore it is critical to understand how the A2C2 system fits into the larger joint airspace management

system and with other countries.

The main purpose of A2C2 doctrine is stated in *Joint Publication 3-52*: to maximize the effectiveness of combat operations, including combat operations in a joint environment. It is within this general framework that the adequacy of the doctrine itself will be evaluated in the next two chapters.

What is A2C2 Doctrine?

A2C2 doctrine is just one component of a much larger doctrinal concept. The United States Military's joint airspace management system is known as the Theater Air Ground System (TAGS). TAGS is comprised of the different service airspace management systems: the Air Force's 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).[17] Each system is independent but based on the same general principles. There is however, one distinct feature separating the Army Air-Ground System from that of the other services: the primary method of airspace control.

Airspace doctrine, at all levels, recognizes two basic ways of controlling airspace: positive control and procedural control. All services identify and execute, a combination of both methods of airspace control. However, within each service, one method of airspace control takes primacy. The Army relies primarily on procedural control as the basis for its doctrine[18] while other services rely more heavily upon positive control for theirs.[19] It is important to realize that it is incorrect to solely identify procedural control with the Army and positive control with the other services. Both methods of airspace control are used by all

services to a certain extent. Each method tends to complement the other resulting in a better overall A2C2 system. However, primary reliance on either positive or procedural control significantly impacts each service on how it conducts operations.

Procedural control is defined as "a method of airspace control which relies on a combination of previously agreed on and promulgated orders and procedures."[20] The previously agreed upon procedures normally take the form of graphical control measures (e.g. air corridors, Minimum Risk Routes, or Fire Support Coordination Measures). Operations orders, unit Standard Operating Procedures (SOP) and Airspace Control Orders (ACO) serve as some of the previously agreed upon orders which place those graphical control measures into effect. To be most effective, procedural control measures require all members of the combined arms team adhere to agreed upon orders and procedures.[21]

Positive control is defined as "a method of airspace control that relies on positive identification, tracking, and direction of aircraft within an airspace, conducted with electronic means by an agency having the authority and responsibility therein."[22] The nature of positive control implies several things. It implies the need for a technical system capable of identifying and tracking airspace users. Ground and airborne radar stations are the most common means used to meet this requirement. The definition also implies a command and control structure that is robust enough to direct airspace users. This not only includes a C2 structure capable of monitoring the execution of airspace users, but also the capability to rapidly change missions of airspace users who are in-

flight. Positive control is generally a more precise method than procedural control, but it requires more resources to execute.

A2C2, the airspace management system component of the Army Air-Ground System, is what dictates the Army's reliance on procedural control.[23] Both the doctrinal foundation and physical assets make up the A2C2 system ensuring the Army coordinates its various airspace users in support of combat operations.

Procedural control is doctrinally founded on the use of standardized graphic control measures. Fortunately, the operational graphics the Army uses to implement procedural control are well established within both the joint and Army communities. There are a few redundant graphics; for example, a Low Level Transit Route (LLTR) is essentially the NATO name for a Minimum Risk Route (MRR), but overall the established set of graphics is common and detailed enough to allow the commander the flexibility to accurately convey his intent.[24] It is through the staff that commanders execute A2C2.

The operations officer is the primary staff officer responsible at all Army levels for A2C2. To accomplish this task, there are designated positions from the battalion through corps level, albeit the number of soldiers dedicated to A2C2 functions is not robust.[25] Often, A2C2 is only one part of the officer's responsibilities. Even at the division level there are only two officers authorized to manage A2C2 functions.[26] A2C2 is executed within the operations communications nets. In theory, because A2C2 graphics are common among all battlefield operating systems, they preclude the need to operate a separate

communications net. The Army's reliance on procedural control allows it to maintain the lean A2C2 infrastructure.

The other services rely primarily upon positive control. Aircraft are identified, tracked and directed while in-flight. Procedural control is used as an incremental measure, substituting for positive control when control centers abilities have been degraded.[27] Positive control allows the other services a greater degree of direct awareness over their airborne assets. It also requires a more robust command and control network to maintain that span of control.

Joint doctrine explicitly states that both methods of airspace control are necessary.[28] This statement is not a reflection of what is preferred, but what the "component, joint, and national capabilities and requirements" are.[29] Joint doctrine's preference is "to fulfill the objective of positive control as much as possible."[30] If this is the case, why does the Army rely on procedural control?

Why the Army Relies on Procedural Control

There are valid reasons why the Army relies primarily on procedural control while the other services primarily rely upon positive control. The differences are due to the missions the aircraft from the different services perform. The Army relies on procedural control for three reasons: technical limitations, manning limitations, and information dissemination limitations.

The reliance on procedural control for technical reasons is not so much of a penchant for procedural control, but the inability to maintain positive control over airspace users. The vast majority of Army airspace users are helicopters who doctrinally fly below the coordinating altitude. The definition of positive control requires the identification, tracking and direction of aircraft by electronic

means. At the altitudes that Army helicopters fly, current electronic means cannot maintain line of sight communications with them throughout the depth of the battlefield.[31] The Army is driven to primarily rely on procedural control due to the current limitations of technology. Given the organic equipment within the Army, positive control is not a realistic option.

In times of constrained manpower, the Army has opted to keep the staffing of A2C2 to a minimum. The size of the staff devoted to airspace control functions between the Army and the Air Force is huge. Currently, to support the entire active Army of ten divisions there is only one active Air Traffic Control Battalion. In contrast, the Air Force maintains many squadrons that perform the air traffic control function.[32] Reliance on positive control requires additional staff and resources, a bill that the Army chooses not to pay. By relying on procedural control, the Army keeps the number of personnel performing A2C2 functions relatively small.

Lastly, the Army's reliance on procedural control is due to its information dissemination limitations. Operating from field locations with limited communications nets (when compared to the Air Force operating out of fixed bases), the Army cannot pass information fast enough to everyone who needs it. The use of standard procedural control graphics enables the Army to overcome its information dissemination limitations.

The Army adopted procedural control out of convenience and necessity. Even if it was technically possible to adopt positive control, the bill to pay in terms of resourcing the force was too high. Procedural control met the basic needs of

the Army given current technical limitations. This does not imply that procedural control is without its limitations. As mentioned in the introduction, the majority of the Army views the current A2C2 system as ineffective.

Perceived Deficiencies of A2C2

In reality, the Army's execution of A2C2 does not meet stated requirements. Too often the Army is incapable of massing combat power or its effects, due to problems with airspace control. As noted, there are three basic reasons cited for ineffective A2C2: A2C2 doctrine is not well understood, the Army fails to resource the A2C2 system, and the Army fails to adequately train A2C2 procedures. There is however, a fourth reason for A2C2's ineffectiveness: the doctrinal differences between procedural and positive control.

A2C2 doctrine does not fully comply with joint doctrine. Joint doctrine firmly establishes the need for a single Airspace Coordination Authority (ACA), who is usually also the Joint Force Air Component Commander.[33] The ACA establishes the airspace control procedures used in the area of operations. Joint doctrine further states that all aircraft are required to comply with the procedures that the ACA establishes in the airspace control order. However, current A2C2 doctrine does not fully recognize this requirement. Consequently, the Army often fails to adhere to the joint procedures established.

The Army often views the coordinating altitude, a procedural control measure used to separate fixed and rotary wing aircraft, as the separation between positive and procedural control.[34] Below the coordinating altitude, the majority of airspace users belong to the Army, while above the coordinating altitude, the majority of airspace users belong to the other services. Regardless

of the common perception of the coordinating altitude as a demarcation line, it has no basis in doctrine. The joint definition of the coordinating altitude is not meant to separate the type of control used, but rather fixed wing aircraft from rotary wing aircraft. The current definition specifically allows for both Army systems (e.g. UAV's or electronic collection aircraft) to operate above the coordinating altitude while under procedural control and for other service's airspace users to operate below the coordinating altitude while under positive control. These gray areas are precisely where A2C2 is ineffective.

There are valid reasons why the Army adopted procedural control as the basis for its A2C2 doctrine. Conversely, there are equally valid reasons why the other services adopted positive control as the primary basis for their airspace management doctrine. Regardless, the A2C2 system is not as effective as it should be. As noted by the Army, too often A2C2 does not meet the objectives it was designed to do -- maximize the effectiveness of combat operations. The next two chapters examine the reasons why it does not live up to its requirements. Chapter II examines whether the problems identified in this chapter are due to the Army's organizing, training, equipping or execution of the doctrine, while chapter III looks at the adequacy of the doctrine itself.

CHAPTER THREE
DO WE PRACTICE WHAT WE PREACH?

> *"...but the basic problem* [with A2C2] *isn't doctrine. The doctrine should work, but doesn't and the primary reason it doesn't is that we don't make it work."*[35]
>
> *- CPT Valle*

Captain Valle's criticism of the A2C2 system is based on an implied assumption: current doctrine is fully adequate to meet the needs of the Army. By

making that assumption, he asserts that it is the failure of the Army to apply its own doctrine that is the source A2C2's inadequacies. The distinction between our inability to apply doctrine and the doctrine itself being inadequate has profound implications. The former implies that the solution is within sight and we only have to figure out how to get there while the latter implies that we do not even know what the solution is.

Captain Valle's criticism is representative of the majority of the Army's opinion on what is wrong with the A2C2 system. Articles and studies written since the Cold War are founded in the belief that the doctrine is sound, and it is only the Army's inability to properly apply the doctrine that leads to an inefficient A2C2 system.[36] The predominant view is that there is a distinct difference between what A2C2 doctrine calls for and how it is actually implemented.

A2C2 is designed as a complete system. *FM 100-103* defines the A2C2 system as the arrangement of the A2C2 staff elements of each command echelon, from the maneuver battalion through Theater Army.[37] This definition is short sided. The system not only includes the structure of the personnel, but also the physical equipment used and training that those personnel receive. This is important because the organization, training and equipping of the system is in large part based on the doctrinal method of airspace control used.

Before analyzing the adequacy of A2C2 doctrine itself, it is crucial to understand if the current inadequacies are due to the doctrine itself or merely our inability to apply it. Does reality reflect A2C2 doctrine? Does the Army make good on that which doctrine espouses, or does it fail to meet the mark? *Title 10,*

United States Code provides the mission for the Army. It states that the Army "shall be organized, trained, and equipped primarily for prompt and sustained combat...."[38] Each of these functions provides the foundation for how the Army executes missions. This chapter evaluates how well the Army adheres to its own A2C2 doctrine using the statutory requirements to organize, train and equip its forces. Finally, the chapter examines if the Army executes its doctrine as designed.

Does the Army Organize A2C2 in Accordance with Current Doctrine?

The Army cannot reasonably expect the A2C2 system to work if it is not organized to meet the requirement. The concept of organization in regards to the A2C2 system includes two components. The first component is where A2C2 elements are located within the Army structure. The second component deals with the composition of the A2C2 elements. This section examines the requirement for the Army to organize the A2C2 system as well as the Army's ability to meet that requirement.

Airspace management effects the entire battlefield. Consequently, doctrine establishes the requirement for A2C2 elements in the entire Army structure.[39] Every level of command from the maneuver battalion through the Theater Army contains an A2C2 element on its staff. This organizational structure allows for airspace management elements throughout the depth of the entire battlefield, but focuses the majority of the elements for units that operate in the Main Battle Area, where airspace management is the most difficult.[40]

The A2C2 organizational structure is not purely limited to the A2C2 elements on the staff though. Other units and staff sections are part of the A2C2

system. Air defense units are integrated into the A2C2 system at the Division and Corps level. Doctrine also calls for an air traffic service battalion at the Corps level. Even the Army's interface to the Joint Force Air Component Commander (JFACC), the Battlefield Coordination Detachment (BCD), conducts airspace management functions. While not a robust organizational structure, doctrine does prescribe an airspace management element at all levels from the maneuver battalion up.

There are however, two exceptions where the Army fails to structurally organize the A2C2 system as doctrine prescribes. First, doctrine implies that each corps should have an air traffic service battalion under its control. Here reality does not replicate the requirement: of the five active Army Corps, there is only one active Air Traffic Control (ATC) Battalion. This does not pose a large problem though since ATC Battalions mostly provide positive control -- the method of control that the Army does not rely upon.[41] The second organizational shortcoming is the failure to dedicate an A2C2 element at the Division Tactical Command Post as described in *FM 100-103*.[42] Instead of providing a specific A2C2 element, the Army relies on the other staff sections to execute A2C2.[43] With only these two minor exceptions, the Army's structure reflects current doctrine.

Doctrine does not specify the number of personnel assigned to A2C2 elements, but doctrine does drive what functions the A2C2 elements are supposed to perform. The Army's doctrinal reliance on procedural control allows for a lean infrastructure of personnel dedicated to perform A2C2 functions. Use

of common graphics enables all staff sections to accomplish airspace management instead of relying on a large A2C2 element.[44] The Army's manning authorizations for units, the Modified Tables of Organization and Equipment (MTOEs), reflect this.

As a result of the Army's reliance on procedural control, the manning that MTOE's provide for the A2C2 structure is lean. At the battalion and brigade level, an S-3 Air is responsible for performing airspace management functions. At the Division, there is the assigned G-3 Air as well as an airspace management officer. The Corps provides a more robust A2C2 staff. The intent for the Army is to have an individual responsible for assisting the commander with the control of the airspace. At all levels the use of procedural control relies on other staff members to plan and execute A2C2 functions. The theory is appealing due to its relatively low cost, but does it actually work?

There is no consensus about whether the size of the A2C2 elements is adequate. Some previous studies found that the limited number of personnel specifically dedicated to perform A2C2 functions is inadequate.[45] Other studies indicated that it is not the number of dedicated personnel that is inadequate, but their level of training that is inadequate.[46] However, all studies do agree that regardless of the number of positions, the location of A2C2 elements within the Army structure is correct. Overall, the Army meets its charter to organize the force with respect to A2C2.

Does the Army adequately fill the A2C2 element positions that doctrine calls for? The answer to this question is difficult to answer. The Army does not

have the ability to track individual assignments to A2C2 positions. This is partially due to there not being an Additional Skill Identifier (ASI) associated with either A2C2 positions or personnel. Previous studies did not examine the level to which A2C2 positions are filled relative the strength of the entire unit.[47] However, it is reasonable to expect that commanders will try to fill their authorized positions to the best of their ability.

Does the Army Adequately Train A2C2?

To organize the A2C2 system with personnel is not enough to meet the Army's mission. Included within the Title 10 responsibility is the requirement to train its forces. While this task is broadly stated, it includes the responsibility for training the A2C2 system. Establishing an operating system is one thing, but training the system to work as it was designed to is another.

The Army recognizes three types of training. *FM 25-100*, *Training the Force*, identifies individual, collective, and leader training as the basis for all Army training programs.[48] Each element is an essential part to achieve combat ready units. For the system to operate as designed, training at all levels must occur. This section examines the Army's ability to meet its training requirements outlined in doctrine.

Individual training is the first step in training a system. It is the precursor to training at the collective level. It is unreasonable to expect that soldiers can make the system work without any explanation of what the system is. Typically, individual training includes both formal and informal training.

The Army does not offer a formal training course on A2C2. Elements of A2C2 are included in both the officer basic and advanced courses of several

branches, but neither level of education provides adequate training on A2C2.[49] Historically, the preparatory formal training course for individuals walking into a position with A2C2 responsibilities was the joint Air-Ground Operations School (AGOS).[50]

The Army's demand for personnel trained in A2C2, exceeds the ability of the school system to produce graduates. The ten active Army Division's battalion and brigade level A2C2 positions results in an annual requirement for training over 150 new soldiers per year. Unfortunately, "there are just not enough slots to populate Army staff and headquarters with school trained personnel."[51] This shortfall leads to a serious formal training deficiency on A2C2 procedures. Worse yet, there is no correlation between attending the formal training and assignment to a position that deals with A2C2.[52] Consequently, the result is that "of S3 and G3 air officers...most cannot perform A2C2 duties immediately upon reporting for duty."[53] This lack of formal training results in the Army relying on informal On the Job Training (OJT).

On the Job Training is not an effective means for training personnel on A2C2. One reason why OJT does not work is that the Army's guide for A2C2, *FM 100-103*, lacks the necessary tactics, techniques and procedures for what specific actions and products an individual must take or produce.[54] Another reason is that despite the title of S-3 Air, often other duties take primacy over A2C2.[55] The net effect is that by the time an individual learns their job, they rotate on to other positions and the cycle is repeated to the detriment of the unit.[56]

A2C2 is a system. There is no one piece that can be fully trained without replicating the whole system as it would work in actual combat operations. It is because of this that the Army must also accomplish A2C2 training at the collective level. *FM 25-101*, *Battle Focused Training*, identifies this by listing "train as combined arms and services team" as one of the Army's training principles.[57] Does the Army meet this collective level training requirement?

The overwhelming opinion is that the Army fails to adequately train A2C2 at the collective level. Even at the National Training Center, arguably the premier collective training center for tactical units, A2C2 is not practiced. NTC trends indicate that many units do not even make any effort to "coordinate the use of airspace."[58] Worse yet, the same trends have been observed almost every year. The other training centers show similar results. The question then becomes why?

One reason for units deciding not to train A2C2 is that it is simply hard. Major Haynes writes in the *Field Artillery Journal*:

> One of the most significant challenges of mechanized combat is synchronizing combat power throughout the depth and breadth of the battlefield...the division must synchronize its efforts both horizontally an vertically and draw upon every resource available to engage and defeat the enemy in all areas of the battlefield.[59]

The applicability of A2C2 across all Battlefield Operating Systems make it one of the most difficult, yet necessary, to synchronize. The more complex the system, the harder it is to replicate.

The A2C2 system is hard to train because it is hard to bring all of the elements together. Due to the diverse nature of the division organization, it

requires a divisional level exercise to train the whole A2C2 system, because only at the division level and above, are all the BOS's represented. Due to financial and spatial limitations, the Army does not train this way. In today's environment, a division cannot train every element simultaneously; the type of collective training required to fully exercise the whole A2C2 system.

Even when elements smaller than a division conduct training where airspace management is required, there is relatively no penalty for failing to exercise it.[60] Multiple Integrated Laser Engagement System (MILES) sets are routinely available to armor/mechanized and infantry units for home station training. However there are too few MILES kits for helicopters, or no kits at all for some airspace users, for use at home station. This provides a false sense of actual combat conditions and decreases the need for an adequate A2C2 system.

Other than doctrinal manuals, there is no requirement to train A2C2 as a system. The Army's Training and Evaluation Program (ARTEP) is a well-developed system that outlines the collective standard training objectives for similar type units. A review of several battalion level ARTEP manuals (tank and mechanized task force, cannon and rocket artillery, short range air defense and main support battalion) shows that there is little to no requirement to train A2C2.[61] Only the air defense battalion ARTEP manual contains any reference to airspace management functions.[62] This is despite all of these battalions having a stake in airspace management. Even the tank and mechanized task force, who has an S-3 Air assigned, does not have any airspace management tasks listed in its ARTEP manual.

Leader training is expected to enable commanders to meld individual and collective training together. Since A2C2 elements first appear at the battalion level, it is worthwhile to understand what training future battalion commanders receive on A2C2. The answer is that future battalion commanders do not receive any A2C2 training while in the pre-command course.

Despite the need, the Army has not codified the necessity to train A2C2 as it has for other requirements. While formal individual training exists, it does not meet the needs of the Army. There is little to no requirement to train A2C2 at the collective level and it shows in unit's performance at the combat training centers. Finally, leader training does not even address A2C2 in the formal preparation course for battalion commanders. In summary, The Army fails to train A2C2 in accordance with its doctrine.

Does the Army Adequately Equip its A2C2 System?

Current doctrine does not outline any specific equipment requirements for the A2C2 system. To that extent, the system does not have a dedicated communications net nor dedicated equipment.[63] All functions are accomplished on other existing nets (e.g. operations, fire support, air defense or intelligence) through the use of common graphic control measures. In the narrow sense, the Army equips its forces consistent with procedural control doctrine.

In the broader sense, the Army fails to equip its forces as required. One of the Joint Forces Land Component Commander's (JFLCC) responsibilities is to establish and maintain an interface with the Airspace Control Authority (ACA), normally the Joint Forces Air Component Commander (JFACC), and the integrated airspace control system.[64] There is no current system below the

Corps level that provides that interface between the Army's use of procedural control and the other services use of positive control.

To meet this equipment shortfall, the Army is developing the Tactical Airspace Integration System (TAIS).[65] TAIS is still based on procedural control. Its use is intended to speed the dissemination of information, not change the method of airspace control. According to current fielding plans, TAIS will still reside at the division and higher levels.[66]

With the exception of the Army's marginal ability to interface with joint systems, the Army meets its mission to equip the A2C2 system. This is not so much due to what equipment is provided, but due to the lack of any special equipment required.

Does the Army Adequately Execute A2C2?

All of the problems mentioned lead to a failure to execute A2C2 as envisioned by doctrine. This is true within both the Army and joint environments. In each case the reality of our execution does not work as advertised.

Within a predominantly Army environment, like the National Training Center, even the units who do train A2C2 routinely fail to make it work as it was envisioned. Procedural control's reliance on graphics is more cumbersome than that explained by doctrine. It simply takes too long to copy and transport the graphics to everyone who needs them.

The failure to execute A2C2 as the doctrine calls for occurs at the joint level as well. A 1996 study of A2C2 claims that "repeatedly, the joint doctrine developed in peacetime to permit the interface of different airspace command and control systems is inadequate during actual combat operations and

exercises."[67] The operations in Kosovo with Task Force Hawk provide a perfect example.

Joint doctrine requires the Airspace Control Authority (ACA) to approve all procedural control measures used. This did not occur during the air campaign in Kosovo with Task Force Hawk. For the Kosovo, the JFACC also served as the ACA. The Army did not fully understand their requirements to have procedural control measures approved by the ACA. Likewise, the ACA did not concern itself with the airspace control measures implemented by the Army while it was training in Albania. In short, the Army did not want to have to deal with positive control procedures and the remainder of the joint community did not want to deal with the procedural control procedures that the Army established.

Summary

From the evidence it is apparent that the Army does not fully implement A2C2 the way that its doctrine is written. Failures in the Army's ability to organize, train, and equip the A2C2 system contribute to the Army's inability to execute it as prescribed by doctrine. Almost every study since the Cold War ended, highlights this finding. However, it is wrong to prematurely attribute the failure in executing A2C2 to these problems.

Finding fault with our ability to execute doctrine does not validate the doctrine itself. This chapter only showed that our failure to apply current doctrine is part of the perceived problems with A2C2. It does not prove whether the doctrine, if applied as written, can meet the needs of Army. The next chapter looks at the validity of the doctrine, assuming that it is properly organized, trained, and equipped to meet the needs of the Army on future battlefields.

CHAPTER FOUR
THE THEORETICAL ADEQUACY OF PROCEDURAL CONTROL

If the Army did organize, train and equip the A2C2 system as current doctrine calls for, will the A2C2 system meet the demands of the Army? Will reliance on procedural control enable the A2C2 system to succeed on future battlefields? It is important to answer this question in the theoretical sense, because if the answer is no, then doctrine needs to look at other alternatives to solve the problem. Tomorrow's conflicts will be different than the conflicts of today. The Army, as part of the joint force, cannot afford to prepare to fight the conflicts of today; it must prepare to fight the conflicts of tomorrow.

TRADOC Pamphlet 525-5, Force XXI Operations, provides the best guidance as to what the future battlefields will resemble. The manual defines the environment that the Army will fight in during the next century. There is no guarantee that TRADOC's view of the world is correct, but it is the basis for how the Army should prepare itself. The Army has structured its Advanced Warfighting Experiments around the types of battlefields that the manual foresees. It is from this vision of the future that the adequacy of procedural control should be evaluated.

TRADOC Pamphlet 525-5 and its related manual *TRADOC Pamphlet 525-72, Army Airspace Command and Control*, prescribe the environment in which A2C2 will have to operate. Neither manual lays out an explicit set of criteria, but there are common themes within each that the adequacy of procedural control as the basis for A2C2 should be addressed against:

1. Is procedural control compatible with joint operations?

2. Does procedural control adequately allow for inter-connectivity within Army and joint systems?
3. Is procedural control adequate for current battle command systems?
4. Is procedural control adequate for operations with higher tempos?

This chapter examines the adequacy of procedural control against each of these criteria given today's force structure.

Is Procedural Control Compatible with Joint Operations?

General Shinseki's view that virtually all future military operations will be joint in nature is stated as a certainty in *TRADOC Pamphlet 525-5*. It states that "early twenty-first century American land operations will be fully integrated, completely joint...."[68] If the Army is to successfully operate in a joint environment then its doctrinal base must be compatible with that of the joint community.

The definition of joint operations is fairly broad. *Joint Publication 1-02* defines joint operations as "a general term to describe military actions conducted by joint forces."[69] Consequently, procedural control must be evaluated to see if it is compatible with all joint operations. *Webster's Third New International Dictionary* defines compatible as "capable of existing together without discord or disharmony: non-contradictory."[70] Does the Army's reliance on procedural control contradict with joint operations?

Joint air operations rely more heavily on positive than procedural control.[71] However, joint doctrine fully recognizes the need for a combination of positive and procedural control.[72] All joint, as well as the individual service manuals,

state that the optimum method of airspace control is a combination of both.[73] Additionally all services actually use both methods in airspace management. Both methods of control can be and are used simultaneously in the same airspace. There is no inherent conflict between the two systems.

Procedural and positive control complement one another. The inherent failures of one are offset by the benefits of the other. Procedural control offers a low technology backup method of airspace control in the cases where the higher technology positive control system has failed. Conversely, positive control provides real time situational awareness to the airspace management system. It is only when one method of control is used exclusively that the two systems conflict.

In 1993 two Army Blackhawk helicopters were shot down during Operation Provide Comfort by friendly fire. A contributing factor to the incident was the failure to integrate positive and procedural control measures.[74] Had the Army complied with the positive control measures required, and had the Air Force aircraft recognized the procedural control measures (flight plans) used by the Army helicopters, the incident may never have occurred. To be effective, all airspace users must understand all airspace control measures being used.

The Army's reliance on procedural control is compatible with joint operations as long as two conditions are met. First, the Army recognizes that its procedural control measures are approved by the ACA so that they can be disseminated to all airspace users. Lastly the joint community must adhere to current doctrine requiring the need for both positive and procedural control.

Does Procedural Control Adequately Allow for Inter-connectivity within Army and Joint Systems?

In order to operate in the joint environment, the Army recognizes the need to have systems compatible with joint systems. *TRADOC Pamphlet 525-5* identifies this need for the future battlefield, calling for "joint, multinational and interagency connectivity."[75] Does the Army's use of procedural control enable compatibility with joint systems?

Joint doctrine cites the need of a single individual, the Airspace Control Authority, to control all airspace in the Joint Operations Area. Because all airspace is doctrinally controlled by the ACA, joint doctrine also requires the ACA to approve all airspace control measures. This includes procedural control measures used by the Army. This doctrinal requirement drives the necessity for there to be a timely interface between the Army and joint systems.

Since procedural control measures are agreed upon orders and procedures, then it is imperative that distribution of orders and procedures is timely during the course of combat operations. To solve this information dissemination problem, the Army and joint community relies on automation systems. It is the inter-connectivity of these information systems that is crucial to the success of the A2C2 system on the future battlefield.

The primary system used within the joint community for airspace control is the Contingency Theater Automated Planning System (CTAPS). Although this system will be replaced within the next several years, CTAPS is the system on hand today.[76] It is through CTAPS that the Army must interface all of its A2C2 requirements. The task is immensely complex when one considers that every

single air corridor or other procedural control measure used by any Army system must doctrinally be approved by the ACA. Without virtually seamless inter-connectivity between automation systems, the sheer volume of information can potentially render the joint airspace management system ineffective.

Army automation systems currently do not interface well with the joint community. *TRADOC Pamphlet 525-72* highlights the Army's current inability to meet these interface requirements:

> The current A2C2 system does not provide the ARFOR commander the capability to interface his requirements with those of other airspace users. This lack of inter-connectivity within the Army – from the lowest to the highest levels of command – currently prevents synchronized operations.[77]

The Army's current automation systems that effect A2C2 are the Maneuver Control System (MCS), the Advanced Field Artillery Tactical Data System (AFATDS) and the FAADC2I. None of these systems fully interface with CTAPS.[78] Consequently, some manual conversion is required at locations where CTAPS and the Army systems are co-located.

Currently there are two places where the interface between CTAPS and the Army systems occur. The first is at the Corps level – the lowest level where there is a CTAPS terminal within the Army structure. The second is at the Battlefield Coordination Detachment, the Army's liaison element in the Air Operations Center. The problem is that with so few places where interface can occur, the results are that many procedural control measure are used and implemented without the ACA and the rest of the joint community ever knowing about them.[79]

Even within the Army systems the automation interface is not seamless. For example, MCS only has the ability to use some of the procedural control measures that *FM 100-103* and *FM 100-5-1* define. Of the procedural control measures that are used within MCS, not all of them transfer to either AFATDS or the other ATCCS systems.[80] Within the past several years the Army has made dramatic improvements to increase the connectivity of its automation systems, but the bottom line is that many procedural control measures still have to be transmitted in an analog fashion to those who need it.

To solve the A2C2 automation interface problem, the Army began development of the Tactical Integration Airspace System (TAIS) following Desert Storm. TAIS is intended to interface the A2C2 functions of all the Army's Tactical Command and Control Systems as well as with CTAPS. TAIS is still in the testing phase, but is scheduled for fielding in 2001.[81] If successful, TAIS will go a long way to meet the required interface levels between Army and joint systems.

It is clear that the Army is working towards inter-connectivity with its own automation systems as well as with joint systems. However it is also clear that the Army's automation systems do not yet provide the seamless inter-connectivity required for the use of procedural control measures.

Is Procedural Control Adequate for Current Battle Command Systems?

The Army places a high degree of emphasis on a leader's ability to look at situations and execute the appropriate actions to achieve military objectives. The leader's ability to accomplish this task is known as battle command. Battle command has two components – decision making and leading.[82] Each component is vital to the commander's ability to achieve success. Does reliance

on procedural measures enable the commander to exercise battle command more effectively?

Doctrine describes the concept of visualization as one of the key aspects of commander's ability to exercise battle command. It is through visualizing the battlefield that the commander makes decisions and leads forces. Procedural control measures enable this process. Previously agreed upon graphical control measures that can be placed on a map are relatively easy to visualize on the battlefield. They provide a basic framework to reduce the myriad of airspace users into a relatively few, easily conceptualized mental models. From this aspect, procedural control measures aid in the commander's ability to visualize the battlefield and exercise battle command.

TRADOC Pamphlet 525-5 expands the implications of visualizing the battlefield. It specifically calls for the need for commander's to visualize the battlefield in the same way. It is no longer acceptable for individual commanders to have a good view of the battlefield, it is imperative that all commanders "share a common, relevant picture of the battlefield scaled to their level of interest and tailored to their special needs."[83] The new concept of battlefield visualization is the result of both the technology now available and the threats that the Army may face. Unfortunately, the benefits provided by procedural control measures in conceptualizing the battlefield do not enable commanders to see a common relevant picture.

Procedural control measures do not allow commanders to see the true picture of the battlefield. They only allow commanders to see what should be a

picture of reality, not what reality actually is. This occurs for two reasons. First, despite the best intentions, airspace users sometimes must deviate from procedural control measures due to changes in the tactical situation. Procedural control measures do not easily allow for commanders at all levels to recognize these deviations and disseminate them in time to be effective. Secondly, procedural control measures do not provide commanders an accurate picture of the situation in respect to time. For example, a commander may know that there is an active air corridor in his sector, but he may not know exactly when or if aircraft will actually fly through it. The result is that procedural control measures do not enable a truly common relevant picture.

The Army Battle Command Systems are supposed to enable commanders to achieve this common relevant picture. Unfortunately, the ABCS systems sometimes exacerbate the problems instead of solving them. On numerous occasions during the Brigade Advanced Warfighting Experiment at the National Training Center commanders made decisions on what the ABCS computer screens showed, in spite of having other information that indicated the screen displays were wrong.[84] ABCS systems allow for rapid distribution of procedural control measures, but degrade from a commander's ability to visualize the battlefield when situations change.

Procedural control helps commanders conceptually understand the battlefield. However they also serve as a potential hindrance in maintaining a common relevant picture with other commanders.

Is Procedural Control Adequate for Operations with Higher Tempos?

Field Manual 101-5-1, Operational Terms and Graphics, defines tempo as

"the rate of military action."[85] The Army believes that on the future battlefield, "tempo will grow in importance."[86] The degree to which tempo may increase is not well defined, but is assessed as being higher than the rate of military action today. If the Army organizes, trains and equips the A2C2 system as designed, will its reliance on procedural control allow for operations with higher tempos?

TRADOC Pamphlet 525-5 identifies higher tempos as the result of an increased threat and the Army's desire for simultaneous operations. As threat capability increases, the Army recognizes the need to increase its capability as well. The method the Army is pursuing is transforming the current force into a knowledge-based force.[87] By understanding the situation better, the Army can then make more timely and accurate decisions than its opponents. The Army is also espousing simultaneous operations. Not a revolutionary concept, but the implications are still profound. As more and more operations are conducted simultaneously, the requirement to analyze the situation and make decisions in a time-constrained environment becomes more important.

The ability of procedural control measures to adequately support operations with higher tempos is marginal. If there is no change in the situation during the course of the operation, then procedural control measures are adequate. It is when the situation changes that makes procedural control inadequate. This is not due the nature of procedural control itself, but rather to the ability of the current A2C2 system to disseminate the changes in procedural control measures necessary to meet the new situational requirements.

Disseminating procedural control measures is a time consuming process.

From the multiple units that can nominate measures, to the approval process by the ACA to the final dissemination of the approved procedures simply takes time.[88] ABCS enables this process to occur more rapidly than before, but fails to meet the requirement.[89] The procurement of TAIS is one example of the Army's realization that ABCS does not meet the requirement.

Procedural control measures are not incompatible with operations of higher tempo. However, the current A2C2 system makes procedural control measures inadequate in higher tempo operations where the environment changes. The speed that changes must be disseminated to all members of the combined arms team outpaces the ability of the current system to accomplish this task.

Summary

Of the four criteria that the Army's reliance on procedural control was examined against, procedural control only meets one. Procedural control is fully compatible with joint doctrine. There are however shortcomings in the ability of procedural control to meet the other three. Of those that it failed only one, the adequacy of procedural control in relation to current battle command systems, is a failure of the doctrine. The remaining two criteria, inter-connectivity and higher tempo operations, are failures of the current A2C2 system that implements procedural control.

This chapter examined the adequacy of procedural control itself against future requirements. It showed that there are shortcomings in both the doctrine itself and the current ABCS system that implements that doctrine. The last chapter draws conclusions and identifies potential solutions to address the

shortcomings of procedural control.

CHAPTER FIVE
CONCLUSIONS AND RECOMMENDATIONS

If *TRADOC Pamphlet 525-5* is a prediction of the future, then it is proving to be an accurate prediction. Many will argue that it is a self-fulfilling prophecy since the same institution that wrote the document is also partially responsible for how the Army will fight future conflicts. Those critics are correct, but it does not change the fact that the types of operations that the pamphlet describes are coming to fruition.

It is almost a forgone conclusion that the Army will operate in a joint environment. The change in the Army from a forward-deployed force to a power projection force reinforces the concept of future conflicts being joint conflicts. Additionally, the conflicts in the Balkans and Southwest Asia indicate that the U.S. Army will also operate within a combined environment more often than not. Fighting within a joint and combined environment also raises numerous challenges.

One of the largest problems that U.S. forces have experienced in the past decade is the inter-connectivity of its systems between services and even more importantly between the U.S. military and our allies. A lack of inter-connectivity between systems defeats their intended purpose. In the case of the U.S. military, a lack of inter-connectivity sometimes increases the force structure required in order to enable the other services or nations to be compatible. Inter-connectivity and compatibility must be a goal for all airspace coordination systems, including A2C2.

A2C2 is not immune to these changes taking place. The recent events in

Kosovo illustrate this point. During the course of the conflict, the issues of joint doctrine, inter-connectivity, and battle command came to the forefront. These issues were compounded by the increased tempo of the operation. Robert Wall noted in Aviation Week that "one of the most serious issues has been coordinating air activity in the very narrow airspace for Operation Allied Force."[90] Within a relatively short period of time, Kosovo enumerated the deficiencies in the A2C2 system against the backdrop of the type of operation that *TRADOC Pamphlet 525-5* describes as the future of warfare.

The experience of Task Force Hawk during Kosovo indicates that the current A2C2 system does not fully meet the needs of the Army. Task Force Hawk had difficulty in coordinating airspace control measures with the Combined Force Air Component Commander (CFACC).[91] This difficulty led to increased tension between the services over airspace control. This is just one example of why the A2C2 system needs evaluation.

Conclusions

Despite a changing environment, the Army should continue to rely on procedural control as the basis for the A2C2 system for two basic reasons. First, the majority of the problems associated with procedural control could easily be fixed if the Army adhered to its current doctrine and were to make minor changes to fully comply with joint doctrine. Secondly the Army does not have the resources necessary to rely primarily on anything other than procedural control today. Nor is it foreseeable that the Army will have the resources to implement sweeping changes in the future. Given the available resources, procedural control provides the commander an adequate solution to airspace control.

Procedural control measures provide a relative freedom of action for Army airspace users to react to changing situations. With proper usage, procedural control can "enhance the commander's flexibility, reduce coordination requirements, and create an environment that enables commanders to execute combat activities without undue delays."[92] Procedural control measures also ensure compatibility with not only the other services, but those of allied nations as well. Positive control measures are resource intensive. Procedural control measures offer a low cost and redundant method to accomplish the same mission of airspace control.

No matter how well executed, procedural control methods have limitations that cannot be completely overcome though. Reliance on procedural control measures will not allow the commander to achieve a common relevant picture of the battlefield as *TRADOC Pamphlet 525-5* calls for. It is also unlikely if the dissemination of procedural measures will ever be able to fully keep pace with the higher tempo of operations envisioned for future conflicts. There are certain limitations of procedural control that must be addressed in order to establish the optimal A2C2 system.

Previous recommended solutions to fix the shortcomings for A2C2 are unacceptable. The 1990 study entitled the *Adequacy of Army Airspace Command and Control on the Airland Battlefield* called for increases in personnel, equipment and time dedicated to perform the A2C2 mission.[93] The 1993 *Army Airspace Command and Control Action Plan for Issue Resolution* also called for the same solutions.[94] The problem is that the recommended solutions

are all means to improve procedural control. Unfortunately, even if the resources called for were available, they could not solely overcome the inherent problems associated with procedural control.

There is little debate that the resources that these studies called for would help alleviate the problems with A2C2 if the resources were available. Since the publication of these studies, the Army has seen a decline in personnel. Additional personnel and training time may be a viable solution to alleviate some of the deficiencies of A2C2, but it is not a realistic one. The Army should look towards different solutions to fix the problems associated with A2C2.

Any failure of procedural control does not imply that positive control meets the requirements of A2C2 for future operations. Positive control was not examined in the monograph and no conclusions should be drawn against it.

Recommendations

The Army should continue to rely primarily on procedural control methods for its A2C2 system. While there are limitations to procedural control measures, they still provide the best method of airspace command and control given the Army's current resources. The cost of relying on positive control measures is prohibitive given the current structure.

The Army should update its doctrine to comply with joint doctrine. Over the past several years, joint doctrine has matured. The Army needs to update its doctrine to reflect the changes made within the joint community. The Army is moving in the right direction. A new *FM 100-103* will be released within the next year. This new document alleviates many of the conflicts between joint and previously published Army doctrine.

The Army should begin to examine incorporating more aspects of positive control into its method of airspace control. The ultimate execution of procedural control methods can be improved, but only to a limited extent. Certain aspects of positive control may fill the void.

One possible aspect of positive control that could be incorporated into the A2C2 system is electronic tracking of airspace users. Digitization provides today's force a method of incorporating some advantages of positive control without the force structure overhead of full positive control. Near real tracking of airspace users (through the use of self position reporting devices) was demonstrated with some success at the National Training Center during the Brigade Advanced Warfighting Experiment.[95] This however was a relatively sterile environment, and may not turn out to be the panacea to fix A2C2. Further study is needed, but the requirement for commanders to have full situational awareness still exists.

The environment that the Army operates in has changed since the end of the Cold War, but the Army should continue to rely on procedural control as the basis of its A2C2 system. Procedural control methods alone cannot meet the demands of the Army as envisioned by *TRADOC Pamphlet 525-5*, but they do provide a sound basis for airspace management given today's resources.

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Hawley, Kenneth, Captain, Observer Controller at the National Training Center. Interview by author, 18 November 1999. Fort Irwin, California. Telephonic interview, Fort Leavenworth, Kansas.

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ENDNOTES

[1] Valle, Hector, "Army Airspace Command and Control," *Air Defense Artillery*, March-April 1993, 27. Captain Valle's comments are representative of all literature reviewed. Many articles and studies varied as to the cause of why A2C2 does not work well, but none dispute that A2C2 has many problems.

[2] Bruce G. Burroughs et al., "Army Airspace Command and Control (A2C2): Action Plan for Issue Resolution," (Fort Leavenworth, Kansas: Command and Control Directorate, U.S. Army Combined Arms Command, 1993). This is the most recent comprehensive study on the adequacy of the A2C2 system. Its comments reflect the 1987 version of *FM 100-103, Army Airspace Command and Control in a Combat Zone*. The other comprehensive study on A2C2 since the publication of FM 100-103 is: Dennis D. Cross and Wayne T. Nelson, "Adequacy of Army Airspace Command and Control on the Airland Battle" (United States Army War College Military Studies Program Paper, U.S. Army War College, 2 April, 1990). It contains similar observations and recommendations.

[3] U.S. Department of the Army, *Field Manual 100-5, Operations* (Washington D.C.: U.S. Government Printing Office, June 1993), 1-1. The manual provides other purposes for doctrine in addition to how the Army will conduct war. However, the definition used is the first listed in the manual.

[4] U.S. Department of the Army, *TRADOC Pamphlet 525-5: Force XXI Operations: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-First Century* (Fort Monroe, Virginia: U.S. Army Training and Doctrine Command, 1 August 1994), 1-1.

[5] U.S. Department of the Army, *TRADOC Pamphlet 525-72: Army Airspace Command and Control (A2C2)* (Fort Monroe, Virginia: U.S. Army Training and Doctrine Command, 1 June 1996), 7. Written as a supplement to *TRADOC Pamphlet 525-5*, this document largely focuses on the technical aspect of what the A2C2 system will have to accomplish in the Twenty-First Century. Other than defining both positive and procedural control, and that the A2C2 system uses both, the manual does not provide any guidance as to which direction the doctrine should head.

[6] Ibid., 2.

[7] Robert Barrrow, "A2C2 the Air," *Air Defense Artillery*, March-April 1990, 6.

[8] Although during NTC rotation 97-06 (TF XXI) allowed for automatic position reporting (essentially a form of positive control), the two Longbow Apaches were the only major weapon systems that did not have that capability.

[9] Kenneth Hawley, interview by author, telephone, Fort Irwin, Ca., 18 November 1999. CPT Hawley is a company/troop observer controller on the Eagle Team (aviation) at the National Training Center.

[10] *Field Manual 100-5,* 1-1.

[11] Rollie Edwards, interview by author, telephone, Hurlburt Field, Fl., 3 November 1999. LTC Edwards is the A2C2 representative at the Command and Control Warrior School at Hurlburt Field, Florida, formerly known as the Air-Ground Operations School.

[12] James Collins, interview by author, Fort Leavenworth, Ks., 30 June 1999. MAJ Collins is the primary doctrine writer for *FM 100-103.* The proponent for A2C2 doctrine is the Combined Arms Center at Fort Leavenworth. As of 3 November 1999, a coordinating draft was published to include comments from the Army element at the Command and Control Warrior School at Hurlburt Field, Florida.

[13] U.S. Department of the Army, *Field Manual 100-103,Army Airspace Command and Control in a Combat Zone* (Washington D.C.: U.S. Government Printing Office, June 1993), 1-1. The same definition is also used in *FM 100-103-1.*

[14] U.S. Department of the Army, *Field Manual 101-5-1, Operational Terms and Graphics* (Washington D.C.: U.S. Government Printing Office, June 1993), 1-11. There is no definition of A2C2 in *Joint Publication 1-02.*

[15] U.S. Department of Defense, *Joint Publication 3-52: Doctrine for Joint Airspace Control in the Combat Zone* (Washington D.C.: U.S. Government Printing Office, 1995), I-2.

[16] Eric K. Shinseki, "Address to the Eisenhower Luncheon" (speech presented to the 45th Annual Meeting of the Association of the United States Army, Washington D.C., 13 October 1999).

[17] *FM 100-103-1*, vii. TAGS is a relatively new concept and does not appear in the A2C2 capstone manual FM 100-103. TAGS is recognized in both joint doctrine as well as the new draft of FM 100-103.

[18] Ibid, 4-3. Other doctrinal manuals confer with this assessment. FM 71-100 also stresses the use of procedural control as the primary means. Past studies have found procedural control as the method used.

[19] Dave Howard, "Airspace Management" (powerpoint presentation to the Joint Doctrine Air Campaign Course: Center for Air Doctrine, Research and Education, Maxwell Air Force Base, Al, 28 October 1999). LTC Howard is the director of the JDACC course within the Center for Air Doctrine, Research and

Education.

[20] U.S. Department of Defense, *Joint Pub 1-02 Dictionary of Military and Associated Terms* (Washington D.C.: U.S. Government Printing Office, 1998). 357. The definition is the same in Army manuals.

[21] David Robinson and Charles Burke, "Fighting Maneuver and Fires in the Third Dimension," *Field Artillery*, April 1993, 13-14. The article articulates the dangers of not adhering to graphics and standard operating procedures used in procedural control.

[22] *Joint Publication 1-02*, 348. The definition is the same in Army manuals.

[23] *FM 100-103*, 2-4.

[24] Edwards, phone interview, 3 Nov 1999. LTC Edwards believes that the basic doctrinal reliance on procedural control is not only sound, but necessary to give commanders the flexibility that they would not otherwise have using positive control.

[25] Burroughs, et al., viii. One aspect of the study reviewed the current manning of the A2C2 system from the battalion through the Corps level. The study cited the lack of personnel, normally only one or two individuals through the division level, in the organizational structure as one reason for failure of the A2C2 system.

[26] United States Army Force Management Requirements Document Directive, *Consolidated TOE List: April 1999* (1999 [cited 1 November 1999]); available from www.usafmsardd.army.mil. Of the 10 active duty divisions, only the 101st Air Assault has a larger staff dedicated to perform A2C2 functions. All other divisions have two officers authorized in the G-3 Air section.

[27] William W. Collier, "Airspace Management Over the Battlefield: the Integration of Air Defense and Airspace Management" (Monograph, Naval War College, 1991), 2. LCDR Collier's comments are based primarily upon his experience with fixed wing aircraft.

[28] U.S. Department of Defense, *Joint Publication 3-56.1 Command and Control for Joint Air Operations* (Washington D.C.: U.S. Government Printing Office, 1994), II-5. *Joint Publication 3-52* also states the same need.

[29] *Joint Publication 3-52*, III-5.

[30] *FM 100-103-1*, 2-4. This does not imply that joint doctrine does not use a combination of both positive and procedural control. On the contrary, joint doctrine recognizes the need for both but in general prefers positive control over

procedural control.

[31] U.S. Department of the Army, "TRADOC Pamphlet 525-80: Army Aviation Warfighting Concept of Operation," (Fort Monroe, Virginia: U.S. Army Training and Doctrine Command, 3 August 1998) 3-3.

[32] Dave Howard, interview by author, personal, 27 October 1999.

[33] *Joint Publication* 3-56.1, II-4.

[34] Edwards, phone interview, 3 Nov 1999. LTC Edwards identifies the Army's lack of understanding of joint doctrine as one reason that the A2C2 is not as successful as it should be.

[35] Valle, "Army Airspace Command and Control," 28.

[36] U.S. Department of the Army, *National Training Center Trends, 2d Quarter FY 97* [journal on line] (Center for Army Lessons Learned, 2d Quarter FY 97 [cited 2 August 1999]); available from http://call.army.mil/call/ctc_bull/97-17/ta4n8.htm. The same observations were cited in the 2d Quarter FY 95 *NTC Trends.* Additionally, the same conclusions were reached by both major studies of A2C2 in the past nine years: "Army Airspace Command and Control – Action Plan for Issue Resolution" and "Adequacy of Army Airspace Command and Control on the Airland Battle".

[37] *FM 100-103,* 1-14.

[38] U.S. Government, "10 U.S.C. Section 3062," in *United States Code* (Washington D.C.: U.S. Government Printing Office, 1956). While not explicitly stated, the title 10 responsibilities are commonly referred to as the mission of the Army.

[39] *FM 100-103*, 1-15. Figure 1-2 shows how the Army's A2C2 system is organized, and where A2C2 elements should exist within the organizational structures.

[40] Dennis D. Cross and Wayne T. Nelson, "Adequacy of Army Airspace Command and Control on the Airland Battle" (United States Army War College Military Studies Program Paper, U.S. Army War College, 2 April, 1990). 20.

[41] *FM 100-103,* 2-3. The manual describes the role of the ATC battalion as providing primarily administrative support in the division rear area. It was already noted that the majority of the A2C2 system exists further forward in the Main Battle Area.

[42] Ibid., 1-15.

[43] *FM 71-100*, 3-25. The manual specifically states that there is no formal

A2C2 element at the Division Tactical Command Post.

[44] *FM 100-103*, 2-6.

[45] Dennis D. Cross and Wayne T. Nelson, 55. Their conclusion that the number of personnel are inadequate was based on the current equipment that the A2C2 system has. They concluded that the number of personnel would remain inadequate until new equipment is brought on line.

[46] Burroughs, et al., 4-13. This study also indicated that the number of personnel was inadequate, but that the primary reason for this was the lack of training received.

[47] Ibid. Neither this study nor the earlier study by Cross and Nelson specifically looked at manning levels. LTC Edwards from the Command and Control Warrior School at Hurlburt Field also commented that his organization does not track how many students from the school actually go to A2C2 positiions.

[48] U.S. Department of the Army, *FM 25-100, Training the Force* (Washington D.C.: U.S. Government Printing Office, November 1988) 1-6. Field Manual 25-101 also recognizes the same types of training.

[49] Barry Taylor, interview by author, personal, 22 OCT 1999. LTC Taylor is an Army instructor at Maxwell Air Force Base.

[50] The Air Ground Operations School located at Hurlburt Field is now named the Command and Control Warrior School. One of the courses, the Joint Fire Power Control Course was relocated to Nellis Air Force Base and another organization named the Air Ground Operations School was established there. Both schools provide training in A2C2 procedures in the joint enviroment.

[51] Edwards, interview by author, telephone, 3 Nov 1999.

[52] Burroughs, et al., vi. The study noted that there is no requirement for formal training identified with the A2C2 positions, nor does the Army provide an additional skill identifier or other means of tracking the individuals who have attended the course.

[53] Dennis D. Cross and Wayne T. Nelson, 37.

[54] Burroughs, et al., vi. This is one of the shortcomings addressed in the draft version of *FM 1001-103.*

[55] John Rosenfeld, "The S-3 Air: More Than an Airspace Coordinator," *Infantry*, November-December 1993, 13. LT Rosenfeld's article focused on all the tasks that the S-3 does in addition to being the S-3 Air. No where in the article does he mention the types of duties required to perform A2C2 operations. His article is representative of the many officers opinions that A2C2 is

unimportant.

[56] Michael Hollis, "Training for Aviators Performing G3 Air Operations and A2C2 Duties," *U.S. Army Aviation Digest*, May-June 1991, 33.

[57] *FM 25-101*, 1-4.

[58] U.S. Department of the Army, *National Training Center Trends, 2d Quarter FY 95* [journal on line] (Center for Army Lessons Learned, 2d Quarter FY 95 [cited 2 August 1999]); available from http://call.army.mil/call/ctc_bull/2ntc95/sec2ta4c.htm. The exact same trends appear in the 2d Quarter 1997 *NTC Trends*. The other Combat Training Centers report the same findings.

[59] Forest D. Haynes, "Synchronizing the Deep Fight," *Field Artillery*, April 1993, 21. MAJ Haynes article focuses on the necessity to synchronize the deep fight. He offers techniques to make a hard process more manageable.

[60] Barrrow, "A2C2 the Air," 9.

[61] U.S. Department of the Army, *ARTEP 71-2-MTP, Mission Training Plan for the Tank and Mechanized Infantry Battalion Task Force* (Washington D.C.: Department of the Army, 3 October 1988). A representative sample of ARTEP manuals was chosen. Other manuals that did not include any reference to A2C2: ARTEP 6-115-20-MTP (Field Artillery Cannon Battalion), ARTEP 6-525-MTP (Field Artillery Multiple Launch Rocket System Battalion), ARTEP 63-226-MTP (Main Support Battalion Light Infantry Division).

[62] U.S. Department of the Army, *ARTEP 44-115-MTP, Mission Training Plan for an ADA Battalion, Gun or Stinger* (Washington D.C.: Department of the Army, 10 February 1992). Out of all the ARTEP manuals looked at, only the ADA BN ARTEP manual had any task associated with airspace management. It contains a fairly good layout of the airspace management requirements.

[63] Burroughs, et al., ix. This study identifies the lack of specific communications equipment as an inadequacy of the A2C2 system. Since the study in 1993, there has been virtually no change in equipment provided to the A2C2 system.

[64] *FM 100-103*, 1-14.

[65] Bill Gregory, "Integrating Battlefield Airspace: New Army Air Traffic Management System Keeps the Skies Friendly," *Armed Forces Journal International*, September 1999, 32. TAIS was also used in the Division Advanced Warfighting Experiment in 1997 with poor results.

[66] Ibid., 32.

[67] Michael W. Drumm, "Army Airspace Command and Control (A2C2) and the Contingency Tactical Air Control System Automated Planning System (CTAPS): Is There a Joint Method to this Parochial Madness?" (Monograph, School of Advanced Military Studies, Second Term, AY 95-96) 4.

[68] *TRADOC PAM 525-5*, 3-21.

[69] *Joint Publication 1-02*, 258.

[70] Webster's, *Third New International Dictionary* (Springfield, Massachusetts: G. & C. Merriam Company, 1976) 463.

[71] *FM 100-103-1*, 2-4.

[72] *Joint Publication 3-52*, ix.

[73] Both Joint Pub 3-52 and 3-56.1 call for the need to utilize both positive and procedural control. Additionally, FM's 100-103 and 100-103-1 also call for the use of both positive and procedural control as the optimum measure of airspace control.

[74] James G. Andrus, "Aircraft Accident Investigation Board Report: U.S. Army Black Hawk Helicopters 87-260000 and 88-26060, Vol 1.," (Washington D.C.: Office of the Assistant Secretary of Defense News Release, 1994).

[75] *TRADOC Pamphlet 525-5*, 3-2.

[76] Howard, 28 October 1999.

[77] *TRADOC Pamphlet 525-72*, 3.

[78] Randall Rigby, "The FA and Air Attack Team," *Field Artillery*, May-June 1996, 1. MAJ Rigby's article specifically deals with the interface between AFATDS and CTAPS. Fred Lugo's article discusses the same issue with respect to FAADC2I.

[79] Kenneth Hawley, interview by author, telephone, 18 November 1999. He cites that rarely do units even know they are supposed to get approval for procedural control measures before implementing them.

[80] Fred Minnich, interview by author, personal, 23 November 1999. Mr Minnich is a contracted instructor for the Maneuver Control System at the Command and General Staff College at Fort Leavenworth. He has extensive experience with MCS and its connectivity with the other ATCCS systems.

[81] Gregory, "Integrating Battlefield Airspace," 32.

[82] *FM 100-5*, 2-14.

[83] *TRADOC Pamphlet* 525-5, 3-4.

[84] Stephen Ferrell, interview by author, telephone, 20 November 1999. Brigadier General Ferrell was the commander of the 4th Brigade, 4th Infantry Division during the Brigade Advanced Warfighting Experiment at the National Training Center in March of 1997.

[85] *FM 101-5-1*, 1-153.

[86] *TRADOC Pamphlet* 525-5, 3-19.

[87] Ibid., 3-18.

[88] *National Training Center Trends, 2d Quarter FY 97.*

[89] Fred Lugo, "If It's Broke, Fix It!," *Air Defense Artillery*, March-April 1993, 32.

[90] Robert Wall, "Airspace Control Challenges Allies," *Aviation Week and Space Technology*, 26 April 1999, 31. The article primarily focuses on the role of the Air Force in Kosovo but does include the problems associated with Task Force Hawk to include the airspace coordination issue.

[91] Mark McKearn, interview by author, survey, 27 November 1999. LTC McKearn is the commander of 5-158 Aviation, the V Corps Command Aviation Battalion. LTC McKearn's unit provided the Blackhawk and Chinook aircraft used by Task Force Hawk.

[92] Rollie Edwards, interview by author, telephone, 3 November 1999.

[93] Dennis D. Cross and Wayne T. Nelson, 55-58.

[94] Burroughs, et al., 4-4 and 4-5.

[95] Stephen Ferrell, interview by author, telephone, 20 November 1999.