THE FUTURE OF THE BRIGADE COMBAT TEAM: AIR-GROUND INTEGRATION AND THE OPERATING ENVIRONMENT

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The Brigade Combat Team is the primary tool for the U.S. Army to support combat operations around the world. As the future operating environment becomes continues to shift and change in both scope and requirements, the U.S. Army must assess current systems to determine their effectiveness. One essential system, air-ground integration, requires attention in order to identify capability gaps for Brigade Combat Teams in order to support future operations. In order to assess the current system, experiences from Vietnam, Operation Desert Storm, Afghanistan and Iraq help to identify future challenges to the operating environment. Once these challenges are assessed, they are compared with other identified future challenges related to enemy capabilities as well as increased multinational partnerships. Based on the current system, shortfalls are present in the Brigade Combat Team's effectiveness to execute air-ground integration and close air support due to demands in personnel and equipment for multinational interoperability. In order to correct this deficiency, the Army and Air Force need to develop a joint solution to produce a greater Terminal Attack Control capacity to support not only U.S. forces but also multinational partners.

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

THE FUTURE OF THE BRIGADE COMBAT TEAM: AIR-GROUND INTEGRATION AND THE OPERATING ENVIRONMENT, by MAJ Joab H. Cohe, 107 pages.

The Brigade Combat Team is the primary tool for the U.S. Army to support combat operations around the world. As the future operating environment becomes continues to shift and change in both scope and requirements, the U.S. Army must assess current systems to determine their effectiveness. One essential system, air-ground integration, requires attention in order to identify capability gaps for Brigade Combat Teams in order to support future operations. In order to assess the current system, experiences from Vietnam, Operation Desert Storm, Afghanistan and Iraq help to identify future challenges to the operating environment. Once these challenges are assessed, they are compared with other identified future challenges related to enemy capabilities as well as increased multinational partnerships. Based on the current system, shortfalls are present in the Brigade Combat Team's effectiveness to execute air-ground integration and close air support due to demands in personnel and equipment for multinational interoperability. In order to correct this deficiency, the Army and Air Force need to develop a joint solution to produce a greater Terminal Attack Control capacity to support not only U.S. forces but also multinational partners.

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ACRONYMS

AAGS	Army Air Ground System
ACO	Airspace Control Order
ADAM	Air Defense Airspace Management
ALO	Air Liaison Officer
ASOC	Air Support Operations Center
ASOS	Air Support Operations Squadron
ASP	Air Support Party
ATO	Air Tasking Order
ATP	Army Techniques Publication
BAE	Brigade Aviation Element
BCT	Brigade Combat Team
CAS	Close Air Support
CALL	Center for Army Lessons Learned
FAC	Forward Air Controller
FAC (A)	Forward Air Controller (Airborne)
FM	Field Manual
FO	Forward Observer
FSO	Fire Support Officer
JAGIC	Joint Air-Ground Integration Center
JFC	Joint Forces Commander
JFO	Joint Fires Observer
JP	Joint Publication
JTAC	Joint Terminal Attack Controller

MTTP	Multiservice Tactics, Techniques, and Procedures
NATO	North Atlantic Treaty Organization
SPINS	Special Instructions
TACP	Tactical Air Control Party
TAC	Terminal Attack Control
TACS	Theater Air Control System
TACS/AAGS	Theater Air Control System / Army Air-Ground System
TAGS	Theater Air Ground System
TTP	Tactics, Techniques, and Procedures

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CHAPTER 1

INTRODUCTION

Close Air Support (CAS) is a mission involving joint and multiservice aircraft providing lethal and non-lethal fires in close proximity of ground forces. The aircraft involved in these missions includes fixed and rotary wing aircraft as well as unmanned aerial vehicles and comes from any U.S. military service or multinational air components. The purpose of the mission is to support ground forces in close combat with the enemy through preplanned requests and extensive planning or immediate requests in response to changes on the battlefield.

The execution of CAS involves four aspects for effective air-ground integration: the planning of its use, the requesting of assets to perform the mission, the airspace coordination for those assets, and the final execution of CAS to support those tactical forces. These processes for the U.S. Army are performed primarily by the U.S. Air Force. Tactical air control parties (TACP) organic to the U.S. Air Force provide support to Army units to plan, request, coordinate, and control joint and multinational aircraft during CAS situations in combat and training. The current system which the CAS mission falls into is the Theater Air-Ground System (TAGS). Within TAGS are the Theater Air Control System (TACS) conducted by the Air Force and the Army Air-Ground System (AAGS) which work together as TACS/AAGS to plan, request, coordinate, and execute CAS in support of U.S. Army forces at the Corps, Division, Brigade, and Battalion level as part of the air-ground integration concept.

Background

Since the introduction of air power into the modern military, close air support to ground forces has been a specified mission. The concept of CAS first developed during World War I with aircraft providing strafing fires with newly mounted machine guns on enemy trench lines as well as dropping grenades and smaller ordnance. Aircraft were a new technology at the time which required experimentation in the aircraft's own abilities, the weapons use, as well as the system to execute CAS between the aircraft and the ground force. These missions were limited in both accuracy and communications between the aircraft and personnel on the ground.[1] Radio communications much like the development of aircraft were still in its infant stages limiting the ability to contact aircraft directly and make necessary adjustments to ground attacks.

The Army Air Corps continued to develop doctrine during the interwar period and used Field Manual (FM) 31-35, *Aviation in Support of Ground Forces* published in 1942 throughout World War II. FM 31-35 covered the key CAS elements of the air support mission and the air support party. The air support mission assigned aviation assets to support ground forces "where contact with the enemy is imminent or has already been established."[2] In order to execute the air mission, the army air corps created the Air Support Party (ASP).

The ASP requested aircraft and provided terminal attack control (TAC) to assets allocated to the ground force by the air corps component. The ASP consisted of one to two air support officers along with other personnel and equipment in order to maintain direct communications and control of aircraft in support of ground forces. Divisions were limited to less than six ASPs to disperse to lower echelons of the fighting force.

However, the doctrine established a restraint on the use of aircraft to only engage targets which could not be effectively and quickly reached by artillery.[3] This along with rules of engagement and asset availability made demand and reliance on aircraft significantly lower during World War II as compared to the modern force. The ASPs were not members of ground force elements but attached at the division level.[4]

Today, TACPs fill the role of their predecessor the ASP. The Air Force aligns and allocates specific TACPs down to the maneuver battalion level and includes teams at both the Brigade Combat Team (BCT) and division headquarters. At times TACP availability may only go down to the BCT level due to external requirements which place TACPs away from the division in order to support coalition forces or other missions. The new realignment of an Air Support Operations Squadron (ASOS) with each of the ten active duty Army divisions creates a direct support relationship where each ASOS establishes the Air Support Operations Center (ASOC) at the division level for combat operations.

Additionally, the division TACP links with the recently developed Joint Air-Ground Integration Center (JAGIC) within the division current operations integration cell. Together, the ASOC and JAGIC manage the division airspace as well as plan, request, coordinate, and execute CAS and other air missions in support of the division. Concerns arise with this new arrangement since the TACP support structure focuses on the ground force division composition and not that of the BCT or a lower echelon. With the operating environment becoming increasingly more joint and multinational centric, the Army's capacity for terminal attack control is limited in the execution of CAS. The BCT is the primary element in the deployment of Army ground forces for a wide range of

military operations. The range of military operations includes major combat operations against near-peer competitors, limited and counterinsurgency operations against lesser opponents and non-state actors, and peacetime operations such as humanitarian assistance and security force assistance. The Army does not possess an organic force joint terminal attack controller (JTAC) capability to provide TAC to joint and multinational aircraft nor the ability to provide observer support to multinational forces operating side by side during these missions.

Problem Statement

The Army's process for TAC relies exclusively on Air Force personnel external to the BCT to provide control and clearance for air assets creating a potential capability gap for the unit to provide joint fire support to ground forces.

Research Questions

The primary research question derived from the problem is: how will the Army address TAC capabilities for the BCT in the future? This question intends to focus on the how the current system to support ground forces, TACS/AAGS, operates and if it is sufficient for future operating environments. Advancements in weapons technology and the growth of electronic and cyber operations along with the growing capabilities of opposing forces, non-state organizations, and technologically sophisticated individuals creates a future battlefield with new unknowns for how the current TACS/AAGS system will operate. These challenges will require the Army to reevaluate its air-ground and TAC structures. Four secondary research questions assist the primary to determine if and

how the Army should address TAC capabilities in future operating environments based on enemy capabilities and other challenges.

1. Do Army ground forces require adjustments to the current air-ground systems to maintain combat effectiveness in joint and multinational environments? This research question determines if the current systems, TAGS and TACS/AAGS, remain effective in the more complex joint and multinational environments. To answer this question, a look at the Army's past experiences from the Vietnam War, Operation Desert Storm, and Operations Iraqi Freedom and Enduring Freedom provide examples of how the current systems resolve or fail to address concerns during those conflicts. All modern operations rely on joint or multinational forces to provide close air support as part of TAGS and TACS/AAGS, therefore, BCTs will receive CAS from numerous services and countries meaning the system must have redundancy, efficiency, and mitigate risk.

2. Is there a capability gap in the BCT structure for TAC and if so at what echelon? This question follows up on the previous secondary research question to identify if a capability gap is indeed present within the BCT. It focuses on current doctrine and structures to identify how the system meets the four functions of planning, requesting, coordinating, and executing CAS in support of ground forces. Other services and multinational forces place JTACs as low as the company level. The current memorandum of agreement between the Air Force and Army attempts to provide a single JTAC down to the company level, but establishes the requirement as "TACPs will have a minimum of two JTACs for each corps, division, brigade combat team, and maneuver battalion."[5] This creates an assumption that there is a potential capability gap requiring further investigation.

3. How do joint and multinational forces address air-ground integration and TAC capabilities and should the Army adopt the same or similar approach? As stated earlier, other services and countries structure their TAC systems differently. These systems will be assessed and compared to the current relationship between the Army and the Air Force.

4. How do the current and future operating environments differ and how do the new challenges affect the current TAGS and AAGS systems? New technologies and capabilities create new challenges for the Army and the military as a whole. These new challenges require responses and adjustments to how the Army fights. The new challenges will be compared with the current systems in order to validate the systems' effectiveness or identify potential shortfalls.

In order to answer these questions, a review of current Army and Joint doctrine will provide a foundation for how the BCT and the Army conducted air-ground integration and TAC in the past and in the current structure using qualitative research and the doctrinal foundation, examples from past operational environments will assist to identify if the current systems can address future requirements, potential threats and challenges.

Methodology

The proposed methodology using qualitative research is a case study methodology. The comparative case study does not include human subject research and focuses on past and current doctrine, after-action reports and commentary, and lessons learned. The case study evaluates examples and capabilities identified during the Vietnam War, Desert Storm, Operation Enduring Freedom and Operation Iraqi Freedom.

Additionally, Russian actions provide certain capabilities likely to affect future operational environments as well as multinational operations. The cases will be compared with capabilities of the current TAGS and AAGS systems to determine if these current systems answered past concerns based on the range of military operations and if they address and resolve potential future concerns. This methodology is relevant because it provides a format to analyze recent scenarios and test current Joint and Multinational capabilities against potential threats in future operational environments. Further internal assessment of Joint and Multinational capabilities versus recent scenarios will analyze their levels of redundancy, efficiency, and risk. The Cynefin framework provides a structure for these criteria to determine if the systems maintain a level of efficiency to allow for fluid execution in any future operating environment. The criteria established based on the desired domains for the systems are redundancy, efficiency, and risk mitigation.

Assumptions

The focus of the thesis is on the current operating environment in order to evaluate how the Army should address potential threats in regards to the air-ground systems which provide CAS in future operations. The assumptions are:

1. The Army will continue to use the BCT as its primary means to deploy and execute missions within the wide range of military operations.

2. The main areas of consideration are major combat operations (MCO) and limited counterinsurgency operations (COIN) because if a unit can address these forms of combat it can downgrade requirements to meet other operations as required.

3. National policies, priorities, and guidance from documents such as the National Security Strategy and the National Military Strategy will remain compatible with the new presidential administration.

4. Current Joint and Army doctrine remains suitable and feasible for future operations.

Definitions

Air Liaison Officer (ALO): The senior tactical air control party member attached to a ground unit who functions as the primary advisor to the ground command on air power.[6] The ALO is a position at every BCT and provides advisement to the BCT commander regarding the planning and execution of CAS. During execution of CAS, they provide airspace management and control of aircraft for the BCT along with the TACP.

Air Support Operations Center (ASOC): The principal air control agency of the theater air control system responsible for the direction and control of air operations directly supporting the ground combat element.[7] The ASOC directly supports the Division within the combat theater and the manning is generally provided by the Air Support Operations Squadron aligned with that Division at home-station.

Army Air-Ground System (AAGS): A component of the theater air-ground system, it provides for interface between Army and air support agencies of other Services in the planning, preparation, execution, and assessment of airspace use. It consists of airspace elements, fires cells, air and missile defense sections, and coordination and liaison elements embedded in Army command posts.[8]

Forward Air Controller (FAC): An officer (aviator/pilot) member of the tactical air control party who, from a forward ground or airborne position, controls aircraft in close air support of ground forces.[9] The FAC provides control of aircraft during the execution phase of CAS.

Forward Air Controller (Airborne) (FAC (A)): A specifically trained and quality aviation officer, normally an airborne extension of the tactical air control party, who exercise control from the air of aircraft engaged in close air support of ground troops.[10]

Joint Air-Ground Integration Center (JAGIC): Located within the Army division current operations integration cell, it provides commanders a technique to coordinate, integrate, and control operations in division-assigned airspace. It facilitates effective mission execution while reducing the level of risk.[11] A staff organization designed to enhance joint collaborative efforts to integrate and synchronize at the division level to allow rapid execution and clearance of fires and airspace.[12]

Joint Fires Observer (JFO): A trained service member who can request, adjust, and control surface-to-surface fires, provide targeting information in support of Type 2 and 3 close air support terminal attack control, and perform autonomous terminal guidance operations.[13] The JFO is an Army forward observer who provides the JTAC essential targeting information to conduct CAS but cannot directly control the aircraft during execution.

Joint Terminal Attack Controller (JTAC): A qualified and certified service member who, from a forward position, directs the action of combat aircraft engaged in close air support and other offensive air operations.[14] A JTAC is a member of the TACP

at the battalion, brigade, and division level and are the only individuals qualified to control aircraft during CAS execution.

Tactical Air Control Party (TACP): The principal air liaison unit collocated with ground maneuver units. It has two primary missions: advise ground commanders on the capabilities and limitations of air operations and provide the primary TAC of CAS. Members of the TACP include the ALO, JTAC, Intelligence Surveillance and Reconnaissance Liaison Officer, and Space Liaison Officer. The ALO at the battalion level is generally a specially trained and experienced non-commissioned officer or officer.[15]

Terminal Attack Control: The authority to control the maneuver of and grant weapons release clearance to attacking aircraft. JTACs located within TACPs at the division, brigade, and battalion level provide this capability to AAGS as the Army does not possess an organic capability.

Theater Air Control System (TACS): It includes all of the command and control related capabilities and activities associated with air, space, cyberspace, nuclear and agile combat support operations to achieve strategic and operational objectives.[16] Portions of TACS are directly embedded with AAGS. These include the ASOC, TACPs, and additional JTACs.

Theater Air-Ground System (TAGS): Combines each Service's command and control and airspace management system into a unified framework allowing each to contribute in a unified joint and coalition effort supporting the joint force commander.[17] Both TACS and AAGS along with other service systems create TAGS.

Type 1 Control: When the JTAC/FAC (A) requires control of individual attacks and the situation requires the JTAC/FAC (A) to visually acquire the attacking aircraft and the target for each attack.[18]

Type 2 Control: When the JTAC/FAC (A) must visually acquire the target or utilize targeting data from another asset with accurate real-time targeting information but still requires control of individual attacks.[19]

Type 3 Control: When the JTAC/FAC (A) requires the ability to provide clearance for multiple attacks within a single engagement, subject to specific attack restrictions. The JTAC/FAC (A) must visually acquire the target or utilize another asset with accurate real-time targeting information.[20]

Limitations and Delimitations

The research and analysis for the thesis focuses on the Brigade Combat Team and how it conducts CAS. This includes the systems for air-ground integration which requires planning, requesting, coordinating, and execution of CAS. The Army Division and Corps systems will be addressed in order to identify the overall structure of the system and how they are directly involved in assisting the BCT support air-ground integration and the CAS mission. The focus will be on Joint and Army Doctrine. The Air Force and Marine Corps only use Joint Doctrine for the execution of CAS. How Multinational forces, the Navy, and Special Operations forces conduct air-ground integration and terminal attack control will not be addressed extensively. Reports, commentary, and lessons learned will be used to build case studies for analysis on previously identified capability gaps and potential threats to limiting CAS capabilities across the force. The study will not use Classified or include For Official Use Only information. The limitation of only

unclassified materials will allow the thesis unlimited distribution and availability to the broadest range of readers.

Significance of Study

The topic of air-ground integration and TAC in the BCT is highly significant to current and future operations. It is significant because it focuses on a capability not organic within Army units and questions whether the capability is one needed for combat effectiveness in operating environments involving Joint and Multinational forces and air assets. Whether the mission is a major combat operation, limited or counterinsurgency operations, or peacekeeping, the BCT provides combatant commanders with a rapidly deployable capability which is then integrated with Joint and Multinational forces. The inability for the BCT to provide its own air-ground integration and TAC poses a potential capability gap affecting operations with Joint and Multinational assets as well as vulnerabilities opposing forces can exploit.

Summary

This introduction provided the background for air-ground integration and CAS and introduced the topic for further study and analysis. The primary and secondary research questions will be answered by the thesis and will enable the research and analysis to remain focused on the BCT and how it will address air-ground integration and CAS capabilities in the future. In order to fully understand the BCT and the capabilities provided to it through TACS/AAGS, a list of key terms and definitions clarify certain aspects of the system. Additional materials compare and contrast their effectiveness in comparison to the current BCT system. However, established limitations and

delimitations allow for the focus to remain on the BCT and not branch off into detailed investigations of other services and countries in their potential capability gaps nor in larger or smaller elements of the Army. Chapter 2 will provide a literature review of sources to include the Army and Joint Publications to identify and understand the past and current structures for the Army cross-service relationship with the Air Force in the TACS/AAGS relationship in the integration of air and ground forces. Additionally, chapter 2 will discuss the materials to introduce historical documents the author has consolidated in order to provide essential background and information for the case studies. Lastly, sources and materials from recent operations within the global environment will assist in constructing the futures aspects of the case studies by which analysis will take place to identify if there are any capability gaps in the current TACS/AAGS and if so provide recommendations to resolve them for future operations. Chapter 3 will combine qualitative research from the structures of the Army, Joint, and Multinational forces; reports, commentary, and lessons learned to build the case study and criteria for assessment based on a systematic approach. Chapter 4 will provide the analysis of the research discovered from Chapter 2U.S.ing the case study framework developed in chapter 3. The analysis will include comparing and contrasting how the current TACS/AAGS would execute CAS and respond to enemy countermeasures. Lastly, chapter 5 will provide conclusions and recommendations for the current BCT as part of the TACS/AAGS. Conclusions will discuss whether the current TACS/AAGS can meet future challenges and threats to both air and ground forces in CAS scenarios. Recommendations will discuss if the current system is adequate for the future or if capability gaps require essential improvements or changes to ensure protection of both air

and ground forces during the execution of CAS missions. Additionally, recommendations will include related topics for future research in order to strengthen the body of knowledge for BCT operations and overall air-ground integration.

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[1] John McGrath, *Fire for Effect: Field Artillery and Close Air Support in the U.S. Army* (Fort Leavenworth, KS: Combat Studies Institute Press, 2010), 49.

[2] U.S. Army, Field Manual (FM) 31-35, *Aviation in Support of Ground Forces* (Washington, DC: U.S. Government Printing Office, April 1942), 2.

[3] Ibid., 6.

[4] Ibid., 5.

[5] United States Army and United State Air Force, *Memorandum of Agreement between the United States Army and the United States Air Force for Army/Air Force Liaison Support* (Washington, DC: Headquarters, Departments of the Army and Air Force, March 2011), 4.

[6] Joint Staff, Joint Publication (JP) 3-09.3, *Close Air Support* (Washington, DC: The Joint Staff, November 2014), GL-8.

[7] Ibid.

[8] U.S. Army, Field Manual (FM) 3-52, *Airspace Control* (Washington, DC: Headquarters, Department of the Army, February 2013), 2-2.

[9] Joint Staff, JP 3-09.3, GL-10.

[10] Ibid.

[11] U.S. Army, Army Techniques Publication (ATP) 3-91.1, *The Joint Air Ground Integration Center* (Washington, DC: Headquarters, Department of the Army, June 2014), 1-1.

[12] Joint Staff, JP 3-09.3, GL-11.

[13] Ibid.

[14] Ibid.

[15] Ibid., II-6-7.

[16] U.S. Army, Army Techniques Publication (ATP) 3-52.2, *Theater Air-Ground System (TAGS)* (Washington, DC: Headquarters, Department of the Army, June 2014), 19.

[17] Ibid., 1.

[18] Joint Staff, JP 3-09.3, III-43.

[19] Ibid., III-45.

[20] Ibid., III-46.

CHAPTER 2

LITERATURE REVIEW

There are five significant literary areas for review for air-ground integration as it relates to the BCT and CAS. The first focuses on items of historical significance. In order to understand how the Army receives CAS from the Air Force, the origin of the Army-Air Force interrelationship requires exploration. Second, current national and service based policies and strategies create the direction for future operating environments for the U.S. military. Next, doctrine shapes how both the Army and Air Force execute their defined roles in support of the national policy and strategy. Doctrine provides the specified procedures and guidelines for how the Army and Air Force will support operations. Service and joint publications further advise how forces prepare for future challenges. Addressed within these publications also includes the doctrinal concepts of TAGS, TACS, and AAGS. The fourth area focuses on lessons learned, reports, and commentary from four major conflicts in order to build the case studies in order to compare the current doctrine with identified challenges. The last area includes after-action reports, commentary, and lessons learned from recent operating environments. This includes information gathered from the recent conflicts as well as other environments to build a body of knowledge to determine which requirements the BCT will need in order to defeat and counter enemy actions in the future.

CAS History

The history of CAS and air to ground integration comes in two forms. First is in past doctrine which includes FM 31-35, *Aviation in Support of Ground Forces*, from

1942. This doctrine provided the necessary guidance for CAS missions at the start of World War II. It also is the first time in which the support of ground forces by air assets is addressed for the Army to include the dissemination of ALOs and ASPs into divisions to coordinate and control CAS. The doctrine proved flawed and required adjustments. The next doctrinal shift came in 1943 with FM 100-20, *Command and Employment of Air Power*. Following World War II, in 1946 FM 31-35 was improved to become FM 31-35, *Air-Ground Operations*. The procedures established in this update were used for CAS throughout the Korean War. It also directly allocated ALOs at the Division and Regiment staff and created the TACP. The current doctrine has advanced drastically in terms of tactics, techniques, and procedures. Technology as well as a stronger joint relationship between services has enabled the production of joint and multiservice publications, standardizing certain requirements across all branches.

National Strategies and Policies

National strategies influence current and future objectives which when applied to the military create a focus, direction, or objective to meet. The strategies reviewed in order to understand where and how the U.S. government wants to fight in the current and future environments begins with the *National Security Strategy* from February 2015 and the *National Military Strategy* from June 2015. These two documents establish the strategy by which the government wishes to influence the global environment.

In order for the U.S. to successful influence the global environment, the military to include the Army and Air Force must develop their own approaches. One tool for doing so is the Quadrennial Defense Review which assesses the current state of the military in meeting its objectives and provides changes as required. For the Army, the

most recent document to provide guidance for the current and future environments is the *Army Campaign Plan* published in January 2017. The purpose of the Army Campaign Plan is to drive senior leader decisions, designate and integrate strategic efforts, and assess the Army's performance.

Army, Multiservice, and Joint Doctrine

Army and Joint doctrine provides the standards for air-ground integration. These doctrines establish the air integration relationship between the Army and Air Force. The major publications at the joint and multi-service level which establish the TAGS are JP 3-52, *Joint Airspace Control*, MTTP 3-52.1, *Airspace Control*, and MTTP 3-52.2, *The Theater Air-Ground System*. The Army identifies MTTPs 3-52.1 and 3-52.2 as ATPs 3-52.1 and 3-52.2 therefore avoiding any possible contradictions and making the documents fully accepted. Additionally, the Army uses FM 3-52, *Airspace Control*, to further integrate TACS and AAGS. These documents identify and establish the air-ground systems that the Air Force and Army use as part of any joint or multinational operation. CAS is a product of TAGS and TACS/AAGS in which aircraft are planned for, requested, and allocated to Army ground forces for execution by TACS elements within their formations.

The doctrine that specifically focuses on the CAS system is the same for both the Army and Air Force. In fact, all services recognize this same doctrine for standardization of CAS execution. Joint Publication (JP) 3-09, *Joint Fire Support* and JP 3-09.3, *Close Air Support*, provide the essential structure for how aircraft provide CAS through planning, requesting, coordinating, and controlling CAS missions. These publications establish and clarify the interrelationship between the Army and Air Force. Additional

publications within the Army establish the proper tactical procedures for executing CAS. Multiservice Tactics, Techniques, and Procedures (MTTP) 3.09.42, *Joint Application of Firepower (JFIRE)*, provides a quick reference guide for the tactics, techniques, and procedures for individual observers and controllers in conducting tactical CAS missions and is accepted throughout all U.S. military forces. Additionally, MTTP 3-01.4, *Joint Suppression of Enemy Air Defense (JSEAD)* provides techniques for suppressing or defeating enemy air defenses which then enables air assets to more effectively provide CAS to ground forces.

Air Force specific doctrine identifies the standards and expectations for how the Air Force supports the Army in air-ground operations. Their primary doctrine for air-ground integration and CAS is AF Annex 3-03, *Counterland*. It provides the framework for the execution of not only CAS but all air-ground operations in support of the Joint Force Commander. The second doctrine reviewed to provide any additional insights into the use of the Air Force in support of BCT operations is AF Annex 3-2, *Irregular Warfare*. This document provides a breakdown of how air-ground integration differs or is similar when conducting limited operations at a smaller scale than major combat operations. The Army doctrine which also discusses air-ground integration for limited operations is FM 3-24, *Insurgencies and Countering Insurgencies*.

The BCT possesses doctrine specific for its structure and execution. First and foremost is FM 3-96, *Brigade Combat Team*, which specifies the structure and functions of the BCT to include the breakdown for forces and differences between the Infantry Brigade Combat Team, Stryker Brigade Combat Team, and the Armored Brigade Combat Team. The primary doctrine for fire supporters within the BCT is ATP 3-09.42,

Fire Support for the Brigade Combat Team. Additional documents that create a greater understanding of air-ground integration for the BCT involve the division operations that directly support the BCT in the AAGS. The component of the AAGS that directly supports the BCT at the division level is the JAGIC. The documents which establish the JAGIC include ATP 3-91.1, *The Joint Air Ground Integration Center* and the Center for Army Lessons Learned (CALL) JAGIC Handbook, January 2017. The JAGIC doctrine, lessons, and best practices provide insights on how the AAGS above the BCT supports and affects the planning, requesting, coordination, and execution of CAS within the AAGS. It also shows some of the functions a BCT must also conduct for successful air integration, primarily CAS.

The publications address the doctrine for how the CAS system should operate, but they only focus on a single force relationship. The joint publications are followed by all U.S. services but they allow for a great deal of flexibility for how each service conducts operations. The JSEAD and JFIRE as well as ATP 3-06.1, *Aviation Urban Operations*, are approved and applied by all joint forces. Multinational ground forces outside of the U.S. Army also require CAS which means each entity has developed their own approach for conducting CAS. Most partner nations include North Atlantic Treaty Organization (NATO) Standardized Agreements with their own principles similar to the U.S. joint doctrine for conducting CAS. Whether a partner nation has adopted U.S. doctrine or not, differences in both language and digital systems difficulties in implementing TAGS and TACS/AAGS. This increases the demand on TAGS and TACS/AAGS to provide personnel to support partner structures during multinational operations.

Case Study Development

The first major document to identify key case studies for this thesis was *Case Studies in the Development of Close Air Support*, edited by Benjamin Franklin Cooling. This not only provided a broad history of the development of CAS but also provided the starting point for identifying how air-ground integration developed during the Vietnam War and Operation Desert Storm. These two major conflicts, while in the past, help to identify future challenges in the wide range of military operations. While Cooling provides the starting point for Vietnam and Desert Storm, the most recent conflicts in Iraq and Afghanistan still required a starting point. *Danger Close*, by Steve Call provides the initial starting point for the Iraq and Afghanistan portion.

CALL provides numerous documents, assessments, and after-action reports, and commentary to identify how air-ground integration operated during Vietnam, Desert Storm, Iraq and Afghanistan. The reports for Vietnam included lessons learned reports from both 1966 and 1970 discussing air-integration and further reports discuss the transition of authority to the home nation Vietnamese. Desert Storm documents provided include the TAIT Report primarily focusing on deep battle operations as they relate to air-ground integration as well as executive summaries from XVIII Airborne Corps and the Government Accounting Office which summarize the effectiveness of airpower during the conflict. Iraq and Afghanistan provide numerous newsletters, handbooks, and reports to review including the *Army/Air Force Integration Newsletter* as well as the Air Land Sea Bulletins. They provide insight into the air-ground integration challenges in Iraq and Afghanistan.

Additional readings discussed air-ground integration as part of firepower and while they providing key information for the development of the case studies, they also provides information for other aspects. Major General (Retired) Robert Scales produced two books, *Firepower in Limited War* and *Scales on War: The Future of America's Military at Risk*. Both provide insights into the effectiveness of fires to include air-ground integration during previous conflicts and also potential challenges for future operations. Lastly, *Grounded: The Case for Abolishing the United States Air Force,* by Robert Farley provides a unique perspective of the Air Force but goes into detail on aspects of previous wars. Additionally, the criteria used for his thesis influence the criteria for this case study methodology.

Future Environment

Information gathered from reports, theorists, and other sources identify key challenges to TACS/AAGS and CAS for future operations. Some of the theorists are mentioned in previous sections. To relate the case studies to the current and future environment examples from recent events in the Russia-Ukraine conflict and the Russian occupation of Georgian territories are assessed. The current environment's challenges include both friendly and potential enemy capabilities. The areas of focus are conventional weapons capabilities, the rise of electronic and cyberspace warfare, and joint and multinational operability.

Reports and commentaries from CALL include information from the publications *Electronic Warfare Smartbook* and *Multinational Interoperability*. Due to certain classification levels, opponent capabilities and systems only include unclassified, open

source articles for information. For conventional and non-lethal opponent capabilities, articles from the Air Land Sea Bulletin, the RAND Corporation, and online sources.

Primary sources provide insight into friendly capabilities in the current environment and how they may or may not change in the future. Sources from the 10th and 13th ASOS provide the current status of JTACs and the way ahead regarding training and competency. Training center reports and presentations from both the Joint Readiness Training Center as well as the National Training Center discuss the current status of the BCT regarding air-ground integration.

Through the use of reports, articles, and primary sources, the current and future environments are identified. This provides a greater understanding of what capabilities are necessary in order to succeed in the next conflict. The understanding of opponent and friendly capabilities allows a greater assessment of TACS/AAGS and identifies possible gaps in supporting the BCT.

CHAPTER 3

RESEARCH METHODOLOGY

The interrelationship between the Army and the Air Force within AAGS started with coordination and execution of CAS during World War I and continues to the modern day within the robust Theater Air-Ground System (TAGS) and within that the smaller Army Air-Ground System (AAGS) which directly supports the BCT. The interrelationship establishes itself during all overseas operations throughout the range of military operations when the Joint Force Commander (JFC) creates both land and air component commands. To assess the current system, AAGS, the case study methodology provides the best option for assessment. Case studies from previous major conflicts prove compatible to prepare for future conflicts by identifying capability gaps or possible similarities in the conduct of the operation. They will assist in assessing if challenges both friendly and enemy in the current and future environments require adjustments or additions to AAGS or if the current system succeeds in supporting the BCT.

The approach focuses on the use of current doctrine along with past experiences in order to identify required functions with the system of AAGS. A systematic approach is required to assess AAGS. The Cynefin framework provides the domains necessary for the system to succeed. The case studies assist this framework in identifying lessons learned regarding known and unknown variables in the system and whether the current doctrine already resolves them or still requires a solution. The development of three criteria to ensure AAGS remains an ordered system to support operations and then to assess these with the challenges of the future.

The criteria to identify success or shortfalls within each case study are redundancy, efficiency, and risk mitigation. The Cynefin framework is a systematic approach which helps leaders to "visualize and understand how the system operates within a variety of domains."[1] This framework helps to assess causal relationships within the AAGS to identify the simplicity or complexity of a challenge. There are desired domains which the AAGS wants to operate in are the simple and complicated ones. Figure 1 presents the Cynefin framework and how individuals within AAGS should approach decisions.

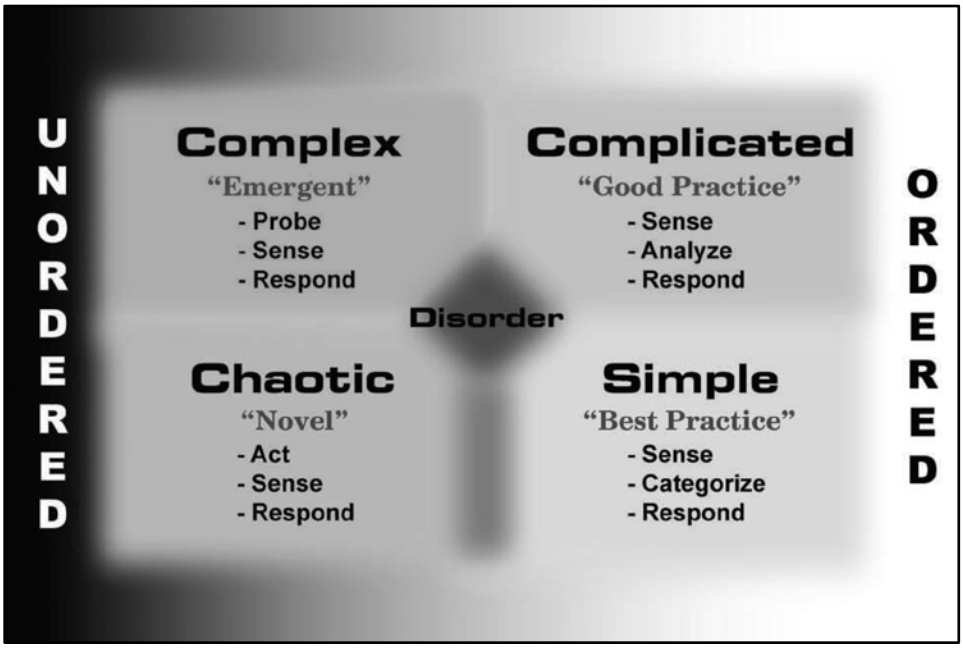

Figure 1. Cynefin Framework

Source: H. William Dettmer, *Systems Thinking and the Cynefin Framework* (Port Angeles, WA: Goal Systems International, 2011), 10.

In the case of the air-ground system of the Army and Air Force, the desired domain falls within the "ordered" spectrum either in the simple or complicated quadrants. The simple domain is when the system has "clear cause-and-effect relationships easily discernible by everyone" and the "variability of the environment is narrow."[2] This is better described with the term "known knowns" in which information is available and the individuals within the system have it. The complicated domain is a little more advanced. The information is available; however, the individuals within the systems have not found it yet as variability and uncertainty increased as compared to the simple domain.[3] This correlates to having procedures and responses in place, but the enemy has not yet affected the fight. Much like the blurred lines within the multi-domain battle between major combat operations and counterinsurgency operations, the line between simple and complicated domains are vague and at times problems pass between the two.

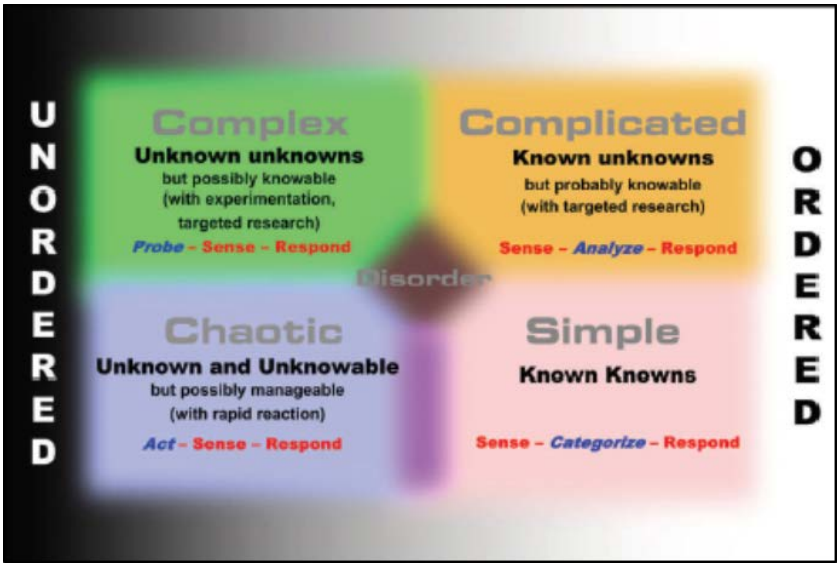

Figure 2. Cynefin Framework and State of Knowledge

Source: H. William Dettmer, *Systems Thinking and the Cynefin Framework* (Port Angeles, WA: Goal Systems International, 2011), 19.

The ability to have set practices, in accordance with doctrine, allows those involved through TACS/AAGS to successfully provide CAS to the BCT and stay within an ordered environment. Future challenges could push TACS/AAGS into an "unordered" situation and potential disorder at which point the system is broken. By avoiding complexity to the level of chaos or total disorder ensures the success of the BCT, TACS/AAGS, and the greater overall success of the operation. Redundancy, efficiency, and risk mitigation within TACS/AAGS and greater TAGS ensure that both the known and unknown challenges the Army and Air Force face are identifiable with set responses and contingencies.

To determine if the BCT has a capability gap in future warfighting, the use of the case study methodology using the defined criteria allows for past experiences to compare and contrast with future challenges to ensure that air-ground integration remains within an ordered state and that the challenges it faces remain simple or complicated where good or best practices provide solutions. It allows identification of system effectiveness or shortfalls regarding air-ground integration between the Army and Air Force during planning, requesting, coordination, and execution of CAS.

Future Environment

The future environment faces many unknowns regarding where, when, and at what level the conflict will occur. The military identifies the range of military operations which extends from major combat operations through security cooperation and deterrence.[4] Policies and doctrine identify the scope of operations the military must meet. The Army and Air Force develop their strategies based on guidance from the national political leadership of the President and Department of Defense. This guidance shapes the

policies for how and where the military engages in the current and future global environments as well as establishes the government's expectations for how the military conducts the operations. In general, the range of operations provides the knowns within all the branches of service which therefore can be extrapolated for knowns in response to AAGS and TAGS need to provide to the fighting force. The range of operations creates three general categories that case studies will address. They are major combat operations, counter-insurgency operations, and transition to host nation control. This allows a broad assessment of the range of operations that U.S. forces will face in the future environment. Over the last fifty years U.S. forces experienced all three situations.

Case Studies

The military prefers major combat operations and therefore are generally more prepared to conduct them. The level of intensity in major combat operations also allows forces for a more fluid drawdown of forces and systems to conduct smaller, limited operations. However, the past experiences show that major combat operations are few and far between. The case studies are the Vietnam War, Operation Desert Storm, and Operations Iraqi and Enduring Freedom. Desert Storm provides the effect of a major offensive operation against a conventional force while Vietnam provides one against a hybrid force shifting between conventional practices and those of an insurgency. It demonstrates the importance and effectiveness of airpower and also how CAS integrated into offensive and defensive operations. The Vietnam War also provides examples of the earlier developments in airspace control and management, therefore showing the capacity of TAGS and AAGS structures to transition between the two or providing for both simultaneously.

While the Vietnam War shows how TAGS and AAGS type structures operate in major combat operations it also shows the transition into the counterinsurgency environment. Additional examples focus on the more recent operations in Iraq and Afghanistan. They demonstrate how the structures within TAGS and AAGS provide CAS in the current environment. Additionally, more recent examples from Afghanistan as well as the end of the Vietnam War provide the transition from U.S lead counterinsurgency operations to host-nation control and security force assistance.

Future Challenges

Future challenges include both emerging new technologies, rising threats, and the growth of multinational and joint operations. The strategic environment over the next ten to twenty years will likely include criminal organizations, terrorists, state and non-state actors, insurgents, transnational groups, proxies, technologically empowered individuals, and paramilitaries. These elements will operate as regular, irregular, or hybrid forces.[5] This assessment identifies the known information for the future environment; however, there is still a great deal of uncertainty and unknowns regarding who the U.S. will fight and how they will do it.

Emerging technologies and threats create greater complexity and disorder to future warfighting because not only do they improve joint and multinational interoperability but also create friction and additional strains on the systems. These capabilities also improve the opposition's abilities to challenge U.S. and partner forces. These include technological advancements in conventional munitions along with electronic warfare and cyberspace capabilities. These new capabilities factor into the

overall effectiveness of TACS/AAGS and push what were previously simple and complicated problems with known solutions into disorder and the unknown.

Munitions in the future will provide not only greater accuracy but greater destructive effects on their targets. While this can have significant effects to ground forces, it creates catastrophic impacts to command posts and tactical operations centers. The ability for potential adversaries to locate and strike key command nodes impacts how the force disperses, maintains centralized control, and how TACS/AAGS coordinates and executes CAS in support of ground forces.

Electronic warfare and cyber capabilities provide advantages to U.S. forces as non-lethal effects against enemy forces. However, potential adversaries also have these capabilities. Their abilities include the use of both small and large offensive and defensive electronic warfare systems to deny friendly forces certain advantages on the battlefield. Cyber warfare capabilities are the most flexible from the standpoint that potential adversaries may come from anywhere. From states and non-state actors to terrorist organizations and self-motivated individuals, a cyber attack's origin and capacity comes from anywhere.

Both U.S. and multinational forces rely heavily on technology and with it numerous online systems and networks. From sovereign nations and non-state actors to terrorist organizations and self-motivated individuals, electronic and cyberspace attacks may originate from anywhere. This creates many unknowns within operating environments which require solutions in order for TACS/AAGS and other systems to run effectively. Future operations will rely heavily on these systems in order for

communications and information systems to function and directly impact the success of the operation.

Evaluation Criteria

The case study methodology takes historic examples to compare and contrast with the current system. AAGS which directly supports the BCT consists of four major functions. These functions are planning, requesting, coordinating, and executing CAS. Within these four functions is the need for order so the use of the Cynefin framework assists to establish the cause and effect relationship within the AAGS. Through an initial analysis of AAGS using the Cynefin framework, the criteria to assess each case study are redundancy, efficiency, and risk mitigation. The first two, redundancy and efficiency, come from the influence of Robert Farley.[6] While Farley uses them to support the argument to disband the Air Force, this thesis uses them to identify certain essential characteristics that the air-ground system requires.

The growing global environment creates numerous demands on U.S. forces to conduct a wide range of operations simultaneously. This means a demand for redundancy in having numerous forces capable of conducting the same tasks. This allows for contingencies and the ability to keep order within the system by providing established options rather than requiring massive changes. It also means efficiency from the standpoint that forces must conduct missions with the minimal number of forces based on additional requirements. Due to the specialized resources needed for TAGS/AAGS, the simplest question to ask is how to most efficiently disperse these resources to meet the demands of the current operating environment? Lastly, risk mitigation shapes how the force fights from the standpoint that CAS is in close proximity to friendly forces which

means that there are numerous risks to friendly forces and non-combatants during its execution. These three criteria provide the backbone to answering the question: does the BCT lack capability within the air-ground system?

Redundancy in regards to TAGS/AAGS means having enough specialized resources to meet the initial mission set as well as provide contingencies to ensure ground forces receive timely support. Organizational redundancy theory describes the use of redundant systems as "embedding key capabilities in several different military organizations in order to avoid failure."[7] The redundancy theory supports the notion that air-ground systems need to be joint and multinational in nature with all services and partners capable of providing all aspects. The current system and doctrine do not have fully redundant capabilities or even standard capabilities with other countries due to limited personnel and communications challenges. Based on the expectations of government policy it is absolutely essential to have this operability in order to conduct future operations.

Flexibility means that ability of the CAS system to adjust to the operating environment. Can the CAS system effectively support the BCT during any type of combat operation ranging from major combat operations through peacekeeping ones? It affiliates with redundancy by providing numerous approved solutions to resolve the challenges faced in providing CAS. It also links with the idea of simplicity when linked to the Cynefin framework. The Cynefin framework assists leaders in approaching challenges based on different environments.

Risk mitigation requires consideration in all current and future environments. This mitigation must occur to avoid fratricide of not only U.S. forces but those of the host-

nation and other multinational forces as well as civilians on the battlefield. In order for the TACS/AAGS to be successful it must maximize effectiveness in defeating the enemy while minimizing error.

Summary

The case study methodology linked with the Cynefin framework allows a strong assessment of air-ground integration in identifying knowns versus unknowns as it relates to TACS/AAGS supporting the BCT in future operations. There are four general functions that TACS/AAGS needs to meet to support the BCT. These four functions are planning, requesting, controlling, and executing CAS. The four functions exist within a system that requires order to succeed with systematic practices that must minimize sporadic changes. The system follows doctrinal and procedural practices with known effects within an environment that ranges from known to unknown. It relies heavily on set practices, knowns, in response to the environment, regardless of the level of understanding. In order for success and to counter the unknown portions of the environment the system must demonstrate redundancy, efficiency, and risk mitigation to overcome future challenges. Future, known challenges do not prevent uncertainty, but still allow for validation of TACS/AAGS to successfully support the BCT. These criteria allow for analysis of the system to support its capabilities and identify any shortfalls in order to develop conclusions and recommendations for improvements to TACS/AAGS in order to better support the BCT and other ground forces.

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[1] H. William Dettmer, *Systems Thinking and the Cynefin Framework* (Port Angeles, WA: Goal Systems International, 2011), 9.

[2] Ibid., 10.

[3] Ibid., 11.

[4] Joint Staff, Joint Publication (JP) 1-0, *Doctrine of the United States Military* (Washington, DC: The Joint Staff, March 2013).

[5] U.S. Army Training and Doctrine Command, *Operational Environments to 2028: The Strategic Environment for Unified Land Operations* (Fort Leavenworth, KS: Training and Doctrine Command G2, August 2012), 17.

[6] Robert M. Farley, *Grounded: The Case for Abolishing the United States Air Force* (Lexington, KY: University Press of Kentucky, 2014), 169.

[7] Ibid., 18.

CHAPTER 4

FINDINGS

This chapter discusses the findings in regards to air-ground integration and CAS based on the case study approach. The areas of interest for the findings include the current environment as driven by national level strategies and policies. The national level strategies and policies provide key information to establish "knowns" within the operating environment which the BCT and the air-ground system must provide for. The Army, Air Force takes these strategies and policies and modifies their doctrine in order to support the known requirements of the operating environment. The "knowns" from the current environment establish "good" and "best" practices in the form of tactics, techniques and procedures to conduct air-ground integration.

Next, case studies from the previous conflicts of Vietnam, Desert Storm, Afghanistan and Iraq will assess how these "good" and "best" practices developed and if they resolved previous challenges to air-ground integration and CAS. The case studies also allow for the identification of additional "knowns" within the environment. The findings show the existence of a capability gap within TACS/AAGS at the BCT level due to a lack of redundancy, efficiency, and risk mitigation which require additional manning in order to meet the challenges of the future environment.

National-Level Strategies and Policies

The current national strategies and policies provide the overarching guidance for how the BCT and AAGS meet national interests by defining the known goals and means by which they will be achieved. These policies influence how the BCT integrates into

theater operations and furthermore how air-ground integration and CAS support the BCT's efforts. The strategies and policies that drive the BCT's efforts continuously identify the need for a flexible, adaptive force capable of supporting any operation within the range of military operations in any possible environment throughout the globe.

The *National Security Strategy* provides the military with the president's overarching guidance for supporting national interests. The latest version identified potential threats, the push for coalition support and partnership, and potential operating environments. The strategy identifies the above items as "leading international coalitions to confront the acute challenges posed by aggression, terrorism, and disease."[1] These coalitions cover the globe in order to rebalance Asia and the Pacific; strengthen alliances in Europe; seek stability and peace in the Middle East and North Africa; invest in Africa's future; and deepen economic and security cooperation in the Americas.[2] The strategy paints a broad picture for the future operating environment where regions and coalition partnerships are known aspects.

The president identifies challenges in the future operating environment. Areas of operations will be fluid creating a great deal of change and uncertainty where the U.S. must have flexibility and embrace capable coalition partners.[3] The flexibility is required to deter and defeat threats regarding missiles, cyber, and terrorist attacks globally and "to defeat and deny aggression in multiple theaters."[4] The expectation of the military to support a wide range of operations will include major combat operations, counterinsurgency, other limited conflicts, and in multiple theaters. This creates the initial demand for military systems like TAGS as well as TACS/AAGS to have structures

adaptable to numerous types of operations along with enough redundancies to establish multiple systems autonomously.

The *National Military Strategy* echoes the President's guidance calling for "greater agility, innovation, and integration" and to "preserve our network of alliances."[5] It also directly identifies opposing actors in depth: Russia, Iran, North Korea, China, and violent extremist organizations such as Al-Qaida and ISIS.[6] Violent extremist organizations pose an immediate threat based on the growing availability of technologies along with their extremist ideologies.[7] Figure 1 presents the "Continuum of Conflict." A major conflict with a state actor poses significant consequences but its probability is low while violent extremist organizations have a high probability with lesser consequences. This creates the impression that while the military needs to make necessary preparations for the full range of military operations, it can expect to operate in limited operations in the current environment.

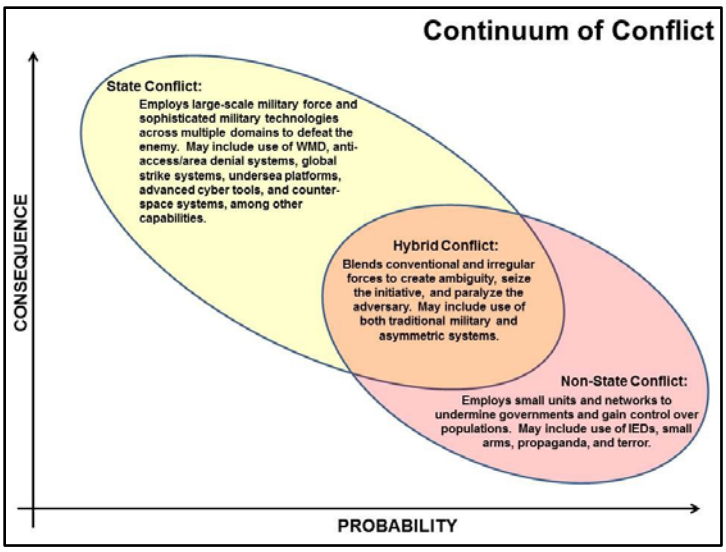


Figure 3. Continuum of Conflict

Source: Joint Staff, *National Military Strategy of the United States of America* (Washington, DC: The Joint Staff, June 2015), 4.

The objectives of the *National Military Strategy* are to deter, deny, and defeat state adversaries; disrupt, degrade, and defeat violent extremist organizations; strengthen our global network of allies and partners; and advance globally integrated operations.[8] All of these objectives reinforce the need for a flexible fighting force, encouraging coalition operations, and emphasizing the global range of operating environments. A further emphasis for a flexible, adaptive force states that the military "requires a joint force capable of swift and decisive force projection around the world."[9]

The *Quadrennial Defense Review* provides an assessment of the fighting force and the way ahead for the military to meet the demands of national strategic objectives. The document identifies the need to reduce the "margin of error in dealing with risks of uncertainty in a dynamic and shifting security environment."[10] It further emphasizes the way ahead for the current environment to promote innovation and efficiency and also the

importance of coalition partnerships in order to help to manage tensions and prevent conflict.[11] These partnerships become more and more important due to the increasing challenges in predicting how threats and opportunities will change in the global environment.[12] The Quadrennial Defense Review continues the trend of emphasizing a force capable of handling the uncertainties within the global environment while capitalizing on coalition partnerships but also provides emphasis in the importance of risk mitigation.

The overall finding from research within the national strategies and policies shows a consensus for future operating environments. All strategies provide some knowns within the environment and how the military will conduct operations. Possible regions and countries are identified both for operations as well as for coalition partnership. Furthermore, national interests are on a global level meaning the military will likely support numerous operations simultaneously. Redundancies are required within the force to allow for the integration of essential systems into each operation. In order to preserve the force and maintain flexibility with each theater, the systems must maintain a level of efficiency due to the strain on low-density resources. Lastly, simultaneous operations with multinational forces in multiple theaters means elevated risk to friendly forces and civilians. The systems emplaced to execute in each theater must account for and mitigate risk in order to prevent the missions from discrediting the U.S.' national interests and objectives.

Key Agreements and Current Doctrine

Current doctrine and agreements provide guidance along with tactics, techniques, and procedures for conducting operations. For air-ground integration these documents are

essential to ensure that all entities involved in the systems can communicate and understand their roles and responsibilities. The challenge within the doctrine is ensuring the expectations and responsibilities of the system at each level are compatible and understood. The BCT has its part in air-ground integration and doctrine defines it. The tactics, techniques, and procedures to support air-ground integration are the good and best practices by which to address challenges to the TACS/AAGS.

The *1948 Key West Agreement* establishes the responsibilities of the Army and Air Force and their interrelationship as part of the armed forces. The agreement states each service they will support and supplement the other services in carrying out their primary functions "where and whenever such participation will result in increased effectiveness and will contribute to the accomplishment of the overall military objectives."[13] As aerial systems advanced over the next half-century, the concept of CAS would shape into more general air-ground integration. This agreement fortifies the Army-Air Force relationship for air-ground integration.

The most current agreement between the two services to further specify the assets the Air Force provides the Army is the *Memorandum of Agreement between the United States Army and the United States Air Force for Army/Air Force Liaison Support*. The document specifies how both services will support one another to carry out their primary functions. The intent of the agreement is to increase joint capabilities, identify joint interdependencies, and standardize air-ground training, equipment interoperability, and combat operations of both services.[14] This agreement aligns an Air Support Operations Center (ASOC) directly with each of the ten Army divisions and each Corps headquarters; places Air Liaison Officers (ALOs) at the corps, division, and brigade

headquarters; and Tactical Air Controller Parties (TACPs) in direct support to corps, division, BCT, and maneuver battalion headquarters in order to provide terminal attack control. The TACPs will encompass no less than two Joint Terminal Attack Controllers (JTACs) at each level.[15]

There is no requirement for JTAC support at the company level or to non-maneuver battalions. However, maneuver units can receive one JTAC at the company or troop level or to non-maneuver battalions if available and based on mission dependence. This leaves the impression that the Air Force will provide two JTACs to support maneuver elements down to the battalion level, but resourcing any support to lower levels will rely on Joint Fires Observers (JFOs).

The Memorandum of Agreement discusses JFOs to assist JTACs in air-ground integration. JFOs increase the capability of CAS employment by providing JTACs and Forward Air Controllers-Airborne (FAC (A)) with timely and accurate targeting data and perform autonomous terminal guidance operations.[16] This means that regardless of the presence of a JFO, the unit must rely on a JTAC or FAC (A) to execute CAS.

Joint publications provide doctrine that applies to all services and provides the necessary structures and systems for joint operations. The joint publications of significance are JP 1-0, *Doctrine of the U.S. Military*, JP 3-09, *Joint Fire Support*, JP 3-09.3, *Close Air Support*, and JP 3-52, *Joint Airspace Control*. The initial analysis of the four manuals is that these documents hold true throughout each service with little to no modifications. Furthermore, they provide the systems for how to establish and conduct joint operations regardless of the operating environment.

JP 1-0 echoes national strategies and policies by identifying the range of military operations and how they relate to the continuum of conflict. The doctrine establishes three main areas within the range of military operations. The first is major operations and campaigns. The second is crisis response and limited contingency operations. The final area is military engagement, security cooperation, and deterrence. The focus for air-ground integration is with major operations and campaigns because they require the most support while the other operations can allow for tailoring the system based on requirements for that specific operating environment.

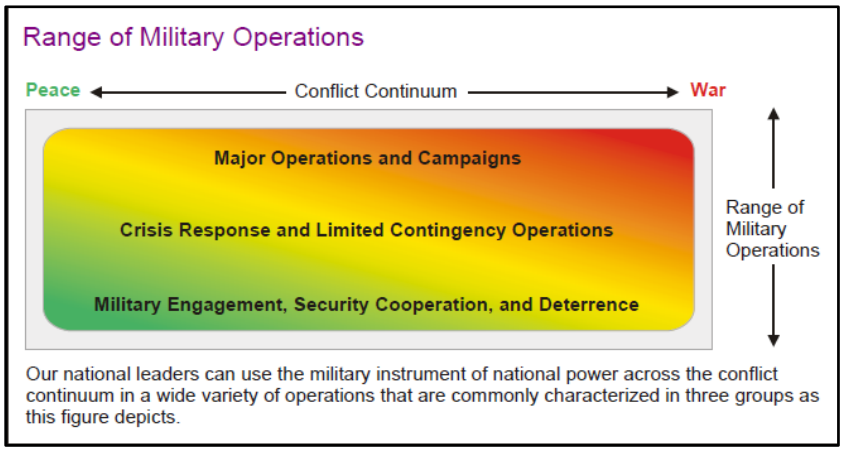


Figure 4. Range of Military Operations

Source: Joint Staff, Joint Publication (JP) 1-0, *Doctrine of the United States Military* (Washington, DC: The Joint Staff, March 2013), I-14.

JP 3-09 identifies fires as a joint function requiring planning, coordination, execution, and assessment. The major employment consideration for joint fires is command and control in operational areas. An essential portion is the establishment of

systems to synchronize diverse fires assets from U.S. and multinational forces.[17] The doctrine goes further stating that these systems must be capable of long-term durations and enduring joint fire support planning processes and procedures. CAS is an example of one of the enduring systems thatU.S.es decentralized execution nodes in the form of TACPs and JTACs. JP 3-09 establishes the precedent that fires related systems, such as theater air-ground integration and CAS, must synchronize all joint fires.

Joint fires include artillery; rotary-wing, fixed-wing, and unmanned aircraft; air defense systems; and coalition assets. Additionally, joint fires related systems need to be compatible to support both planned, detailed operations as well as immediate, dynamic ones. This leaves fires systems needing to have enough personnel and assets to provide for contingencies, enough flexibility to respond rapidly, and the ability to integrate coalition partner assets.

Air-ground integration relies heavily on JP 3-52 and JP 3-09.3 for the establishment of roles and responsibilities as well as procedures for air-integration and CAS. JP 3-52 provides basic principles for airspace control. The basic principles for the BCT are: unity of effort within both joint and multinational forces, decentralized execution, and able to conduct 24-hour operations.[18] While the BCT is echelons below the joint level, decentralized execution and 24-hour capabilities directly affect how the BCT manages its area of operations and also how unity of effort and common airspace control procedures become even more important when operating with joint and multinational aircraft within the airspace.

While JP 3-52 is the primary joint publication for airspace control, JP 3-09.3 provides details on airspace control systems to shape air-ground integration in order to

link air components with those on the ground for CAS. As identified with the Memorandum of Agreement between the Army and Air Force from 2011, Figure 5 shows the link between the ASOC with the division and the TACP alignment with the division, BCT, and maneuver battalions.

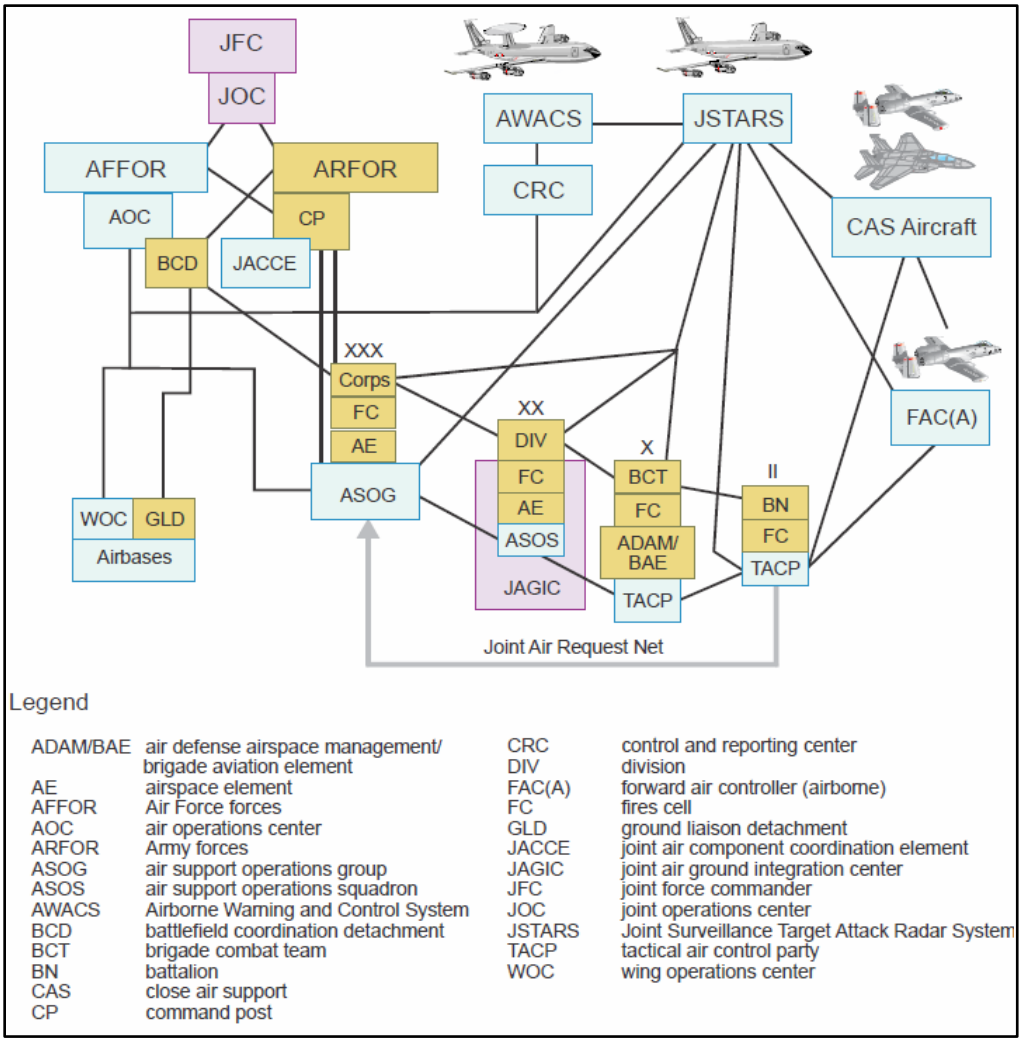


Figure 5. TACS/AAGS

Source: Joint Staff, Joint Publication (JP) 3-09.3, *Close Air Support* (Washington, DC: The Joint Staff, November 2014), II-5.

The TACS/AAGS structure illustrates how the ASOC collocates with the division headquarters. The division level TACP positions within the JAGIC in order to control division airspace and allow for decentralized execution of CAS. The BCT includes a TACP along with other special personnel, Air Defense Airspace Management (ADAM) and the Brigade Aviation Element (BAE), to assist with the planning, requesting, coordination, and execution of joint fires to include organic artillery, army rotary-wing assets, air defense assets, as well as external joint and multinational assets.

Component / Agency	United States Air Force	United States Army	United States Navy	United States Marine Corps	Special Operations Forces
TAGS Element	Theater air control system	Army air-ground system	Navy tactical air control system	Marine air command and control system	Special operations air-ground system
Air Control Center	Air Force air operations center	Airspace element	Tactical air control center/ tactical air direction center	Tactical air command center/tactical air direction center	Joint special operations air component
	Airborne warning and control system				
	Joint surveillance and target attack radar system			Tactical air coordinator (airborne)	
	Control and reporting center		Fleet air warfare coordinator	Tactical air operations center	Special operations command and control element
Liaisons to the JFACC	Air Force liaison element	Battlefield coordination detachment	Naval and amphibious liaison element	Marine liaison element	Special operations liaison element
Air Support Control Agency	Air support operations center		Air support coordination section	Force fires coordination center/ fire support coordination center	Joint special operations air component
	Tactical air coordinator (airborne)		Tactical air coordinator (airborne)	Tactical air coordinator (airborne) Tactical air control party	
Fire Support Coordinating Element		Fires cell	Supporting arms coordination center	Direct air support center	Joint fires element
Tactical Air Support Control Agency	Tactical air control party				
Terminal Attack Element	Forward air controller (airborne)		Forward air controller (airborne)	Forward air controller (airborne)	
	Joint terminal attack controller		Joint terminal attack controller	Forward air controller/ joint terminal attack controller	Joint terminal attack controller

Figure 6. Component Air Command and Control Agencies for Close Air Support

Source: Joint Staff, Joint Publication (JP) 3-09.3, *Close Air Support* (Washington, DC: The Joint Staff, November 2014), II-3.

The component air command and control agencies for CAS in figure 6 show the lack of organic structures in the Army and the AAGS based on the support relationship from the Air Force with TACS. While the Army has a fires cell for fire support coordination, it relies exclusively on the ASOC and TACP to provide coordination and control of airspace at the tactical level and to provide TAC during execution of CAS. The Navy and Marine Corps both possess organic JTACs and FAC (A)s and their own elements equivalent to the ASOC. Because the Navy and Marine Corps possess air-ground systems that are organic to their services, it allows for them to establish themselves early in theater with minimal demands on the Air Force or even temporarily as a single service.

JP 3-09.3 provides the systems and structures for air-ground integration and the coordination and execution of CAS. It additionally provides the standards for TAC procedures as well as approved tactics and techniques. The tactics, techniques, and procedures also correlate with NATO's procedures for TAC which allows for both aircraft and JTACs from NATO nations to effectively integrate into the joint air-ground systems and execute CAS. However, in geographic areas such as Eastern Europe and the Pacific, the ability to integrate both aircraft and forward observers fluidly is limited.

JP 3-52 and JP 3-09.3 provide joint forces with essential uniformed standards to follow to ensure that airspace and air-ground integration are executed systematically and consistently. Each service, excluding the Army, possesses redundancies within TAGS to allow for them to execute their subsystem with minimal external assistance. This allows for efficiency in economy of force in limited conflicts or deterrence where only the Navy or Marine Corps are present in theater. Lastly, the standards established in both doctrines

provide the foundation for how NATO conducts their own operations and therefore allows for a more fluid integration with U.S. forces.

ATP 3-09.32, *Joint Application of Firepower (JFIRE),* is a pocket sized, quick reference guide for observers. It contains the formats for planning, requesting, coordination and execution of joint fires to include artillery, naval surface fires, and both rotary and fixed wing air assets. The standard among joint and multinational forces is 9-line CAS format for all aircraft, fixed-wing, rotary-wing, or unmanned aircraft. However, Army rotary-wing can use the 5-line brief format to expedite fires. This format also allows non-JTAC observers to include JFOs to provide the brief and does not require TAC to employ ordnance.

When utilizing the JFO as part of a specific CAS mission, the JFO passes target and situation information directly to the JTAC; however, the JFO may require the CAS aircraft to relay the situation update and targeting information to the JTAC.[19] This is inefficient for the JFO and CAS aircraft already observing the target to require a JTAC not observing the target to validate prior to engagement. It appears this procedure while mitigating risk is less responsive and delays CAS execution.

JP 3-09.3 also provides guidance for CAS execution with non-JTAC observers. It acknowledges increased risk and that the aircrew bears increased responsibility for detailed integration. The maneuver commander accepts the risk and forwards the request through the ASOC to alert the supporting crew. However, there is no specification as to which echelon maneuver commander accepts the risk.

In accordance with both JP 3-09.3 and the JFIRE, JTACs are the primary observer for the execution of joint fires in order to maintain efficiency and responsiveness with

fires and to mitigate risk to friendly forces and civilians. In relation to the BCT, the Air Force provides JTACs during training and operations for the TACPs aligned with the BCT headquarters and each maneuver battalion. The total number of JTACs in the BCT is between eight and ten based on availability. The ASOC aligns with the division headquarters for airspace management and coordination. So any airspace management and coordination within the BCT area of operations for joint or multinational aircraft relies exclusively on the TACPs following coordination with the ASOC at the division headquarters.

Annex 3-03, *Counterland*, is an Air Force publication and provides greater understanding of how the Air Force expects to support air-ground integration and CAS to maneuver forces. Counterland operations are defined as a "vital airpower function that applies throughout the range of military operations" meaning that regardless of a major combat operation or a lower intensity conflict, the Air Force expects to provide air-ground capabilities to support the fight.[20] This reinforces the importance of the interrelationships between the Army and Air Force and how the TACS/AAGS system allows both services to achieve their missions with air-ground integration.

Annex 3-03 also solidifies the JTAC relationship within maneuver forces. While JTACs hold the responsibility of TAC in support of ground forces, the "ground commander is the release authority within the area of operations" and delegates release authority to trained JTACs and FAC (A)s in the execution of CAS.[21] As reiterated in the joint publications, Annex 3-03 echoes that two key factors to successfully employing CAS are the need for flexibility and avoidance of fratricide.

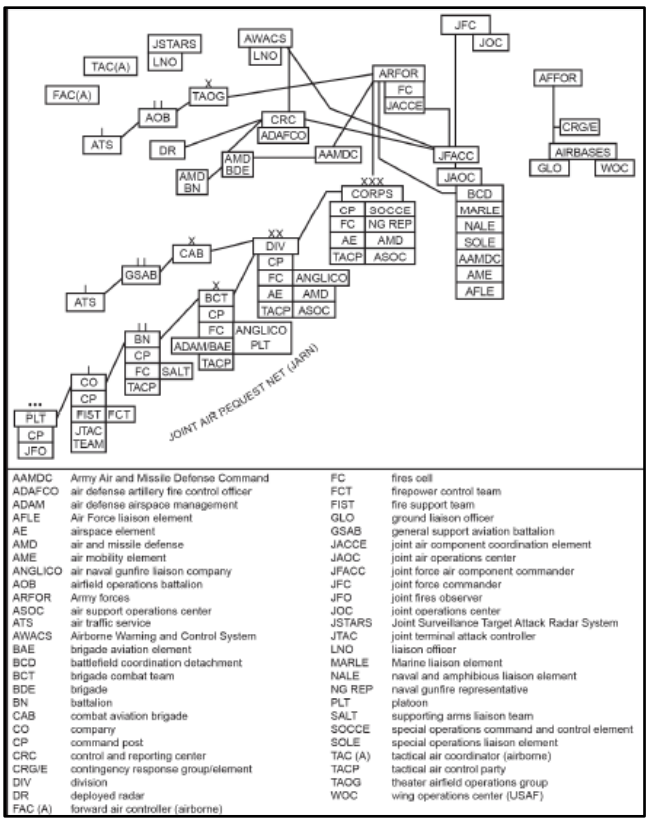
Army doctrine provides a more direct definition of how AAGS should operate. FM 3-52, *Airspace Control* and ATP 3-91.1, *Joint Air-Ground Integration Center,* provide the guidance for the division while FM 3-96, *The Brigade Combat Team*, and ATP 3-09.42, *Fire Support for the Brigade Combat Team* provide the guidance for the BCT. These documents shape the necessary requirements, expectations and procedures for air-ground integration for the BCT and how the division supports the BCT. It describes the division level structures of the JAGIC and ASOC assist or alleviate the BCT of certain integration requirements. It discusses the AAGS system and how the BCT, primarily the fire support cell within, conducts air-ground integration in the four functions of planning, requesting, coordinating, and executing CAS.

FM 3-52 establishes the policies and procedures for airspace control within the AAGS. Ground force commanders own their designated area of operations, but FM 3-52 states that "airspace is not owned by individual subordinate organizations" the air control authority maintains ownership within TAGS.[22] Therefore, the ground force commander owns the authority for TAC delegated down to the JTACs but the air component commander owns all airspace and delegates certain aspects of control down to as low of a level as the ASOC.

The centralization of airspace control increases effectiveness by promoting flexibility, efficiency, and mitigating risk in use of the airspace.[23] It allows the ASOC to control the airspace for the division to allow for a single entity to move aircraft across the battlefield. When the air control authority assigns control authority, they do so using procedural controls which then the Army may use positive control within smaller

portions of that give airspace. The air control authority assigns the control through the air control plan and the Airspace Control Order (ACO).[24]

An example is the air control authority giving a division ASOC a specific portion of airspace, generally the airspace above their area of operations up to a specific altitude. The airspace creates a three-dimensional box where aircraft must contact the ASOC to enter. Within that three-dimensional box, the ASOC can establish additional procedural or positive control measures for the aircraft as it passes through the airspace. This control becomes "an additional task of the mission command warfighting function and a continuing activity of the operations process."[25] FM 3-52 provides a breakdown within each Army headquarters of both the Air Force and Army components within the TACS/AAGS as seen in Figure 7. It shows the enablers within the division and lower echelons that ensure airspace control within the area of operations.



AAMDC	Army Air and Missile Defense Command	FC	fires cell
ADAFCO	air defense artillery fire control officer	FCT	firepower control team
ADAM	air defense airspace management	FIST	fire support team
AFLE	Air Force liaison element	GLO	ground liaison officer
AE	airspace element	GSAB	general support aviation battalion
AMD	air and missile defense	JACCE	joint air component coordination element
AME	air mobility element	JAOC	joint air operations center
ANGLICO	air naval gunfire liaison company	JFACC	joint force air component commander
AOB	airfield operations battalion	JFC	joint force commander
ARFOR	Army forces	JFO	joint fires observer
ASOC	air support operations center	JOC	joint operations center
ATS	air traffic service	JSTARS	Joint Surveillance Target Attack Radar System
AWACS	Airborne Warning and Control System	JTAC	joint terminal attack controller
BAE	brigade aviation element	LNO	liaison officer
BCD	battlefield coordination detachment	MARLE	Marine liaison element
BCT	brigade combat team	NALE	naval and amphibious liaison element
BDE	brigade	NG REP	naval gunfire representative
BN	battalion	PLT	platoon
CAB	combat aviation brigade	SALT	supporting arms liaison team
CO	company	SOCCE	special operations command and control element
CP	command post	SOLE	special operations liaison element
CRC	control and reporting center	TAC (A)	tactical air coordinator (airborne)
CRG/E	contingency response group/element	TACP	tactical air control party
DIV	division	TAOG	theater airfield operations group
DR	deployed radar	WOC	wing operations center (USAF)
FAC (A)	forward air controller (airborne)		

Figure 7. TACS/AAGS down to Platoon Level

Source: U.S. Army, Field Manual (FM) 3-52, *Airspace Control* (Washington, DC: The Joint Staff, February 2013), 2-3.

The division airspace element oversees airspace control for the entire division area of operations, regardless if area of operations has been further assigned to the BCT. When the division assigns part of its area down to the BCT, it delegates some airspace control responsibilities. The fires cell within the BCT along with the ADAM/BAE and TACP coordinate and de-conflict established airspace coordinating measures both positive and procedural as well as fire support coordination measures.[26] The ADAM/BAE includes the brigade aviation officer who is the designated airspace control officer for the BCT.[27] In most cases, the fires cell communicates with the JAGIC at

division and the TACP through the ASOC for the purposes of planning, requesting, and coordinating airspace and air-ground integration. The execution of air-ground integration will vary based on which echelon is the end user. In general, execution should be decentralized to the lowest level possible.

The fires cell at the battalion level is responsible for planning, coordinating, and synchronizing fire support operations, to include joint fire support.[28] The fires cell along with the TACP is responsible for the planning, requesting, coordinating, and executing all air-ground integration to include CAS at the battalion level. They do not possess ADAM/BAE capabilities, so they rely on the BCT for airspace control functions.

The demands on the BCT from the battalions based on limited enablers are assisted by the JAGIC at the division level. The JAGIC is responsible for the division assigned airspace and the execution of joint fires and aviation maneuver within it. This airspace is generally all airspace below the coordinating altitude from the division's rear boundary to the fire support coordination line to its front, if one has been planned. The JAGIC consists of the fire support element; its own TACP; the air and missile defense element; the airspace control element; the aviation operations element; and a collocated ASOC.

The JAGIC and the BCT both possess digital systems and personnel to plan, request, coordinate, and execute air-ground integration. This gives the initial assumption that the BCT can replicate the JAGIC when necessary but they do not have the Army and Air Force manpower or equipment to run a JAGIC. The BCT only has a single Army non-commissioned officer for airspace control and no Air Force air traffic controllers. Therefore, the current BCT cannot effectively act as a JAGIC meaning that the airspace

control capabilities within the BCT are limited for coordinating and executing air-ground integration.

Further evidence shows the difficulties that BCTs have in conducting their own clearance of fires during training center rotations. During a briefing to the U.S. Army Command and General Staff College, the observer team from the Joint Readiness Training Center noted that BCTs are not conducting effective fire support planning. The average airspace clearance of fires for the BCT over the last year was twelve minutes, forty five seconds while the standard is three minutes.[29] This shows that the BCT faces difficulties in proper planning and executing airspace control.

ATP 3-09.42 is vague in the responsibilities for airspace coordination at the BCT. It states "airspace coordination, which should always be a part of the clearance of fires, is assisted through the staff process."[30] It can only be assumed that as part of clearance of fires the BCT relies on the JAGIC in order to perform this portion based on its limited capabilities.

The issue that arises from this reliance is that the BCT is the primary building block unit for Army operations and "shapes the security environment and wins across the range of military operations."[31] It is the primary deploying force that can provide continuous and simultaneous combinations of offensive, defensive, stability, and defense support of civil authorities.[32] When deployed, the BCT will fall under the control of a division or joint task force. The division or joint task force controls as many as six BCTs while at home station the ASOS generally only supports between two and four.[33]

There are three types of BCTs that are deployable. They are the Infantry Brigade Combat Team, the Stryker Brigade Combat Team, and the Armored Brigade Combat

Team. Each possesses their own unique capabilities. Each of the BCTs has a certain number of maneuver battalions according to FM 3-96. Those numbers along with the JTAC allocations in accordance with the *2011 Memorandum of Agreement between the Army and Air Force* are depicted in table 1. Table 1 shows the general number of JTACs allocated by BCT type.

Table 1. JTAC Allocations by Brigade Combat Team

Brigade Combat Team	IBCT	SBCT	ABCT
BCT Headquarters	1	1	1
# of Maneuver Battalions / Squadrons	4	4	4
# of Manuever Companies/Troops	15	12	15
JTACs required IAW MOA 2011 (min. 2 per HQ)	10	10	10
Additional 1x JTAC for each Maneuver Company	15	12	15
Total JTACs if disseminated to MVR CO/TRP	25	22	25

Source: Created by author. Data from U.S. Army, Field Manual (FM) 3-96, *Brigade Combat Team* (Washington, DC: Headquarters, Department of the Army, October 2015).

Each division differs in number and type of BCTs. Initial concerns arise based on the division ASOS alignment. While divisions differ in configuration, each ASOS is identical in structure. It is important to determine if there are any shortfalls in the ASOS to provide JTAC support to each BCT. Table 2 shows each division based on its current BCT configuration and the total JTAC requirements in order to disseminate a JTAC down to company.

Table 2. Brigade Combat Team JTAC Coverage

Division (Aligned with 1x ASOS)	IBCT	SBCT	ABCT	JTACs per MOA	JTAC x MVR CO
1st Armored Division	0	1	2	30	72
1st Cavalry Division	0	0	3	30	75
1st Infantry Division	0	0	2	20	50
2nd Infantry Division	0	2	0	20	44
3rd Infantry Division	1	0	1	20	50
4th Infantry Division	1	1	1	30	72
10th Mountain Division (Multiple Locations)	3	0	0	30	75
25th Infantry Division (Multiple Locations)	3	1	0	40	97
82nd Airborne Division	3	0	0	30	75
101st Airborne Division	3	0	0	30	75
Total JTACs IAW MOA 2011 and FM 3-96 BCT Structure Breakdowns				280	685

Source: Created by author. Data from U.S. Army, Field Manual (FM) 3-96, *Brigade Combat Team* (Washington, DC: Headquarters, Department of the Army, October 2015).

Table 2 shows that in order to meet all ten divisions' requirements the Air Force must provide approximately 280 JTACs with 20 to 40 JTACs per division. ATP 3-09.42 states that Air Force TACPs can deploy forward with maneuver companies or forward positions to best support the operation. If the ASOS were to provide additional JTACs to each company within the maneuver battalions it would total 685 JTACs and between 44 and 97 JTACs per division, more than double the current requirement. This would provide commanders and subordinate units with more expertise for the use of CAS and air-ground integration.[34] This would more than double the current requirement, but would strengthen both planning and execution and also provide additional JTACs for integration with coalition partners.

The current doctrine and key agreements provide essential roles, responsibilities, and expectations for what air-ground integration provides the joint force as well as each service. The doctrine establishes the interrelationship between the Army and Air Force through TACS/AAGS in order to provide effective air-ground integration and CAS in

theater operations. How TACS/AAGS integrates in support of the Division and BCT emphasizes the importance of flexibility, efficiency, and risk mitigation. It also demonstrates how the Army alone cannot conduct air-ground integration. With support from the ASOC and TACPs, the Army is able to plan, request, coordinate, and execute air-ground integration.

Previous Conflicts

Current doctrine is shaped by past experiences with the intentions of preparing the fighting force for future conflicts. The range of military operations identifies numerous challenges in the future and identifies the possible levels of conflict the U.S. military will face. The appropriate past conflicts to reflect on are the Vietnam War, Operation Desert Storm, and the recent operations in Afghanistan and Iraq. These hold appropriate as future conflicts are likely to be multi-domain with the potential to cover the full range of military operations simultaneously in multiple theaters.

Vietnam

The Vietnam War still provides significant insights in preparation for future challenges. Regarding the BCT and air-ground integration, Vietnam provides lessons learned regarding redundancy, efficiency, and risk mitigation within the four functions of air-ground integration. The areas which the Vietnam War introduced challenges and also solutions were the use of a full TAGS to include the air component command for the theater, clearance of fires between air assets and artillery, and operating with host-nation partners in the Army of Vietnam. The study demonstrates these challenges inherent with joint and coalition operations. The conflict was a multi-domain one where major combat

operations quickly transitioned back and forth into limited operations and counterinsurgency.

The Vietnam War was the first to establish an air component commander and fully integrate an effective TAGS structure. The air component commander allocated air assets throughout the theater based on apportionment guidance from the overall commander of the Military Assistance Command, Vietnam. The structure centralized control of airpower for the functions of requesting, coordination, and execution of CAS.[35] Immediate requests for CAS were streamlined to allow for responsiveness through the TACP channels up to the direct air support center. The ASOC and air operations center currently perform duties similar to the direct air support center. Figure 8 shows the CAS request structure during Vietnam.

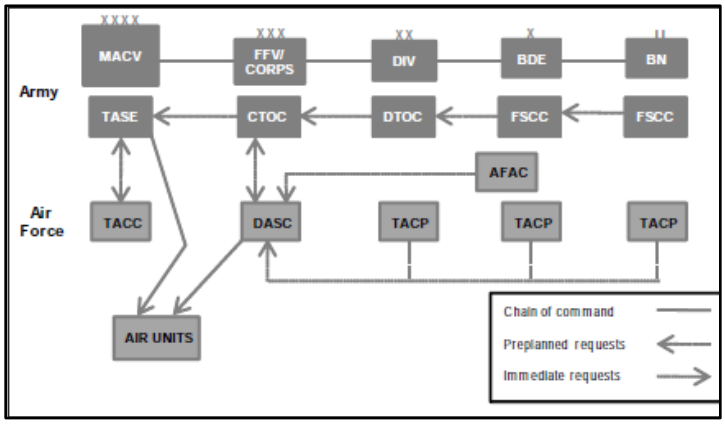


Figure 8. Vietnam Close Air Support Request within Army Air-Ground System

Source: John J. McGrath, *Fire for Effect: Field Artillery and Close Air Support in the U.S. Army* (Fort Leavenworth, KS: Combat Studies Institute Press, 2010), 118.

The CAS request system from Vietnam has similarities to the current TACS/AAGS structure. Currently, TACS/AAGSU.S.es the Joint Air Request Net (JARN) for immediate CAS requests to streamline requests directly to the air support operations group or the ASOC to shorten the requesting chain for better responsiveness. TAGS in Vietnam instead used air assets dispersed through the theater to provide near continuous overhead coverage in order to shorten response time; however, these aircraft remained under centralized control requiring additional coordination to directly communicate with the ground forces below.

The centralized control of air support resulted in more than 80 percent of the Army allocations not being distributed. Air support remained under corps and higher echelon control.[36] This meant that it was seldom distributed down to the division, brigade, or battalion for detailed planning which created a greater demand for immediate requests to provide air support. Along with limitations in planning, the coordination and execution of air-ground integration relied heavily on the Air Force to execute.

The Air Force used FAC (A)s already overhead in specified areas to provide CAS to ground forces. The FAC (A)s would receive communications with ground forces who would provide targeting data in order to execute CAS. So while the feeling from ground forces was that they controlled aircraft directly, the FAC (A) provided TAC to supporting aircraft. The FAC (A) operated similar to how ground forces use the JFO to JTAC relationship where targeting guidance is sent to the JTAC and the JTAC provides TAC to the aircraft.

FAC (A) aircraft were dispersed throughout the theater continuously to provide overhead coverage and responsiveness for CAS. This shortened response times for CAS

but also created friction and concerns with the clearance of fires, namely artillery in support of ground forces. In 1966, risks to aircraft during artillery fire missions raised concerns, "with every artillery round fired, the danger to our pilots and the chance of aircraft accidently being hit is greatly increased."[37] The recommendations established new procedures placing air control measures and fire support coordination measures to ensure safety of flight for aircraft using air corridors and also the establishment of artillery air control centers for each tactical area of operations.

The artillery air control centers helped to mitigate risk to aircraft and other friendlies and created redundancies to ensure effective air-ground integration. The downside is it also prevented efficiency by delaying effects of munitions until airspace was confirmed clear. In the case of Vietnam, positive control of aircraft could prove difficult based on the communications ranges and number of frequencies between airspace managers and aircraft. These issues with communications created additional procedures for aircraft; delaying responsiveness of fires.

Along with responsiveness, situational awareness was another challenge for both observers and aircraft in Vietnam. The use of the FAC (A)s in providing aerial observation was the most effective means of not only identifying the enemy but also in adjusting artillery fires during the early phases of Vietnam.[38] But as the conflict transitioned into a counterinsurgency, the ability to gain situation awareness and provide CAS became more difficult. First, there were no identifiable boundaries or rear areas. The enemy was dispersed through highly vegetated terrain difficult to identify even from overhead.[39] Secondly, the counterinsurgency environment forced friendly forces to cover

a wider area of operations. These effects on situational awareness affected the ability to plan, coordinate, and execute CAS.

The larger area created a demand for more aircraft in order to provide overhead coverage continuously.[40] It also meant that responsiveness to each enemy attack was more urgent because of the short, sporadic nature of enemy insurgent forces. Lastly, because of the larger range, the ability for ground forces, TACPs, and FAC (A)s to maintain communications were limited. This created a greater safety concern to all involved as the non-linear environment blurred lines between CAS and air interdiction, as well as enemy combatants and friendly forces.[41] The blurred lines meant that aircraft may or may not know when they required TAC in order to execute a mission and also the ability to identify between friend and foe.

The final challenge with air-ground integration during Vietnam was regarding host-nation partnership. South Vietnamese integration into combat operations experienced multiple challenges. A requirement established that all fires be cleared by the appropriate South Vietnamese officials down to the provincial or district level, a restriction that "does not allow rapid and direct channels from the fire support requestor."[42] Authority for clearance of fires required a provincial chief or higher approval but could be granted in advance to ground commanders in certain areas of operation.[43] This challenge remains present in current and future theaters when operating with the host nation and its forces.

When assessing Vietnam through the four functions of air-integration certain challenges were identified. In the planning process, aircraft allocations were held at echelons above division in order to provide greater overall coverage in theater. This

technique was effective in a permissive, low anti-air threat environment. The shortfall of this technique was that it was inefficient in conserving aircraft and managing airspace. This resulted in a prolonged clearance of fires for maneuver elements and greater communications requirements for aircraft to check into multiple airspaces. Situational awareness proved difficult as well. Having airpower allows for effects in terrain and areas previously not reached, but the dispersion and terrain also make identifying the enemy more difficult when in close proximity to friendly forces. Lastly, Vietnam showed the difficulties encountered with the host-nation government and forces. This challenge will continue in all operations and conflicts based on the goals of national strategies and current doctrine.

Overall, Vietnam showed how redundancy is needed throughout a theater regarding both airspace control and TAC. It also showed that efficiency is required in order to allow for forces to use air-ground integration to its maximum. It was lacking in Vietnam due to the fact that elements at the division and lower were limited in the amount of CAS they would receive for preplanned air. Risk mitigation was a challenge when coordinating with South Vietnamese authorities and the military. While it proved difficult, forces were able to shorten the process to allow more efficiency once the host nation gained familiarity with procedures and tactics. Clearance of fires, situational awareness for observers and aircraft, and multinational partnerships are all challenges the U.S. military will face in current and future conflicts.

Operation Desert Storm

Operation Desert Storm from the ground perspective lasted less than 100 hours. Credit for this was given to the effectiveness of airpower to gain air superiority and then

proceed to perform an air campaign to destroy enemy ground forces. The conflict included extensive amounts of airpower to support a massive coalition ground force. With the size of the force and the speed by which it advanced, many challenges presented themselves within the four functions of planning, requesting, coordinating, and executing air-ground integration. The challenges included: establishing standard control measures during the planning process; dissemination of essential information; dysfunctional airspace control; and difficulties for observers to maintain situational awareness.

The first challenge during Desert Storm was poor efforts in the planning function. Joint airspace command and control and communications were inadequate. There was a lack of airspace coordinating measures and fire support coordination measures in order to allow aircraft to transition between different airspaces and permit or restrict the use of fires for both aircraft and artillery.[44] The blame for this may potentially have been a lack of access to the Air Tasking Order (ATO) and Special Instructions (SPINS) for all aviation units as well as ground maneuver command posts. This lack of dissemination leaves not only Army aircraft at risk, but also prevents the TACPs and artillery elements from having full situational awareness of the air picture. Furthermore, the ATO and SPINS were unresponsive to rapidly changing situations on the ground requiring CAS and other fire support.

A possible reason for the lack of flexibility was the introduction of the 72-hour ATO cycle. During Vietnam, the tasking cycle was on a 24-hour cycle and this change to 72-hours ensured efficiency but forfeited responsiveness.[45] The 72-hour ATO cycle proved effective during the initial air campaign but started to experience challenges when dissemination of information required cross-service communications and networks. This

created concerns within the planning function which in turn also created concerns with the preplanned request system. Ground forces were not prepared to request effects provided by air support in a manner timely enough for the speed of the offensive.

Failure to disseminate the ATO and SPINS to Army elements created concerns with planning and requesting and left corps headquarters with the responsibility to manage a large airspace. Further concerns were raised due to the rapidly growing area of operations as forces advanced forward. Divisions, brigades, and battalions had no access to the ATO or SPINS so they could not relieve the Corps headquarters of some of those duties.[46] After-action reports recommended that Army airspace command and control needed significant improvements at all levels to alleviate this issue. On multiple occasions the corps failed to deconflict airspace to include failing to post the ACO graphics on overlays.[47]

The corps headquarters served as the focal point for centralized control of the airspace based on its success in Vietnam. Unlike Vietnam, Operation Desert Storm saw rapid changes to the battlefield as ground forces quickly advanced into Iraq. This success on the ground created chaos in coordination of airspace and in maintaining situational awareness at all echelons. The lack of redundancies in AAGS from the corps level meant that it became overwhelmed with controlling airspace and clearing fires. With lower echelons unable to provide effective air-ground integration due to not having the current ATO and SPINS, efficiency was lacking. The lack of full situational awareness in knowing aircraft and ground locations within the expanding area of operations created greater risk to both aircraft and ground forces. The assessment of the coordination portion

of the AAGS showed that improvements were needed across all echelons from the battalion to the corps levels for air-ground integration.

Despite the deficiencies in the AAGS, CAS proved responsive and effective in Desert Storm. CAS became more efficient by providing sorties of two to four aircraft rather than sending every available aircraft and diverting aircraft as during Vietnam. The response time was generally 30 minutes and accurate in close proximity of ground forces.[48] So while coordination concerns are raised regarding AAGS, it still effectively provided CAS through immediate requests and dedicated CAS sorties.

Limited communications and situational awareness of aircraft overhead created friction for ALOs and TACPs to coordinate and execute air-ground integration. The major issue was a lack of personnel and equipment at the division level and below concerning ALOs and TACPs as well as the pace of the fight.[49] The speed of the ground force offensive proved too fast to maintain effective situational awareness of the forward line of troops. This created higher uncertainty in target identification and airspace deconfliction.[50] Along with difficulties for observers to gain situational awareness of friendly ground forces and know where aircraft were based on procedural controls, additional issues arose concerning Army aircraft within the corps airspace.

Army aircrews were disregarding airspace coordinating measures whether intentionally or due to lack of information. Equipment issues with the identification friend or foe system in friendly aircraft also made it so that air defense systems and other receivers could not positively identify friendly aircraft while in flight.[51] This further complicated coordination and execution of air-ground integration by forcing positive control of aircraft in order to ensure safety of flight and clearance of fires.

The coordination and execution functions of the AAGS were flawed due to lack of personnel and equipment. Proper dissemination of the ATO and SPINS down to the lowest levels did not occur. The ability of TACPs to maintain situational awareness on the ground due to the rapid movement of ground forces was limited. Lastly, airspace and ground control measures were lacking or discarded creating greater risk of fratricide.

Redundancy, efficiency, and risk mitigation are essential for success on current and future battlefields. In the event of a major offensive operation like Desert Storm, redundancies in airspace controllers and JTACs need to be present to maintain combat effectiveness in air-ground integration. The adjustments to the ATO cycle as well as the allocation of aircraft helped make air-ground integration more efficient in the use of aircraft in support of ground forces. Advancement in precision munitions further made CAS missions more effective in support of the ground force. The dysfunction of AAGS in Desert Storm created unnecessary risk. Deficiencies in the use of coordination measures; the failure to disseminate necessary ACOs, ATOs, and SPINS; and the failure of friendly identification equipment were unacceptable.

Operation Enduring Freedom

The first forces to establish themselves in Afghanistan were special operations forces followed by conventional elements of both the Army and Air Force[52]. The problem this created during planning was that they lacked any training, experience, manpower, or developed systems to properly establish an initial air-ground system.[53] Their difficulties were equivalent to a BCT trying to set up their own AAGS without higher echelon support from an ASOC. These problems emphasized the importance of establishing a TAGS as early as possible in a theater of operations in order to ensure all

systems are running to allow for planning and allocation of resources. An additional challenge in planning was when conventional forces arrived in Afghanistan. In order for the forces to get into theater faster, they left some organic assets at home station. One unit deployed without their organic artillery systems while another did so without their TACPs. This meant that the ground force planned with far fewer fire support assets than they had trained with prior to deployment.[54]

The challenges to planning in Afghanistan included lack of resources in establishing the necessary air-ground systems to properly plan and manage airspace. Most of the planning early in Afghanistan to include Operation Anaconda did not include the air components. Part of the reason was that there was no air representation collocated with the mission planners because they were left at home station. Air and land component representatives were scattered between Saudi Arabia, Kuwait, and Bagram, Afghanistan.[55] With the proper equipment these distances are not as challenging, but because the headquarters in Bagram initially lacked an ASOS due to poor higher level planning, the ability to properly support mission planning was non-existent. Air-ground integration planning early in Afghanistan failed in redundancy and efficiency. The lack of an ASOS and TACPs within certain formations prevented proper planning which resulted in confusion during the execution of the mission.[56] These failures in redundancy and efficiency also created unnecessary risk to ground forces and aircraft which fortunately did not come to bare.

Operation Anaconda was the primary fight within the Afghanistan Theater during the first year. From a requesting perspective, the operation received the necessary assets. However, in the execution of Operation Anaconda, nearly all CAS provided during the

initial days was immediate, meaning that due to the failures in the planning function, most requesting of assets was responsive with a minor number of preplanned targets. Additionally, most of the preplanned missions were re-routed to meet additional immediate CAS requests because the initial allocation was not sufficient to support the operation.[57]

As the operation continued, the ASOC along with other entities began to fully implement doctrinal planning cycles. By the end of the two week operation, most CAS requests were preplanned, coordinated, and synchronized to support the operation. Based on the initial amount of immediate CAS requests and re-routing of preplanned CAS mission aircraft, it is apparent that that the requesting function lacked efficiency. In terms of redundancy, there were enough sorties provided for the operation. In whole the airspace was packed with assets including fighter jets, bombers, Army helicopters, intelligence, surveillance, and reconnaissance aircraft and even non-government organization aircraft in transit.[58] With all of these assets in the airspace simultaneously, planning and coordination were essential to mitigate risk. Planning as previously discussed was lacking initially during Operation Anaconda.

Coordination during Operation Anaconda faced multiple challenges. First, based on the requesting function, a huge number of assets were in the airspace to support the operation. The operation itself covered an area approximately eight nautical miles by eight nautical miles.[59] An area this small requires extensive coordination. The ACO, ATO, and SPINS provided procedural coordination to aircrews while the ASOC and TACPs on the ground provided further coordination of the airspace. An issue with procedural coordination was that civilian aircraft are not included in these orders which

means their presence was generally unknown until aircraft were in the airspace. Additionally, the AC-130 Gunships used exclusively by special operations elements was also not included in the ATO. This meant that multiple aircraft were conceivably entering and exiting the airspace without other aircraft knowing or coordination through proper channels.[60]

The execution of air-ground integration and CAS proved challenging in Operation Anaconda. During the operation there were at least 24 JTACs on ground in this small operations area. This is arguably more than enough redundancy TAC coverage for ground forces; however, there was no authority to coordinate with the JTACs as to which aircraft were tasked to them. This was due to the ASOC at Bagram, 300 kilometers away, being unable to talk directly with aircraft or properly manage the air picture.[61] Their inability to manage aircraft as well as prioritize and designate which JTACs received which aircraft created a great deal of confusion during the initial stages of the operation.

The lack of centralized control and management of aircraft resulted in JTACs in competition with each other for assets arriving into the airspace. This left the aircrews to determine who to support based on a limited understanding of priorities and the current ground situation.[62] The lack of control shows inefficiencies in the system. During the execution of the ATO on March 3rd, the second day of the operation only 27 of 66 planned sorties dropped ordnance in support of the operation.[63] This shows that not only was there a lack of efficiency in the handoff of aircraft to controllers but also in providing the appropriate amount of aircraft to support the operation. Air-ground integration suffers when there is a lack of redundancy and efficiency within the system during execution. This results in ground forces requiring CAS not getting what they need when they need it.

This elevates risk to ground forces. When this risk elevates, urgency sets in which with human nature shortens certain procedures which can endanger aircraft and further endanger ground forces.

Overall, air-ground integration in Afghanistan improved after 2002. However, what Operation Anaconda demonstrates is the difficulties that a BCT size formation faces in terms of planning, requesting, coordinating, and executing air-ground integration. The BCT is the primary deployment element for the Army and can face a wide range of operational demands. For air-ground integration it is essential for TACS/AAGS to establish itself in theater and ensure communication and coordination between all players throughout all four functions. There must be cross communication to include the ASOC or BCT sized equivalent, the BCT headquarters, higher echelon headquarters, the aircraft providing support for the operation, and most importantly with the controllers on the ground. This also means there needs to be adequate and redundant representation of air liaisons at all necessary levels to provide successful integration.

Operation Iraqi Freedom

An opposite situation occurred in Iraq just one year later. Air-ground integration was initially successful in establishing TAGS, but problems arose with delegating responsibility between artillery, Army attack aviation, and Air Force assets.[64] The reason for this confusion was due to the great initial success of the offensive in Iraq, a similar situation to Operation Desert Storm. Once the transition from fighting conventional forces to irregular ones took place, planning became more complex in what systems were best for effects to fight small and irregular formations.

Major combat operations in Iraq started with coalition forces entering Iraq on March 20th, 2003. Less than four weeks later on April 14th, major military operations ended.[65] During this period of time, air-ground integration was successful due to the experiences in Afghanistan. A significant difference between Operation Iraqi Freedom and Desert Storm was the allocation of CAS to ground forces, creating a greater demand on air-ground integration at the division and lower echelons. According to the V Corps Commander, Lieutenant General William Wallace, "we've gotten more close air support and more availability of CAS and more access to CAS than I can ever remember. I go back to Vietnam, and we didn't have that kind of CAS in Vietnam."[66] The four functions for air-ground integration during the initial portions of Iraq were more successful than during Desert Storm as well as Afghanistan.

Planning and requesting for air-ground integration was vastly improved for the initial invasion of Iraq as compared to Operation Anaconda in Afghanistan. The fighting force was significantly larger and included coalition forces from Great Britain, Australia, and Canada to assist in air support. Much like in Vietnam, a great deal of sorties were retained at the corps level. This meant there was limited to no planning at the BCT level based on lack of allocated sorties. The apportionment of CAS provided to the land component command during the first month of Operation Iraqi Freedom was 50.7 percent out of the 41,404 sorties flown by approximately 1,800 coalition aircraft.[67] The planning system had some flexibility to re-task sorties for dynamic targeting which allowed the engagement of 686 targets over the course of almost four weeks of major combat operations.[68] The major concern from ground forces though was the ATO cycle was still

not flexible enough to keep pace with the rapidly changing battlefield conditions, much like in Desert Storm.[69]

The offensive advanced approximately 600 kilometers during the less than four weeks of operations creating significant strains in coordination. The ACO changed 12 times and included approximately 1800 airspace coordinating measures for the theater. Unlike Desert Storm, the ability to disseminate the ACO, ATO, and SPINS was much more efficient based on better communications interoperability. Total terminals for satellite communications and broadcasting systems increased from 36 before Operation Iraqi Freedom to 107 during the initial invasion.[70] Increases in bandwidth and connectivity ensured that all echelons could communicate to maintain coordination of both airspace and assets.[71]

Along with increased communications capabilities were targeting capabilities for the higher echelons. This directly affected the execution of CAS as part of air-ground integration. The common trend during Iraq was that higher echelons maintained CAS at their level, above the division, because of the numerous operational level intelligence, surveillance, and reconnaissance systems such as unmanned aerial vehicles and Army attack aviation assets.[72] The support for centralized execution at the higher echelons was justified by these headquarters because they possessed greater situational awareness of the target and therefore were the most appropriate to perform air-ground integration and execute CAS.

The counterargument from division and brigade leadership was that while higher echelons possessed greater situational awareness of the target, the lower echelons had greater situational awareness of friendlies.[73] When it comes to air-ground integration,

especially CAS, the greater situational awareness of friendlies should outweigh the target identification due to the requirements for detailed coordination.

Execution of air-ground integration during Iraq was effective in meeting its desired end state, but friction regarding proper knowledge of friendlies created a greater concern. It elevated risks to ground forces due to incomplete situational awareness. Furthermore, it failed to capitalize on the redundancies the fires elements and TACPs at the brigade and lower echelons can provide not only in the capability to execute CAS but to mitigate risk to friendly forces. Lastly, by managing the fight and delegating execution down to lower echelons, the corps and division can focus better on being airspace managers and on the coordination function for the rapidly expanding area of operations, a problem that the U.S. faced during Desert Storm.

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CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The ever changing global environment creates challenges which U.S. forces will face. The BCT as the front line echelon will be up close and personal when facing these challenges and in order to have success they will need strong a strong air-ground integration system to match it. The TACS/AAGS supports these endeavors. The challenges of the future operating environment are the rising capabilities in conventional lethal munitions both in accuracy and destructiveness; non-lethal capabilities in the electromagnetic spectrum and cyberspace warfare; and the inherent challenges of multinational partnerships. The known challenges to the future allow for identification of assumptions within the unknown portions of the environment.

Conventional systems from near-peers such as Russia raise concerns for the future fight. Current known information for the future environment is that opposition possesses an "overwhelming advantage in tactical and operational fires."[1] A 2016 study by the RAND Corporation determined Russian forces had ten artillery battalions positioned to support maneuver forces along the border with the Baltic States. These battalions consisted of three cannon battalions and seven rocket battalions.[2] This amount of artillery is significant tactical advantage compared to U.S. and coalition forces in Europe.

To make the situation even more concerning, the range of U.S. cannon artillery is out-ranged by Russian cannons 24 kilometers to 29 kilometers while coalition rocket and missile systems are out-ranged 70 kilometers to 90 kilometers.[3] These known disadvantages in both volume and range create a greater reliance on air support to achieve

parity. It also extends the BCT area of operations as reconnaissance forces will have to extend further forward in order to locate enemy forces while trying to minimize the main force's exposure to enemy artillery.

With disadvantages in both volume and range of artillery as well as armored forces, a major advantage the U.S. and NATO forces possess is airpower which means a greater emphasis on air-ground integration. Therefore, joint fires must be employed with limited or temporary air superiority while simultaneously integrating close air support and suppression of enemy air defense. As discussed with Desert Storm and Operation Iraqi Freedom, if a major combat operation hopes to initiate and maintain a tactical advantage, it must include effective air-ground integration. This also means BCTs having the ability to conduct airspace control for their area of operations to allow the division to focus on the deeper operational objectives.

The emerging challenges in the multi-domain battle are the electromagnetic spectrum and cyberspace warfare. These aspects create concerns for U.S. forces based on technological reliance. It becomes even more complex as the power to challenge the U.S. technological capabilities can come from state actors, rogue individuals, or anywhere in between. On the battlefield the effects of these new technologies have manifested in both the Ukraine and Georgia.

In the Ukraine, Russian hackers used malware on phones in order to track Ukrainian artillery personnel. The malware was hidden in software from a popular app and could access the phone's communications, location data, and contacts.[4] The use of this information allowed Russian forces to triangulate and locate Ukrainian artillery positions to ensure greater effects with lethal fires. With the extensive use of technology

by U.S. and NATO forces, the same techniques could be used in order to not only locate artillery unit locations but observer locations and headquarters.

In 2008, Russia used a cyber interdiction campaign against Georgia. The techniques they used included a distributed denial of services. The denial of services targeted two of the major banks, commercial entities and other means that could communicate in order to coordinate a response to Russian forces. The result of the attacks was that normal online transactions were instead transferred over telephone and radio. This overloaded telephone and radio lines blocking communications between Georgian government and military entities.[5] If similar techniques were used on U.S. and coalition forces it could greatly hamper communications between echelons as well as deter positive control during air-ground integration.

Cyberspace attacks create two thoughts. First, the importance of redundancies in the system to ensure that if a single node loses connectivity or capability, the system can continue to function. Second, the use of orders and control measures must be thoroughly planned, coordinated, and disseminated to ensure that aircraft, airspace managers, and controllers can continue the fight while relying solely on procedural controls. This ensures the air-ground system is efficient and also helps to mitigate risk.

Multinational interoperability is a major internal challenge for U.S. forces in the future operating environment. To counter potential adversaries, multinational organizations such as NATO identify the demand for both strength and speed for rapid response. In order to do so the use of airpower and air-ground integration to include CAS are essential.[6] Known significant challenges within multinational interoperability include: centralized versus decentralized control of fires; demands for liaisons at all echelons;

doctrinal differences in planning and execution; and technological limitations. All of these challenges directly influence the ability for TACS/AAGS to plan, request, coordinate, and execute air-ground integration in a multinational environment.

The challenge of centralized versus decentralized control of airspace and fires is a constant in the multinational environment. When control of airspace and fires is decentralized, it means that the area of operations is divided with the BCT controlling its area while its multinational partners control additional ones. This fails to fully integrate all coalition force capabilities creating an inefficient system. To add to that inefficiency, when conducting clearance of fires additional steps are required for safety of air and ground forces.[7] So regarding air-ground integration functions, this technique helps to alleviate additional planning but falls short in coordination and execution and also creates a more complex requesting process when requiring the use of coalition assets. The fully centralized approach allows for more in-depth planning at higher echelons but increases demands for air-ground personnel at the BCT and lower echelons where joint fires systems deliver effects to shape operations.

The demands for liaisons are based on the multinational forces involved. Language barriers and differing fires procedures create greater demands for fire supporters as liaisons within tactical units. The language barrier remains a factor even with countries who apply the same doctrine.[8] In order to counter this issue, JTACs and other fire supporters are allocated within coalition forces. With an already limited pool of JTACs and airspace managers, this creates a strain on the current TACS/AAGS system in manpower distribution. The distribution of fire supporters and air controllers throughout multinational forces improves air-ground integration with coalition partners but creates

limitations in planning, requesting, coordinating, and executing air-ground integration for the BCT and lower levels.

Along with language barriers, different methodologies in doctrine create a challenge to air-ground integration. Many newer members of NATO and other allies to the U.S. follow doctrine influenced by the former Soviet Union. The Soviet concept of fire support planning was a "bottom-up" concept where the lowest tactical levels determined their requirements while the U.S. planning process executes a "top-down" approach.[9] This creates potential problems when conducting multinational planning and requesting for air-ground integration. This methodology also believes in volume over accuracy for the execution with fires systems.[10] This means that when conducting fires in support of ground forces, there is a higher risk to friendlies in close proximity to the enemy. It also means that there is less efficiency in the use of systems and munitions to cover multiple aspects of the battlefield. The placement of JTACs and fire supporters within coalition forces can alleviate some of the friction within the four functions of air-ground integration.

Lastly, technological limitations in communications and control systems create another challenge to air-ground integration. The U.S. military relies heavily on digital systems to conduct air-ground integration. These systems allow for better situational awareness within the area of operations for both air and ground forces. The BCT possesses these systems to track forces to maintain control. Voice communications provide redundancies to these digital systems to ensure the most current picture is present. Coalition partners operate on different digital systems or do not possess them at all. This results in a higher volume of voice radio traffic.[11] This can potentially create an

overload on those systems which along with language barriers create an even greater challenge. These limitations affect all the functions of air-ground integration. They further prevent the use of redundant systems, degrade efficiency, and increase risk due to miscommunication and lack of responsiveness.

Multinational interoperability is necessary for success in current and future conflicts. The known challenges that come with it allow for the ability to adopt solutions in the future. The current good and best practices involve the use of liaisons in identified command nodes and locations as well as the adoption of U.S. joint doctrine for air-ground integration by NATO forces. These will allow for better planning, requesting and coordinating between all forces. However, language and technology differences will continue to remain present during the execution meaning the Army will need to develop greater capabilities in airspace control and TAC at the BCT and lower echelons in order to cover multinational interoperability requirements.

In summary, the demands on the current and future fighting force will require a force that is flexible, capable of operating at any echelon, in any environment, against any enemy. Joint systems such as TACS/AAGS must have redundancy, efficiency, and risk mitigation to ensure success. These three characteristics allow the BCT to succeed as the Army's primary element for supporting future operations.

The knowns identified through national strategies and doctrine established what the BCT is able manage by itself and require to assist and support coalition partners. This includes its own capabilities to control airspace and clear fires through the use of organic and attached specialties. The fires cell, TACP, and ADAM/BAE elements must perform planning, requesting, coordination, and execution air-ground integration with overhead

assistance from the ASOC and JAGIC. However, based on the level of intensity in the conflict and the size of the fighting force, they must be able to perform as a JAGIC for undetermined periods of time. The knowns from the environment have identified that the BCT will have to conduct air-ground integration along with multinational partners who may or may not have similar capabilities and against adversaries focused on disrupting or destroying friendly command posts and headquarters with lethal and non-lethal capabilities.

Vietnam, Desert Storm, Afghanistan and Iraq identified challenges to the air-ground system. The demand for CAS from the ground force will never be satisfied regardless of how much they receive but the knowns from previous conflicts assists to identify potential friction points in the future. By having redundancies at all echelons for the four functions of air ground integration it allows for greater overall understanding of air-ground systems and greater effectiveness. The case studies showed that a centralized system for requesting and initial coordination allows for efficiency in providing air support to lower echelons. It further showed the importance to establish this centralized air-ground system early in theater operations. TACS/AAGS must provide enough redundancy and personnel that it can expand during operations in order to maintain situational awareness of both airspace and ground forces in order to mitigate risk and provide effective fires.

Future challenges within the multi-domain environment demonstrate how the BCT will need to rely more heavily on air-ground integration in order to combat peer adversaries. It also demonstrates how cyberspace and the electromagnetic spectrum now play into operations. These two areas can create further chaos on the battlefield by

denying the use of essential digital systems. This places greater emphasis on the need for the BCT and lower echelons to have the greatest understanding possible to effectively plan, request, coordinate, and execute air-ground integration at their levels. Additionally, when facing these challenges, BCTs will be the focal point for shaping and developing multinational partners during the range of military operations. The BCTs will need to not only maintain their own TACS/AAGS capabilities, but also reinforce those of their multinational allies in order to successfully integrate air and ground systems into operations.

Air-ground integration is an essential system for future combat. Its capabilities at the BCT level must be redundant and efficient in order to initiate TACS/AAGS in a smaller theater, reinforce the JAGIC during offensive operations, and to support and reinforce multinational partners throughout all operations. The current BCT within TACS/AAGS does not possess this capacity. There is a capability gap within TACS/AAGS at the BCT level due to a lack of redundancy, efficiency, and risk mitigation which require increased manning, equipping, and training in order to meet the challenges of the future environment. The shortfalls are not just within the ability to execute CAS at the BCT and lower echelons but also to manage and control airspace.

Recommendations

The current TACS/AAGS when executed according to doctrine provides an adequate structure to support any type of major combat operation at the BCT level. However, it lacks redundancies in order to make it flexible to support the future operating environment. The future operating environment will have greater demand on air-ground integration structures such as TACS/AAGS in order to support coalition partners.

Therefore, there is a capability gap within the BCT in being able to expand when required to support multinational operations. In order to expand, TACS/AAGS must drive to establish a larger JTAC and airspace management capability at the BCT and lower echelons through expanding the Air Force JTAC program, creating an Army JTAC program, or combined solution.

In order to expand air-ground integration and CAS capabilities at the BCT and lower echelons, both the Army and Air Force must recognize that providing JTACs down to the company level creates this flexibility. It would allow for maximum planning, requesting, coordination, and execution down to the company level. It would also allow when necessary to attach these JTACs with coalition partners. In order to achieve this goal, the total number of JTACs required for the Army rises from approximately 280 to nearly 700.

Courses of Action

The Air Force currently provides an approximate total of 280 JTACs to the Army's ten divisions based on the current Memorandum of Understanding between the two services along with joint and service doctrine. This thesis concludes there are three options in the ability to more than double the current slate of JTACs. The first is that the Air Force maintains this task exclusively and produces more JTACs. The second option is that the Army establishes their own JTAC program alleviating the Air Force of the requirement to support the Army altogether and focus exclusively on coalition integration. Lastly, the Army and Air Force combine their efforts to fill the gap with the Air Force continuing to produce their current slate and the Army focuses on their own JTAC program in order to produce additional JTACs at the battalion level and below.

Further research is required to determine how the Air Force could expand its current pool of JTACs to fill positions down to the company level. The advantages to the Air Force maintaining the JTAC mission exclusively are that they have always held the mission making them the most familiar, and more importantly, they possess the education and training structures to recruit, educate and train JTACs. A significant challenge with this expansion revolves around the ability for the expanded pool to maintain semi-annual currencies based on availability of aircraft and equipment. Another potential solution would be to allow more currency training to be conducted through online and simulations means. The research question to ask with increasing the Air Force JTAC pool is can simulations training substitute live aircraft training without diminishing the quality and capability of the JTAC?

The option of the Army creating and supporting requirements with its own JTAC program has potential. The Army currently has forward observers within all maneuver companies and platoons as well as at the battalion and BCT levels. The advantages of this approach are that the direct ownership of the observers, their training, and manning structure remain under Army control. The disadvantages with this approach are the requirements to establish and maintain an Army JTAC program and additions to overall Army end strength. The processes would require extensive thought into the funding and structuring of formal education as well as creating the requirement within the Army to have organic rotary wing and unmanned assets provide CAS. Possible research questions can assess the necessary funding and establishment requirements it would take to create a JTAC schoolhouse, the ability for Army JTACs to establish and maintain currency, and the demands required of Army aviation and their feasibility.

The third course of action is that the Air Force maintains its current structure and support relationship with the Army but the Army also establishes its own program in order to fill the gap currently present in the BCT. The advantages are that the Air Force continues to maintain the training and structure which make TACS/AAGS successful while also expanding the pool of JTACs needed for multinational operations. The challenges for this approach mirror the second one with the requirements to establish a JTAC program. Further research regarding this approach can assess which Air Force and Army personnel are most appropriate for integration with coalition forces and also which service will own the education and training structures for the joint JTAC program.

With any of the three courses of action the challenge lies in the demands on funding, training, and aircraft availability. It is apparent that in order to conduct multinational operations these specialized skills are necessary to be effective in air-ground integration. The need for redundancy, efficiency, and risk mitigation are essential requirements for the future operating environment.

Additional Future Research

Certain challenges arose during the research for this thesis. There is a wealth of information about previous conflicts readily available through physical and digital library sources, CALL research personnel, and other online means. However, difficulties were present in turning this information into knowledge and understanding. The primary challenge with case study research was a lack of consolidated quantitative information on CAS during Vietnam. CALL as well as the online Joint Lessons Learned Information System provided tremendous amounts of field reports, lessons learned, after-action reports, and much more. But there were no adequate, available summaries on the

quantitative use of CAS during Vietnam. Such products were available for Desert Storm, Iraq, and Afghanistan. Items such as number of sorties, percentage of sorties releasing ordnance, and ratios of planned versus immediate CAS requests were not readily available. The Vietnam War is a great case study for CAS and air-ground integration as it relates to the current and future operating environments as it encompasses major combat operations, counterinsurgency operations, advisory support, and multinational operations.

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[5] E. Lincoln Bonner, III, "Cyber Power in the 21st Century Joint Warfare," *Joint Forces Quarterly* (3rd Quarter 2014): 106.

[6] John W. Nicholson, "NATO's Land Forces: Strength and Speed Matter," *Prism* 6, no. 2 (July 2016): 41.

[7] Center for Army Lessons Learned (CALL), Handbook 14-16, *Multinational Interoperability Reference Guide, Lessons and Best Practices* (Fort Leavenworth, KS: Center for Army Lessons Learned, February 2016), 47.

[8] Imre Marton, "Improvement of Hungarian Joint Terminal Attack Program" (Master's thesis, Command and General Staff College, June 2013), 44.

[9] CALL, Handbook 14-16, 50.

[10] Ibid. 48.

[11] Ibid., 52.

GLOSSARY

Air Liaison Officer (ALO): The senior tactical air control party member attached to a ground unit who functions as the primary advisor to the ground command on air power. The ALO is a position at every BCT and provides advisement to the BCT commander regarding the planning and execution of CAS. During execution of CAS, they provide airspace management and control of aircraft for the BCT along with the TACP.

Air Support Operations Center (ASOC): The principal air control agency of the theater air control system responsible for the direction and control of air operations directly supporting the ground combat element. The ASOC directly supports the Division within the combat theater and the manning is generally provided by Air Support Operations Squadron aligned with that Division at home-station.

Army Air-Ground System (AAGS): A component of the theater air-ground system, it provides for interface between Army and air support agencies of other Services in the planning, preparation, execution, and assessment of airspace use. It consists of airspace elements, fires cells, air and missile defense sections, and coordination and liaison elements embedded in Army command posts.

Forward Air Controller (FAC): An officer (aviator/pilot) member of the tactical air control party who, from a forward ground or airborne position, controls aircraft in close air support of ground forces. The FAC provides control of aircraft during the execution phase of CAS.

Forward Air Controller (Airborne) (FAC (A)): A specifically trained and quality aviation officer, normally an airborne extension of the tactical air control party, who exercise control from the air of aircraft provide close air support of ground troops.

Joint Air-Ground Integration Center (JAGIC): Located within the Army division current operations integration cell, it provides commanders a technique to coordinate, integrate, and control operations in division-assigned airspace. It facilitates effective mission execution while reducing the level of risk. A staff organization designed to enhance joint collaborative efforts to integrate and synchronize at the division level to allow rapid execution and clearance of fires and airspace.

Joint Fires Observer (JFO): A trained service member who can request, adjust, and control surface-to-surface fires, provide targeting information in support of Type 2 and 3 close air support terminal attack control, and perform autonomous terminal guidance operations. The JFO is an Army forward observer who provides the JTAC essential targeting information to conduct CAS but cannot directly control the aircraft during execution.

Joint Terminal Attack Controller (JTAC): A qualified and certified service member who, from a forward position, directs the action of combat aircraft engaged in close air

support and other offensive air operations. A JTAC is a member of the TACP at the battalion, brigade, and division level and are the only individuals qualified to control aircraft during CAS execution.

Tactical Air Control Party (TACP): The principal air liaison unit collocated with ground maneuver units. It has two primary missions: advise ground commanders on the capabilities and limitations of air operations and provide the primary TAC of CAS. Members of the TACP include the ALO, JTAC, Intelligence Surveillance and Reconnaissance Liaison Officer, and Space Liaison Officer. The ALO at the battalion level is generally a specially trained and experienced non-commissioned officer or officer.

Theater Air Control System (TACS): It includes all of the command and control related capabilities and activities associated with air, space, cyberspace, nuclear and agile combat support operations to achieve strategic, operational, objectives. Portions of TACS that directly embedded with AAGS are the ASOC, TACPs, and JTACs.

Theater Air Control System / Army Air Ground System (TACS/AAGS): The full integration of the Air Force TACS with the Army AAGS. This includes the integration of the ASOC with the Division Headquarters and JAGIC as well as the placement of TACPs throughout the BCT Headquarters and Maneuver Battalions.

Theater Air-Ground System (TAGS): Combines each Service's command and control and airspace management system into a unified framework allowing each to contribute in a unified joint and coalition effort supporting the joint force commander. Both TACS and AAGS along with other service systems create TAGS.

Terminal Attack Control (TAC): The authority to control the maneuver of and grant weapons release clearance to attacking aircraft. JTACs located within TACPs at the division, brigade, and battalion level provide this capability to AAGS as the Army does not possess an organic capability.

Type 1 Control: When the JTAC/FAC (A) requires control of individual attacks and the situation requires the JTAC/FAC (A) to visually acquire the attacking aircraft and the target for each attack.

Type 2 Control: When the JTAC/FAC (A) must visually acquire the target or utilize targeting data from another asset with accurate real-time targeting information but still requires control of individual attacks.

Type 3 Control: When the JTAC/FAC (A) requires the ability to provide clearance for multiple attacks within a single engagement, subject to specific attack restrictions. The JTAC/FAC (A) must visually acquire the target or utilize another asset with accurate real-time targeting information.

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