TRADOC Pamphlet 525-7-3

The United States Army Concept Capability Plan for

Airspace Command and Control

for the Future Modular Force

2015-2024

Version 1.0

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Foreword

From the Director
U.S. Army Capabilities Integration Center

Airspace command and control (AC2) as defined in TRADOC Pamphlet (Pam) 525-7-3 replaces Army airspace command and control (A2C2) which was primarily a planning and integration process. AC2 is the dynamic integration of all airspace users in accordance with the commander's intent, priorities, and risk guidance. While not unique to airspace, jointness, priority to supported commander and speed of events affect AC2 more than other C2 tasks. TRADOC Pam 525-7-3 is fully nested within joint and Army concepts and integrates the airspace requirements necessary to support the Army's family of capstone, operating and functional concepts.

AC2 has become a complex challenge for commanders that can no longer be addressed with simple preplanned routes, fixed altitudes, and static control measures. The current plan-centric method of controlling airspace use does not enable commanders to fully integrate all airspace users with ongoing operations in near real time. While detailed planning will remain critical, AC2 will shift from a planning to an execution centric activity enabling individual airspace users to be retasked dynamically to respond to immediate needs. The focus of airspace management will change from today's practice of reserving large blocks of airspace for potential use to protecting airspace near airspace users. Automated decisionmaking will use relevant information from sensors and self reporting platforms to integrate airspace users in accordance with commander's priorities and risk levels automatically.

The operational environment during the 2015-2024 timeframe will increase in complexity with the proliferation of unmanned aerial systems and the introduction of host nation, nongovernmental agencies, and civil aviation to the battlefield. This presents commanders with airspace challenges not previously encountered. In order to successfully operate in this OE, future Modular Force commanders at all echelons must be capable of synchronizing forces and warfighting functions in all four dimensions in near real time.

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Executive Summary

Introduction

Future Modular Force commanders at all echelons must be capable of synchronizing forces and warfighting functions in the vertical dimension in near real time. AC2 is the dynamic integration of all airspace users in accordance with the commander's intent, priorities, and risk guidance. The primary A2C2 deconfliction method was to reserve airspace for each airspace user and then ensure that each airspace user stayed within their reserved airspace. A2C2 was not responsive enough to dynamically support current operations forcing commanders to accept excessive risk to airspace users, to operations or to both. Often, the airspace requested was no longer needed by the time it was approved, disseminated, and activated. While A2C2 was effective for managing airspace use for the legacy force, it is incapable of meeting the requirements of the future Modular Force.

Purpose

The purpose of TRADOC Pam 525-7-3 is to describe how future Modular Force commanders will conduct AC2 and to identify the capabilities required to implement AC2 fully. The description of these capabilities will be sufficient to enable follow-on analysis designed to develop doctrine, organization, training, materiel, leadership and education, personnel, and facilities changes required to integrate AC2 into the future Modular Force command and control (C2) warfighting function. The capabilities identified in this document will enable the effective integration of AC2 into the C2 warfighting function of the future Modular Force and synchronize these with joint battle management. This will provide future Modular Force commanders the same flexibility and responsiveness for airspace and airspace users as for ground area of operations and maneuver forces.

Scope

The capabilities described by this plan are applicable to all Army echelons with responsibilities for C2 of airspace and airspace users, from tactical to operational level, through all operational phases, focused on the timeframe of 2015–2024. Typically, this includes combined arms headquarters from brigade combat team multifunctional brigades through theater Army headquarters. However, based on mission, enemy, terrain and weather, troops and support available, time available, civil consideration and task organization, some of the capabilities will be applicable to platform and platform controller level, such as situational awareness and data and voice beyond line of sight and non line of sight communications.

Military Problem

AC2 has become a complex challenge for commanders that can no longer be addressed with simple pre-planned routes, fixed altitudes, and static control measures. The current plan-centric method of controlling airspace use does not enable commanders to integrate fully all airspace users with ongoing operations in near real time. The increasingly complex operating environment with the proliferation of unmanned aircraft systems and the introduction of host nation, nongovernmental agencies, and civil aviation to the battlefield presents commanders with an airspace challenge not previously encountered. To successfully operate in this environment, future Modular Force commanders at all echelons must be capable of synchronizing forces and warfighting functions in the vertical dimension in near real time.

Solution Synopsis and Key Ideas

The Army will improve airspace access and safely and effectively increase the density of airspace users by building airspace control nodes into combined arms headquarters optimized to control airspace in tactical areas from low to mid altitudes. These AC2 nodes do not replace or supplant existing airspace C2 elements provided by other Services. Rather the Army provides the joint force commander's theater air ground system additional C2 assets. TRADOC Pam 525-7-3 incorporates the following key ideas.

- AC2 is both a major task within the joint and Army C2 warfighting function and a major activity of the joint interdependency category of joint battle management.
- The Army will contribute to the joint force commander's airspace control system by enabling combined arms headquarters to control joint airspace over an Army area of operations.
- While detailed planning will remain critical, AC2 will shift from a planning to an execution centric activity enabling individual airspace users to retask dynamically to respond to immediate needs.
- Networked sensor data coupled with self-reporting data from airspace users will enable the situational awareness necessary to integrate airspace utilization with commander's priorities.
- Automated decisionmaking will use relevant information from sensors and self-reporting platforms to integrate airspace users in accordance with commander's priorities and risk levels automatically.
- Networked infrastructure and interoperable data will connect decisionmakers at joint C2 nodes in near real time enabling collaboration during the operations process.
- Airspace control elements will have beyond line of sight and non line of sight data and voice communications in all required frequency spectrums with all airspace users (joint, Army, multinational, governmental, and civil). This capability will exist at the platform level and will allow all airspace users to see the relevant portion of the common operational picture in near real time enabling immediate hazard avoidance at the platform level as combatants react to battlefield action.
- TRADOC Pam 525-7-3 is fully nested within joint and Army concepts and integrates the airspace requirements necessary to support the Army's family of capstone, operating, and functional concepts.

Department of the Army
Headquarters, United States Army
Training Doctrine Command
Fort Monroe, Virginia 23651-1046

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20 April 2009

Military Operations

THE U.S. ARMY CONCEPT CAPABILITY PLAN FOR AIRSPACE COMMAND AND CONTROL CONCEPT CAPABILITY PLAN FOR THE FUTURE MODULAR FORCE 2015-2024

FOR THE COMMANDER:

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History. This pamphlet (pam) is a new U.S. Army Training and Doctrine Command (TRADOC) concept capability plan (CCP) developed as part of the Army Concept Strategy for the future Modular Force and as part of the capabilities based assessment process.

Summary. TRADOC Pam 525-7-3, *The U.S. Army Concept Capability Plan for Airspace Command and Control Concept Capability Plan for the Future Modular Force 2015-2024* identifies capabilities that provide the required details to initiate an AC2 focused capabilities based assessment, if necessary, within the Joint Capabilities Integration and Development System. An AC2 or battle command assessment will identify doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) solution sets for a concept focused on the strategic, operational, and tactical application of integrated AC2 capabilities required to conduct full spectrum operations during the 2015-2024 timeframe. TRADOC Pam 525-7-3 is derived from documents addressing the Army's future Modular Force, which includes divisions, corps, Army service component commands, and brigade combat teams. It also addresses requirements specified in the Army Future Combat Systems Organization and Operation Plan, TRADOC Pam 525-5-600, *U.S. Army's Concepts of Operations LandWarNet 2015*, and emerging joint and Army concepts relevant to Department of Defense and Army transformation.

Applicability. This CCP applies to all Department of the Army, TRADOC, and non-TRADOC Army proponents and activities that identify and develop DOTMLPF solutions to field required AC2 capabilities. Active Army, Army National Guard, Army Reserve operating forces, and Army Materiel Command may use this pamphlet to identify future AC2 trends in the Army. It may also serve as a reference document for agencies within the joint community that are planning or are otherwise concerned with Army AC2 initiatives.

Proponent and supplementation authority. The proponent of this pamphlet is the TRADOC Headquarters, Director, Army Capabilities Integration Center (ARCIC). The proponent has the authority to approve exceptions or waivers to this pamphlet that are consistent with controlling law and regulations. Do not supplement this pamphlet without prior approval from Director, TRADOC ARCIC (ATFC-ED), 33 Ingalls Road, Fort Monroe, VA 23651-1061.

Suggested improvements. Users are invited to send comments and suggested improvements on DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to Commander, TRADOC (ATFC-ED), 33 Ingalls Road, Fort Monroe, VA 23651-1046. Suggested improvements may also be submitted using DA Form 1045 (Army Ideas for Excellence Program Proposal).

Distribution. This publication is only available on the TRADOC Homepage at http://www.tradoc.army.mil/tpubs/pamndx.htm.

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Chapter 1
Introduction

1-1. Purpose

a. TRADOC Pamphlet (Pam) 525-7-3 describes how future Modular Force commanders will conduct airspace command and control (AC2) and to identify the capabilities required to fully implement this concept of AC2. AC2 is defined as the integration of all joint airspace users, in both planning and near real time execution in accordance with the commanders intent, priorities and acceptable level of risk, in order to maximize all airspace users' capabilities, while minimizing adverse impacts. Joint airspace users include manned and unmanned aircraft systems, munitions, and directed energy weapons operated by all components including multinational forces and authorized governmental or civil agencies. The description of these AC2 capabilities will be sufficient to enable follow-on analysis designed to develop doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) changes required to integrate AC2 into the future Modular Force command and control (C2) warfighting function. Additionally, the key ideas and capabilities will provide concepts and focus for wargaming and experimentation and may result in one or more AC2 and battle command focused capabilities based assessments. These assessments will refine the identified AC2 capabilities into exact DOTMLPF solutions for AC2 operations capability gaps during the 2015–2024 timeframe.

b. The capabilities identified in this document will enable the effective integration of AC2 into the C2 warfighting function of the future Modular Force and synchronize the AC2 task with joint battle management AC2. This will provide future Modular Force commanders the same flexibility and responsiveness for airspace and airspace users as for ground area of operations (AO) and maneuver forces**.**

c. The intent of TRADOC Pam 525-7-3 is to establish AC2 as an integral task of the C2 warfighting function for ground forces. However, several factors, while not unique to airspace, affect AC2 more than other C2 tasks. The factors that make AC2 complex and highly sensitive to DOTMLPF shortfalls include the following

(1) Jointness. Airspace is inherently joint, meaning; any action taken by one component's airspace user may impact on another component's airspace user. Joint doctrine does not inherently give land AO commanders the authority to control airspace over their assigned AO. The airspace remains under the control of the joint force commander (JFC) and is managed by the airspace control authority (ACA) because multiple functional components, and often multiple nonmilitary agencies, require access to airspace in order to function. One result is that combined arms headquarters (HQ) often at multiple levels, routinely coordinate with the ACA or airspace control elements of other functional components.

(2) Priority to supported commander. In accordance with joint doctrine, the priority of airspace use should be to the supported commander, in accordance with JFC priorities. Often, the priority of airspace use is blurred when multiple supported commanders require access to the same airspace for different missions. The land AO owner is the first supported commander for

operations in his assigned AO, but the joint force air component commander (JFACC) is always the supported commander for defensive counter air. Other commanders (for example, special operations) frequently have JFC priority for operations without respect to the boundaries of an AO. These conflicting priorities and requirements often lead to confusion that is not an AC2 specific problem but rather a joint C2 problem.

(3) Speed of events. Both planned and immediate events occur much faster in the air than on the ground due to the speed of the platforms involved. AC2 must enable near real time coordination, decisionmaking (a combination of automated and human) and dissemination to ensure all users and platforms receive relevant information (RI) quickly enough to react appropriately. The operations process for ground maneuver usually has some flex time as the speed of ground systems rarely exceed 50 miles per hour. By comparison, joint and Army air assets routinely operate three to nine times faster, necessitating near real time conflict resolution and decisionmaking in four dimensions. The new definition of four dimensional is a plane of reference referring to latitude, longitude, altitude, and time.

1-2. Why the Concept Capability Plan (CCP) is Needed

a. There is no Army concept or plan that fully describes the capabilities required for the future Modular Force to conduct AC2 operations as an enabling task of the operations process for the four dimensional AO. The future Modular Force commander requires an operations process that fully integrates airspace users and ground maneuver forces with joint AC2 planning and decisionmaking organizations and authorities.

b. This concept capability plan (CCP) describes the AC2 capabilities required to produce a fully integrated C2 warfighting function that enables commanders to synchronize forces and warfighting functions to accomplish missions.

1-3. Functional Area

a. This CCP identifies capabilities required to enable Army airspace operations during the 2015–2024 timeframe. This plan addresses AC2 activities (C2, airspace management, fires, movement and maneuver, and protection) and the capabilities needed to integrate these activities in support of a fully integrated C2 warfighting function for future operations. It incorporates key elements of the operational environment (OE), C2, and network-enabled operations joint functional concepts, and is fully nested with the Army Concept Strategy.

b. The capabilities described in this plan will enable future Modular Force commanders to perform the following.

(1) Gain and maintain situational understanding (SU) of four dimensional operational environments.

(2) Integrate, synchronize, and deconflict all airspace requirements and operations in near real time.

(3) Interoperate digitally in joint, Army, multinational, governmental, and civil operations.

1-4. References
Required and related publications and prescribed and referenced forms are listed in appendix A.

1-5. Explanation of Abbreviations and Terms
Abbreviations and special terms used in this regulation are explained in the glossary.

Chapter 2
Scope

2-1. Introduction

a. The scope of Army AC2 as depicted in TRADOC Pam 525-7-3 is consistent with current joint and Army concepts, and focuses during the 2015–2024 timeframe. The basis for analysis include the joint and Army concepts detailed later in the chapter.

b. The capabilities described by this plan apply to all Army echelons with responsibilities for C2 of airspace users. Typically, this includes combined arms HQ from brigade combat team (BCT) and multifunctional brigades through Theater Army HQ. However, based on mission, enemy, terrain, troops, time, and civil considerations (METT-TC) and task organization, some of the capabilities will be applicable to platform and platform controller level, such as situational awareness (SA) and data and voice beyond line of sight (BLOS) and non line of sight (NLOS) communications.

c. TRADOC Pam 525-7-3 covers all AC2 requirements from tactical to operational level, through all operational phases. It includes interoperability requirements between all airspace users (joint, Army, multinational, governmental, and civil). These requirements provide additional focus for capabilities which can be broadly described as follows.

(1) The ability to detect, track, classify, identify airspace objects; predict their flight path and trajectories; integrate all airspace users; and display this information on an integrated display.

(2) The ability to collaboratively analyze airspace requirements and utilization, and maximize employment of all systems while minimizing risk.

(3) The ability to communicate rapidly data, information, and C2 decisions to all users and decisionmakers.

(4) Provide common, agreed upon procedures that govern the processes for planning and utilization of airspace and regulation of airspace users.

2-2. Airspace Command and Control

a. AC2 increases combat effectiveness by synchronizing forces and warfighting functions to accomplish missions in the vertical dimension. AC2 promotes the safe, efficient, and flexible use of airspace consistent with commander's priorities and risk guidance. The capabilities described in this publication apply to Army users of airspace throughout the entire scope of full spectrum operations. AC2 allows the maneuver commander to operate within the framework of operations on the distributed battlefield. AC2 elements enhance SA and understanding of all airspace users in order to reduce fratricide, and assist in navigation and the location of airspace users. Airspace systems assist in maintaining a near real time complete integrated air picture through networked, self-healing, secure communications with all members of the air-ground team.

b. AC2 is crucial for the integration and deconfliction of competing users that must share the finite resource of airspace for mission accomplishment. Highly trained AC2 personnel with future C2 systems will enable commanders to dynamically orchestrate the air and ground maneuver, fires and effects, and air defenses throughout the joint operational environment (JOE). Airspace users of all types of airspace systems, from the small unmanned aircraft systems (UAS) to manned air platforms to munitions, must be educated on the airspace task and properly equipped.

c. Elements organized to provide AC2 support to current Army forces are resident in the following organizations and will also reside in the equivalent future Modular Force organizations. They include the air traffic service (ATS) company of the general support aviation battalion; a theater airfield operations group, airfield operations battalion; air defense airspace management, and brigade aviation elements. They also include Stryker, infantry, and heavy BCTs, and a battlefield surveillance brigade. Finally, elements include air defense airspace management: fires brigade, combat aviation brigade, maneuver enhancement brigade, future BCT, and AC2 element of the division command posts; AC2 element of the corps command posts; air defense artillery fire control officers located at Theater Air Ground System (TAGS) nodes; AC2 element of the theater Army's operational command post; and, airspace management section of the battlefield coordination detachment.

2-3. Relation to Joint Concepts

a. Joint operating concepts (JOCs). While the AC2 concept and capabilities identified in this CCP support all JOCs, they are most relevant to three; the Major Combat Operations JOC; the Stability Operations JOC; and the Homeland Defense and Civil Support JOC. In these JOCs, future C2 tasks and systems must provide commanders a comprehensive understanding of the OE in order to enable rapid assessment and understanding of the JOE and the ability to make decisions and disseminate information to all participants rapidly. Joint networked, interoperable, AC2 systems will provide the aerial portion of the common operational picture (COP), fully integrating joint, Army, multinational, governmental, and civil airspace users. Full data interoperability of AC2 systems with joint C2 nodes will enable joint collaborative planning and decisionmaking that will optimize the employment of systems while minimizing operational risk to forces and platform.

b. Joint functional concepts. As joint functional concepts identify capabilities in support of JOCs, AC2 capabilities are most relevant to the joint functional concepts focused on SA, joint interoperability and C2. The AC2 task and associated systems are most relevant to three joint functional concepts: Battlespace Awareness Joint Functional Concept, Joint C2 Functional Concept, and Force Application Joint Functional Concept.. Fully networked AC2 systems will utilize data links from joint sensors to provide commanders with near real time, collated aerial SA. Full joint interoperability of all AC2 systems will allow joint collaboration throughout the planning and execution of full spectrum operations, enabling commanders to synchronize the employment of all joint assets at the decisive points with maximum effectiveness and minimal operational risk.

c. Joint integrating concepts (JICs). The JICs that are most relevant to AC2 capabilities are C2, integrated air and missile defense (AMD), joint forcible entry, joint urban operations, and the net-centric OE. A common theme in these JICs is a rapidly changing OE involving complex distributed, simultaneous or sequential operations, often with other agencies and nations. Commanders must make decisions in a volatile, ambiguous environment containing irregular, catastrophic, disruptive, and conventional threats. Joint C2 systems must ensure information and decision superiority that will enable joint planning and coordination in order to integrate numerous capabilities from all sources into a cohesive force. AC2 systems will employ data from networked joint sensors to ensure that all joint C2 nodes have continuous access to air SA. Common aerial situational analysis and AC2 systems' collaborative planning and coordination capabilities will allow commanders at all echelons to develop SA, develop and evaluate courses of action and make decisions quicker than adversaries can react. In all operations, AC2 systems will provide rapid access to relevant, accurate, and timely information, and the ability to create and share the knowledge with joint, Army, multinational, governmental, and civil agencies.

2-4. The Army Concept Strategy

a. Capstone concept. TRADOC Pam 525-3-0. TRADOC Pam 525-3-0 states the future Modular Forces will conduct operations as an integrated component of a joint force and will depend on the capabilities from other services to maximize effectiveness. Information and decision superiority, enabled by networked C2 systems will allow future Modular Forces, as a component of the joint force to maneuver throughout the joint operations area, employ a multitude of capabilities to defeat enemy forces and conduct stability operations in order to maintain continuous pressure on hostile forces. Joint networked interoperable C2 systems and activities enable each of the key operational ideas by providing the capabilities to do the following.

(1) Develop and share an integrated air picture of all airspace and airspace users in the joint operations area through digital data links with all joint sensors.

(2) Plan collaboratively with all AC2 and joint C2 nodes.

(3) Develop and share operational data with all joint C2 nodes.

(4) Fully integrate operations of all joint, Army, multinational, governmental, and civil airspace users in accordance with commander's priorities.

(5) Detect, identify, and destroy threat air platforms before they affect operations.

(6) Execute automated integration of all aerial platforms in order to mitigate risk.

b. Operating concepts: TRADOC Pam 525-3-1 and TRADOC Pam 525-3-2. Future Modular Force commanders link a broad array of tactical actions to achieve a JFC's campaign objectives. Higher levels of SU and networked C2 permit the future Modular Force to operate non-linearly and apply a variety of joint capabilities at lower levels in support of land operations. Collaborative joint decisionmaking and execution processes will enable more effective conduct of full spectrum operations and rapid transition between offensive, defensive, and stability operations. As with the capstone concept, AC2 capabilities interoperate with joint sensors and joint C2 nodes to provide SA, collaborative planning and decisionmaking, integration of all airspace users, and detection, identification and engagement of threats.

c. Functional concepts. Chapter four contains a detailed examination of AC2 capabilities and their relationship to the Army functional concepts. This is a brief summary of how AC2 capabilities support each of the functional concepts.

(1) TRADOC Pam 525-3-3. AC2 systems employ fully networked, organic, and joint sensors, and seamless, BLOS and NLOS voice and data communications to develop air and ground SA. Full joint data interoperability, BLOS and NLOS communications and joint doctrine and multi-Service tactics techniques and procedures (MTTP) allow AC2 personnel to collaborate with all joint C2 nodes in both planning and execution. This enables commanders to make timely, well informed decisions that optimize the employment of all available resources and assets.

(2) TRADOC Pam 525-2-1. AC2 systems will employ networked organic and joint sensors coupled with self-reporting aerial platform information to produce an integrated air picture. This four dimensional location, identification, and classification data will be used by AC2 systems to reference joint and civil airspace databases to provide complete identification and mission data. The combined capabilities of netted sensors, joint interoperable data and MTTP will enable AC2 elements to coordinate immediate airspace requirements directly with joint C2 nodes. These capabilities will enable both the tasking and the retasking as necessary of air sensors and other aerial platforms.

(3) TRADOC Pam 525-3-6. In order to support the initial force flow, AC2 systems will enable near real time planning and coordination with the ACA for air movement into the area of responsibility. Employment of BLOS and NLOS communications, interoperable data exchange, joint MTTP, and SA developed from networked joint sensors, AC2 elements will coordinate directly with TAGS control nodes and individual airspace users to ensure safe passage of intra- and intertheater maneuvering forces.

(4) TRADOC Pam 525-3-4. AC2 systems support TRADOC Pam 525-3-4 by providing near real time air SA allowing for the integration of airspace users, enabled by networks and systems that electronically perform the deconfliction of airspace. Fires and AC2 network applications exchange data to facilitate near real time execution of activities to reprioritize fires, redirect, or delay air or ground fires and aircraft to facilitate operations. Future fires systems will pass planned and immediate missions to AC2 systems in order to integrate these missions with other airspace users. Joint interoperability with networked, secure, BLOS and NLOS data and voice communications, joint doctrine and MTTP will allow AC2 elements to coordinate directly with all affected TAGS control nodes and with airspace users.

(5) TRADOC Pam 525-3-5. Full aerial SA, composed of fused data from organic and joint sensors, with combat identification (CID) data, will enable AC2 elements to coordinate directly with TAGS control nodes and AMD forces to identify threat systems before they can affect friendly forces. The ability of AC2 systems to identify all airspace users and interface seamlessly with joint and civil airspace systems allows the dual capability of protecting noncombatant civil aviation while simultaneously identifying potential threats from civil aircraft.

(6) TRADOC Pam 525-4-1. Enabled by interoperable AC2 systems, joint doctrine and MTTP, AC2 elements can rapidly coordinate within the TAGS to establish or modify required transit routes and corridors. Persistent surveillance of these routes via the air portion of the COP allows AC2 elements in coordination with all other TAGS control nodes to identify potential threats and conduct the necessary coordination to defeat or neutralize those threats in order to protect air corridors and transiting aircraft.

2-5 Joint Doctrine

a. Airspace use is inherently joint, as the JFC retains authority over airspace use. Therefore, Army airspace doctrine must remain complacent with the family of joint doctrinal manuals that directly or indirectly affect airspace use. While the implementation of joint doctrine will vary over the lifespan of TRADOC Pam 525-7-3, the broad joint doctrinal principles are expected to remain consistent.

b. Understanding TRADOC Pam 525-7-3 requires knowledge of joint doctrine to include: supported and supporting command relationships and how these relationships are affected by the assignment of an AO; the roles, responsibilities and authority of the ACA and the area air defense commander; and the roles, functions and interrelationships of the functional component commanders.

c. Joint doctrine imposes the requirement to coordinate AC2 operations with joint, multinational and government agencies. Additionally, legacy system limitations in the joint force complicate future Modular Force AC2 operations. Without updated information systems, sensor technologies, staffing structures, and MTTP, Army future AC2 capabilities will limit effective operations. Relevant joint doctrinal publications can be found in the reference section of this publication.

2-6 Airspace Relationship to Joint Command and Control (C2)

a. In general terms, C2 is the ability to recognize what needs to be done in a situation and to ensure that effective actions are taken to accomplish the mission. Commanders make decisions after reducing their uncertainty about the OE and increasing their understanding of the complexities of the relationships between adversary, friendly, and neutral forces within the operating environment. Commanders must apply leadership throughout the operations process but a critical factor is the time available in which to make timely decisions and initiate actions.

b. AC2 adds additional complexity to C2 as airspace is inherently joint with all components requiring access to airspace in order to execute the JFC's assigned missions. As such, the processes and systems used to control and manage airspace should link decisionmakers and C2 elements from all components. However, current AC2 doctrine, MTTP, and systems, while functional for planning, do not adequately integrate component C2 execution nodes in order to affect near real time coordination and decisionmaking between components. This lack of integration between airspace users at the execution level significantly limits commanders' ability to synchronize forces and warfighting functions during operations in near real time. No technological gains in capability will mitigate shortfalls in the application of joint doctrine and MTTP.

c. Joint and Army concepts clearly establish that C2 is fundamentally a human activity and that technology and commanders exist to support decisionmaking. In developing future AC2 capabilities, it is important to preserve the enduring principles that underpin the effectiveness of military C2, specifically, unity of command and unity of effort, the authority, responsibility, and accountability of the commander and the principle of the offensive. The AC2 system must accomplish this while integrating the requirements and doctrinal approaches of multiple components.

2-7 Assumptions

Future Modular Force AC2 capabilities identified in this CCP are based on key assumptions. They are listed below.

a. The acquisition community will deliver required technologies in accordance with future Modular Force threshold capabilities.

b. While joint doctrine will evolve, joint doctrinal principles for C2 will remain consistent for the duration of this CCP. Initiatives of the Air Force, Navy, or Marine Corps will not significantly impact this CCP in the near term.

c. The network that will serve as the backbone for network-enabled operations will exist and work as envisioned.

d. Army force transformation campaign objectives are met and will constitute a baseline with respect to basic force structure during the 2015-2024 timeframe.

e. Army will remain a force of infantry, Stryker, heavy future combat systems and special purpose forces during the 2015-2024 timeframe.

f. Future adversaries may not employ large-scale weapons of mass destruction, but are likely to implement asymmetric tactics involving smaller scale chemical, biological, radiological, and nuclear weapons with their associated effects.

g. Peacetime airspace operations and training will require coordination with the Federal Aviation Administration (FAA) within the National Airspace System.

h. In accordance with the theater commander's priorities United States (U.S.) forces from operational to tactical levels will have access to space and the global information grid (GIG). This will provide an interconnected, end-to-end set of information capabilities, for the collection, processing, storing, disseminating, and managing of information.

Chapter 3
The Military Problem

3-1. Operational Environment

a. The OE is characterized by adaptive adversaries and extremes in the physical environment (temperature, terrain, extended distances, etc.). In this OE, the force must prepare to deploy and fight globally, while operating with joint, Army, multinational, governmental, and civil forces, in coordination with national and host nation government agencies and international organizations across the full range of unified action. The spectrum of conflict will range from peacetime military engagement to conflict involving employment of strategic forces and weapons of mass destruction, major theater wars, regional conflicts, homeland security and defense, and small scale contingencies. Theaters range from mature to immature and may require forced entry. Forces must be able to conduct prompt, sustained, synchronized operations with combinations of forces tailored to specific situations and with freedom to operate in all domains, such as space, sea, land, air, and information. Current threat operations are characterized by low-tech systems versus high-tech systems.

b. The speed, diversity, and distribution of operations throughout the joint operations area present considerable challenges to commanders who must continually balance operational requirements with capabilities and conditions in the OE. The requirement to integrate all operations and execute in real time is magnified by the speed and agility of the systems involved and the immediate nature of the missions. Additionally, given the international nature of all operations, civil and commercial aviation will impact the JFC's ability to control airspace use due to the limitations imposed by national and international airspace agreements under the International Civil Aviation Organization (ICAO). Individuals and organizations not subject to the operational control of the JFC operate in accordance with civil aviation rules for airspace use which frequently conflict with operations. In order to integrate and synchronize all operations, commanders must rely on technologies and capabilities in a number of areas, including C2 systems, systems that create SA, joint and interagency dependencies, and communications.

c. Specific current shortfalls include the lack of complete, correlated SA, inadequate secure, jam-resistant, BLOS and NLOS voice and data communications, and inadequate digital data communication and computer network interfaces between Services. Shortfalls also include the inability to share digital data between the services and other interagency, governmental, civil organizations; inadequate joint doctrine and MTTP addressing near real time airspace C2 operations; and inadequate training and education addressing airspace control in a unified action OE.

3-2. Evolution of Airspace Command and Control (AC2) in the Operating Environment (OE)

a. AC2 has evolved from the Army aviation command and control (A2C2), primarily a planning and integration process, which used the same process for both planning and execution. All airspace user needs were identified, planned, and deconflicted. Then requests to reserve and restrict airspace to support the anticipated requirements were forwarded up through A2C2 channels. At each echelon, these requests were reviewed, deconflicted, and forwarded to the ACA through the theater Army's battlefield coordination detachment. These requirements were then integrated into the future airspace control order or published as a change to the current airspace control order. The ACA then sent the changes to all TAGS control nodes, which in turn disseminated the changes to airspace users.

b. The process to react to immediate airspace needs followed the same scheme; airspace requests were submitted through numerous echelons of command for review, approval at the ACA level, then publication and dissemination through the TAGS architecture. This process was time consuming and not responsive enough to enable immediate actions necessary to support current operations. Often an airspace request was no longer needed by the time it was approved, disseminated, and activated. Attempting to mitigate the lead time required for airspace request approvals, many units submitted requests for more airspace coordinating measures than they probably used, or they requested extremely long time periods for their airspace coordinating measures in order to build in flexibility for changes during the operation. These actions led to unnecessarily restricting large blocks of airspace. This blocking of airspace in excess of actual requirements had several unfavorable consequences. It further exacerbated the lack of responsiveness of the airspace request process and it canalized airspace users into predicable patterns of airspace use. Consequently, many leaders viewed A2C2 unfavorably as a separate staff C2 task due to the lack of flexibility needed to react to immediate execution needs.

c. Despite these limitations, the A2C2 process was adequate during past conflicts. Aircraft had specified routes that served to deconflict aircraft, artillery, and air defense systems. The coordinating altitude separated rotary wing from fixed wing by altitude. Restricted operations areas and airspace control areas were established when more than one system operated in close proximity to others. While this system mitigated conflicts among users, it was not reflective of, nor responsive to changes on the ground. While not ideal, the A2C2 system worked for most operations for the reasons covered below.

(1) Everything that flew was flown by rated pilots. UAS were rare and were operated by specialized crews. These aviators and crews were formally trained in airspace and the implications of their actions on other users.

(2) Army airspace users were organic to a limited number of organizations simplifying coordination by allowing controlling agencies to communicate directly with the owning HQ.

(3) In the past, warfare was a 180º fight with a linear battlefield, forward line of troops, and with defined deep, close, and rear battlefield areas. Systems generally flew or fired from the rear to the front with little lateral movement or firing required.

(4) Functional components each flew a different flight profile, governed by the coordinating altitude. U.S. Air Force fixed wing aircraft rarely flew below the coordinating altitude while Army rotary wing aircraft generally stayed below.

(5) Short range air defense used visual engagement rules that when coupled with identification, friend or foe (IFF) and static airspace coordinating measures, mitigated the risk of fratricide.

(6) Major threat users of airspace were higher altitude fast movers. Theater air defense systems detected and identified threats at extended ranges, negating their ability to mix with low altitude airspace users.

(7) Only military aircraft flew in a combat area. Civil air traffic avoided the combat area and contract air carriers were extremely rare.

(8) Artillery and mortars were largely ballistic and were integrated via procedures or risk management.

d. The following sections address how the OE will change and how these changes will affect the control and management of airspace and airspace users.

3-3. Future Operational Environment

a. Threat. The U.S. will remain the dominant military power, yet there are emerging near peers that may challenge this dominance, as well as regional actors that will accept the risk of a conflict with the U.S., and other entities that may falsely believe they can pursue an agenda of violence with impunity. These adversaries will continually seek new capabilities and employment methods to counter the military superiority of the U.S. and its allies.

(1) Adversaries will closely observe emerging U.S. capabilities to identify and exploit weaknesses using asymmetric approaches, rather than confront U.S. forces head-on. Most adversaries will become more adept in the use of camouflage, cover, concealment, denial, and deception as technological advances make hiding increasingly difficult. While the U.S. currently has superior information reporting capabilities in large-scale operations against uniformed enemy

formations, U.S. superiority in intelligence collection will be much less effective against an enemy who conceals himself within a civilian population.

(2) Joint operations will increasingly depend on the successful networking of weapons and information systems. The ability for the future Modular Force to synchronize actions will depend on the capability to rapidly gain and maintain SA from the GIG, pass and receive pertinent near real time data and information to and from all allied and coalition forces, and direct forces and actions in a secure, reliable manner. Specific to AC2, future forces must maintain complete SA of all airspace in order to detect and defeat enemy asymmetric threats. Adversaries will attempt to reduce our SU through tactics and means that conceal their movement and intentions, and technology to directly combat the systems the Army uses to promote SA.

(3) The critical capabilities that will enable these operations include complete, correlated air picture with all platforms identified; secure, jam-resistant, BLOS and NLOS voice and data communications; complete joint interoperability between AC2 systems allowing automated integration of airspace users; joint doctrine and MTTP that enable near real time execution of airspace operations.

(4) As the above capabilities are critical to future Modular Force operations, so too will adversaries target these capabilities. The means used to deny SA will vary considerably, depending on the sophistication of the adversary. As SA is developed from the networking and collaboration of numerous C2 systems, adversaries will attack the system of systems, hindering not only SA but our overall C2. In most scenarios, adversaries will mainly seek to reduce our SA through physical destruction of the systems that provide our RI and SA. This will occur during attacks on recognized combat systems and will, in many cases, affect AC2 infrastructure only by chance. Deliberate attacks against C2 systems will occur only after the adversary has learned to associate command and control information systems with our warfighting capabilities. While the AC2 system is not envisioned as a primary target, it will be degraded as a result of attacks against key enabling networks and nodes. Adversaries will target the capabilities because they are critical to future Modular force operations.

(5) Potential targets and methods of attack include attacks against network connections using electronic attack such as jamming and electronic magnetic radiation; attacks against individual nodes in the network by conventional or unconventional means such as attacking communication nodes, antennas or command posts (CP) with guerilla or other special purpose forces; and attacks against specific C2 systems, using the network itself to corrupt or spy on individual C2 systems.

(6) Threat UAS

(a) The use of low-cost, low-observable UAS by adversaries is increasing. This is possible as a result of micro electronics and the increasing proliferation of non U.S. controlled precision navigation systems analogous to global positioning systems. Threat UAS have the potential for both reconnaissance and strike missions.

(b) Use of threat UAS may not be of itself tactically significant but the concerns of threat use of UAS may force unacceptable restrictions on airspace. These concerns are compounded by joint C2 system inability to adequately address issues of sensor coverage, track identification, and track classification.

b. Friendly Forces

(1) The Army's future Modular Force will conduct operations in complex environments to support the achievement of campaign objectives across the spectrum of conflict. Joint forces will employ large numbers of airspace users including manned and UAS, munitions, and directed energy weapons operated by all components, by coalition forces and authorized governmental and nongovernmental agencies. This intensive use of airspace is a critical base for all Army future concepts. The future Modular Force's ability to use airspace depends on a complete integrated C2 system that allows the seamless flow of information between all C2 nodes, near real time collaboration, data sharing and rapid dissemination of orders. Employing this C2 system will enable future Modular Forces to conduct simultaneous, continuous distributed operations to control the operational tempo and maintain continuous pressure on adversaries.

(2) All future operations will rely upon an integrated, collaborative C2 system to synchronize and optimally employ all capabilities of the future Modular Force. The AC2 subset of this C2 system must enable near real time, collaborative planning, preparation, execution, and assessment processes necessary to synchronize air operations with ground operations. The simultaneous and continuous operations noted above will demand an exponential increase in the numbers of aerial platforms over operations of today's forces. Every echelon from platoon to theater will employ UAS. Manned Army aviation platforms performing missions from reconnaissance to attack to resupply will be retasked en route between these missions.

(3) Indirect fires systems must respond immediately to threat systems with conventional, precision, and loitering munitions, while AMD forces will engage threat systems at all ranges, altitudes, and aspect angles. Based on the speed of these systems, the immediacy of the required actions and the sheer number of these platforms vying for airspace, the future Modular Force must be able to integrate all of these systems in a near real time, collaborative method. To reduce the risk of fratricide commanders will rely on automated deconfliction and integration capabilities resident in future C2 systems to redirect platforms or to alert the decisionmaker when changes cannot be implemented within mission constraints automatically. In order to enable this method of operation, all C2 systems must have complete SA of all airspace users, be completely netted to all other C2 systems, and employ common rule sets that are keyed to the commander's priorities.

c. Complex terrain. Complex terrain includes urban settings, weather, topography, hydrology, and environmental conditions that detract from a conventional force's ability to concentrate its efforts. Adversaries clearly understand that less complex and open environments favor the U.S. with its standoff technology, precision guided munitions, long range, networked sensors and communications systems and advanced (such as, reconnaissance, surveillance, and surveillance; reconnaissance surveillance and target acquisition; and intelligence, surveillance, and reconnaissance capabilities. For this reason, adversaries will seek to use complex terrain

such as urban environments and unfavorable weather patterns when confronting U.S. forces. Adversaries will take advantage of urban terrain to limit line of sight and aerial employment of sensors and communications relays. Adverse weather will limit aerial operations and cause limited, localized degradation of sensors. Taken together, these effects could degrade the future Modular Force's ability to generate air SA and increase risk levels for near real time execution.

3-4. AC2 in the Future Operational Environment

a. As described in paragraph 3-2, A2C2 was sufficient to support previous operations. As the Army moved to modularity and distributed operations, the A2C2 process demonstrated several shortcomings. These shortcomings arose from increases in numbers, capabilities, and employment of manned and unmanned aircraft, improved ground SA allowing immediate reaction to threat activity and the increased reliance on joint capabilities. Specifically, A2C2 became ineffective for the following reasons

(1) Airspace is used by numerous UAS. In some areas, UAS will be the predominant airspace platform. UAS operators will have a wide range of training, some will be rated aviators, many will have the FAA Class 2 license but the smaller UAS operators will be unit trained. The future Modular Force will extend the airspace user community to NLOS and BLOS gunners employing maneuvering munitions.

(2) All Army BCT and brigades are airspace users for small UAS, tactical UAS, munitions, and supporting aviation assets. All of these units must participate in the management of airspace to ensure all users are integrated and synchronized with ground operations.

(3) Warfare is a 360º fight. The battlefield will be nonlinear, and noncontiguous. All flying or firing platforms must be capable of operating in any direction without undue time restrictions from requesting airspace.

(4) The number of Army aerial platforms over the tactical area at low to mid-level altitudes will be higher than the number platforms in the tactical area controlled by the JFACC.

(5) Mixed flight profiles: All components, especially JFACC, joint forces land component commander (JFLCC), and joint special operations forces will have numerous aerial platforms at low to mid levels.

(6) AMD is BLOS and more reliant on electronic CID. All aerial platforms must be identified in order to differentiate friendly, hostile, and neutral aircraft and mitigate fratricide while ensuring threats are destroyed.

(7) The emerging threat is low-altitude, low-observable UAS, cruise missiles, and non-traditional air vehicles, increasing the importance of early detection, identification, and engagement of threats.

(8) The combat zone airspace may have many civil users (governmental and nongovernmental) using civil flight rules due to financial incentives of overflights and commercial airport operations.

(9) Digital battle command enables the integration of fires and airspace in execution of current operations.

b. AC2 improves joint airspace capabilities by providing both data and decisionmaking linkages between Army AC2 nodes and the AC2 nodes of the other components. However, as operations become interdependent, several issues of a joint nature must be addressed to fully implement a joint AC2 system.

(1) Joint doctrine does not clearly address the authorities, responsibilities and architectures necessary to link component C2 nodes for collaborative, near real time coordination and decisionmaking. This shortfall is significant as differences in component doctrine (such as, mission command; centralized control/decentralized execution) can result in a lack of alignment between authorized component airspace decisionmakers.

(2) Lack of synchronization of ground AO with airspace responsibilities. Airspace problems often are symptoms of larger joint C2 issues as airspace management is sensitive to any lack of clarity of joint C2 roles. Joint Publication (JP) 3-0 clearly states that the land maritime AO commander is the JFC and establishes priorities within his or her AO. However, the needs of the future joint force require that multiple components use airspace over an AO simultaneously or near simultaneously. While the JFC is usually the supported commander, for some missions such as interdiction and defensive counter air in or above a land maritime AO, the AO commander frequently finds that he or she is the supporting commander with these operations potentially in conflict with his or her priorities. Joint doctrine requires collaboration with the JFC to avoid adverse effects and fratricide, but the current joint C2 structure does not facilitate this collaboration. The lack of horizontal collaboration between component execution C2 nodes results in AC2 nodes attempting to manage airspace with inadequate low-altitude SA, incomplete SU of the various component missions, and lacking the capability and authority to dynamically reprioritize and synchronize ongoing tactical operations.

(3) Doctrine does not clearly establish what authorities and responsibilities a ground commander has with respect to accepting risk to airspace users. While joint doctrine specifically states that the ACA (or subordinate TAGS control node) cannot deny combat operations, it does not delineate the risk decisions and authorities that accompany decisions to execute operations not specifically agreed to by all users. Non-Army airspace users of airspace above a ground AO have no requirement to coordinate movement through airspace with the AO owner. These airspace users operate under risk guidance from the JFACC based on the JFACC's SU of theater operations. Army airspace users operating in a tactical zone operate under risk guidance from the combined arms commanders based on SU of the tactical situation. Under current doctrine, U.S. Air Force TAGS control nodes designated as ACA controlling agencies may not have adequate SA of the low-altitude airspace or of ongoing operations in the ground AO due to limitations of terrain or other environmental conditions. With no formal linkage (doctrinally or

procedurally) between the controlling agency and the AO owner, transiting airspace users cause conflicts with ongoing operations and increase the risk to all users.

(4) There is only a limited capability to share information between component provided AC2 nodes in near real time. Current joint doctrine and MTTP do not provide a doctrinal basis for collaborative decisionmaking between component provided AC2 nodes. With immediate operations, lack of common SA of the airspace coupled with component driven different SU of the OE results in controlling agencies often making decisions based on perceived risk (which may differ between echelons) versus actual risk. Limited by delegated authority and low-fidelity air picture, controlling agencies become extremely risk-averse, limiting their capability to assist commanders with immediate fires and redirection of airspace users. The lack of a high-fidelity, low-latency air picture, and shared information between C2 nodes, and the lack of established processes to collaborate with SU, does not allow the controlling agency and the ground AO owner to look at the same picture with the same information and make an informed decision based on priorities and acceptable risk.

c. The future Modular Force airspace structures and systems must be able to contribute actionable information within the supported commander's decision cycle while enabling joint, Army, multinational, governmental, and civil coordination. Further, the future force must possess the information systems, sensor technologies, staffing structure, and MTTP that enable it to support the tempo of future operations. Without these capabilities, BCTs and Multi-functional brigades will not be able to employ all systems to their maximum effectiveness. A unified and integrated airspace C2 capability, enabled by advanced communications, data, and decision support tools will enable commanders to make timely decisions based on a full understanding of OE, friendly and enemy forces and associated risks.

3-5. Problem Statement

AC2 has become a complex challenge for commanders that can no longer be addressed with simple pre-planned routes, fixed altitudes, and static control measures. The current plan-centric method of controlling airspace use does not enable commanders to integrate fully all airspace users with ongoing operations in near real time. The operating environment has increased in complexity with the proliferation of UAS and the introduction of host nation, nongovernmental agencies, and civil aviation to the battlefield. This presents commanders with airspace challenges not previously encountered. To successfully operate in this OE, future Modular Force commanders at all echelons must be capable of synchronizing forces and warfighting functions in the vertical dimension in near real time.

Chapter 4
Solution

4-1. Facts Bearing on the Problem

a. In the future Modular Force, AC2 is the dynamic integration of all airspace users in accordance with the commander's intent, priorities and risk guidance. To accomplish this, the future Modular Force fully integrates AC2 with battle command, breaking down existing barriers

between the different warfighting function's perspectives and requirements for airspace use. This will enable the effective use of joint airspace without adding undue restrictions and with minimal adverse impact on the capabilities of any service or functional component.

b. AC2 is an integral part of the C2 warfighting function. AC2 is often perceived to be a distinct, specialized task with similar but distinct from C2 tasks for ground forces. However, the tasks involved in C2 for airspace and airspace users are the same as for the C2 of land AO and maneuver forces. See figure 4-1 for a comparison of tasks involved in controlling an AO and airspace. In order to fully integrate AC2 into future Modular Force operations, this concept will delineate and describe the required capabilities, specific to airspace and airspace users, that will integrate AC2 into the C2 warfighting function, making AC2 compatible with other C2 tasks employed for ground maneuver forces.

(1) In general, C2 is enabled by staffs coordinating with other staffs in order to gather and analyze data and information to establish SA. Commanders use the work of the staff to gain SU in order to make decisions, issue orders, and direct operations. This general construct is the same for ground and air operations, requiring the same capabilities to build SA, coordinate with organic and outside organizations, communicate with all affected organizations and employing established, agreed upon doctrine and procedures.

(2) AC2 adds a level of joint integration to the operations process as AC2 elements operate as part of an overall TAGS. Airspace use is a requirement for multiple components affecting numerous joint interdependencies. Almost all airspace activities in an AO require coordination between AC2 and JFACC airspace elements.

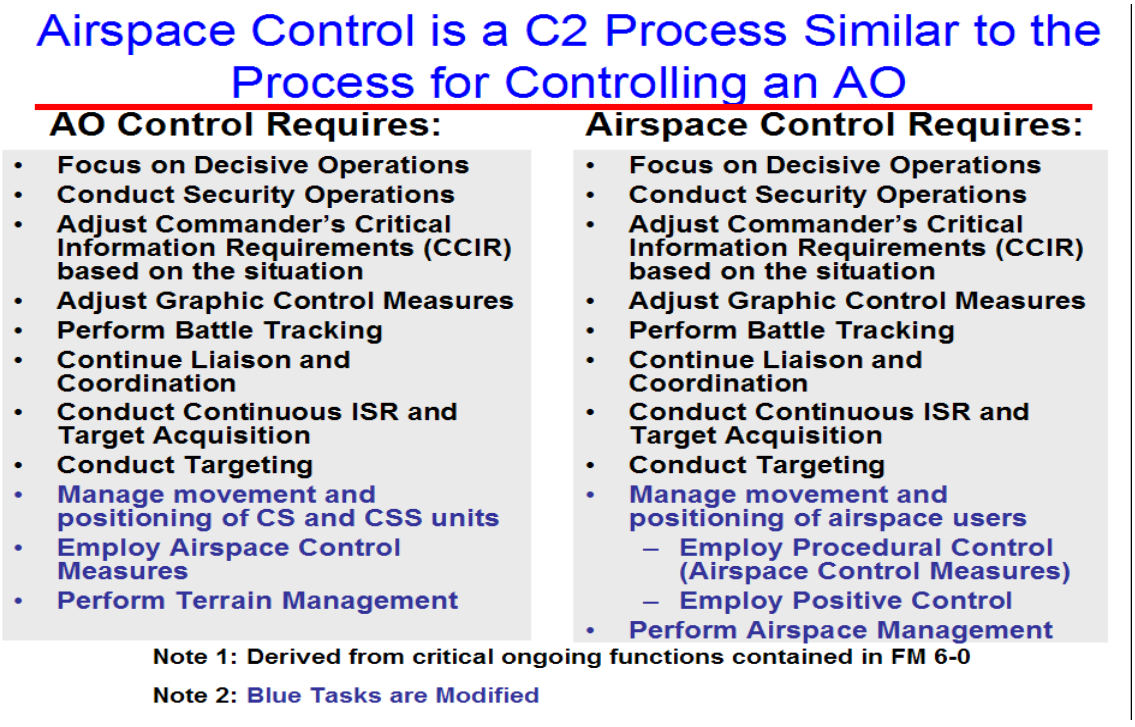

Figure 4-1. Airspace Control and C2 Processes

c. The future Modular Force is highly dependent on access to airspace for movement, maneuver, fires and protection. Most future Modular Force units are airspace users with a mix of manned, unmanned and munitions requiring access to a wide range of altitudes without detailed preplanning. This increasing reliance of the modular force on organic airspace systems, coupled with increased complexity of airspace use, increases the risk (both real and perceived) of an airspace user's mission failure and of fratricide between airspace users.

d. Airspace risk is a friction point to C2.

(1) The operations process would not require AC2 if there were no risk of mutual interference and fratricide between airspace users. Airspace risk is a friction point to C2 that reduces the effectiveness of the future Modular Force and can lead to an underutilization of available airspace. The current approach to AC2 is incapable of managing risk while maintaining the effectiveness of future systems and organizations.

(2) The current joint and Army approach to AC2 is plan-centric, manually intensive, prone to errors, and not responsive enough for future requirements. The current approach manages risk by reducing airspace access and limiting the number of airspace users. Future AC2 must integrate the airspace requirements of all airspace users (manned, unmanned, and munitions) to maximize the effectiveness and efficiency of combat power.

(3) Future Modular Force AC2 must be effective both in planning and during execution, while keeping both perceived and actual risk to levels acceptable to commanders.

e. AC2 requires a system that provides near real time, four dimensional, RI supporting development of SA of current and projected airspace use, automated conflict identification with automation assisted decisionmaking, and rapid reliable transmittal of airspace information to platform and user level.

4-2. Solution Synopsis

a. The Army will improve airspace access and safety while effectively increasing the density of airspace use by providing joint capable airspace control elements to the JFC's ACA. The Army AC2 nodes do not replace or supplant existing airspace C2 elements provided by other services; rather, the Army provides the TAGS additional airspace C2 assets. These AC2 nodes are optimized to control joint airspace users (manned, unmanned, and munitions) in the low to mid-level altitudes while collaborating with ACA elements controlling the higher altitude airspace. The intent is to assist the ACA in controlling the additional airspace requirements generated by the Army.
Note. Low altitudes include airspace used by small UAS and helicopters while mid-level altitudes includes airspace used by tactical UAS up to the maximum ordinate of mortar munitions.

b. The AC2 system is designed to support the full operations process, and be effective for planning and execution.

(1) Planning. All AC2 elements will integrate future airspace requirements through higher headquarters and coordinate, if required, with the ACA. The operational level AC2 element(s) will ensure that these requirements are integrated into the theater airspace control plan, the daily airspace control order and air operations directive. The operational level AC2 elements will work with the ACA to build an airspace control architecture that supports both the JFLCC and JFACC's concept of operation. The AC2 element belonging to the highest Army HQ is responsible for establishing standard Army AC2 policies and procedures.

(2) Execution. The highest tactical Army combined arms HQ will request that the ACA delegate control of airspace over their tactical area where the majority of airspace use is by Army airspace users.

(a) This tactical HQ is responsible to the ACA for AC2 of the allocated airspace in accordance with JFC guidance. Using today's joint terminology, the senior tactical headquarters will be controlling a high density airspace control zone with authority over all joint airspace users within the assigned airspace. The highest tactical HQ is optimal for this role as the decisionmakers have both tactical and operational SU, the HQ is normally augmented (or routinely interfaces with) with robust JFACC control elements empowered to control JFACC assigned air operations, and the senior tactical HQ controls an AO large enough to make decentralized airspace execution practical for the ACA.

(b) Subordinate tactical combined arms headquarters will remain the primary airspace controller for Army airspace users. Senior tactical headquarters will generally delegate to subordinate tactical headquarters controlling an AO, airspace authority in their AO over all Army airspace users and over joint aircraft in support of that unit (such as, close air support). Normally the higher tactical headquarters will retain airspace control authority for unified action airspace users (joint, multinational, governmental, and civil); however this authority can be delegated lower if required.

4-3. Key Ideas

a. The Army will become a contributor to the JFC's airspace control system contributing additional airspace control capability to the ACA. Army combined arms HQ with its AC2 elements are optimized for controlling joint airspace over an Army AO from the low to mid-level altitudes and capable of rapid collaboration with ACA elements controlling the higher altitude airspace.

b. Compared to legacy capabilities, airspace control must be more responsive during mission execution. Effective airspace control will always require detailed planning; however, airspace control will become more responsive during mission execution than what was perceived in the past. Rather than planning to reserve and thus restrict large volumes of airspace for an airspace user, the AC2 system will shift to protecting the moving volume of airspace around each airspace user. The net effect is that large amounts of airspace will become available in the joint network-enabled OE enabling individual airspace users to be more dynamically retasked to respond to immediate operational needs. While detailed planning will remain critical, AC2 will shift from a planning to an execution-centric process enabling individual airspace users to be dynamically

retasked to respond to immediate needs.

c. C2 of airspace users is based on commanders' intent, mission priorities and risk guidance.

(1) Control of airspace users is not defined in the same manner as civil aviation authority's (FAA or ICAO) definition of control. Airspace control is the authority granted by the JFC through the ACA to make joint airspace decisions in the assigned volume of airspace for the purpose of enabling operations. AC2 personnel do not routinely manage the flight path or trajectory of individual airspace users; rather they integrate airspace use both in planning and execution to manage risk. Only when two or more airspace users are in conflict do AC2 personnel direct changes in flight path or trajectory. These changes are based on commanders' mission priorities and risk guidance. Pilots, UAS operators, and weapon system controllers still maintain the responsibility to make the directed changes to their flight path or trajectory.

(2) The Army requires a capability for a higher level of airspace control in limited areas of the AO to support TRADOC Pam 525-3-1, TRADOC Pam 525-3-6, and TRADOC Pam 525-4-1. To meet the requirements from these concepts, the Army requires the capability to operate a number of rapidly deployable scalable tactical all weather airfields. The air traffic C2 systems for these elements must meet the additional requirements for this specialized capability while being fully compatible with the AC2 C2 system. This tactical airfield capability, while outside the scope of this CCP, requires additional analysis to identify the capabilities needed to support these Army concepts.

d. Near real time, four dimensional, RI is the foundation for AC2. An accurate air operational picture within the COP requires a combination of integrated sensors all contributing to the air operational picture together with platform self-reporting. Integrated sensors will ensure that all sensors regardless of their primary function (AMD, fires, and ATS) will provide accurate near real time aircraft location data to the network. However, the future Modular Force will also require friendly airspace RI in the absence of sensors. This requires all friendly airspace users to be self-reporting to the C2 system. This self-reporting can be directly from the aerial platform using IFF, or other C2 tracking systems or it can be from the airspace users' control system and launching platform contributing data to the network. The airspace data compiled from various sources must be integrated to ensure that the data is not redundant and is available to all network users (joint and Army).

e. AC2 is a C2 continuing activity. Commanders and their operations officers have the responsibility to integrate airspace use among the warfighting functions. The AC2 system should integrate airspace requirements in accordance with the commander's (JFC and unit) priorities and guidance. This integration should be automatic when integration can be accomplished without degrading the mission effectiveness of any airspace user and without exceeding commander's guidance for risk. When the automated AC2 system cannot resolve competing airspace use without degrading the mission effectiveness of an airspace user or without exceeding acceptable risk, the AC2 system must present the airspace issue to the commander or designated decisionmaker. Commanders need enough information to make risk and benefit decisions, optimize their decisions, and reprioritize airspace usage based on immediate mission needs. This automated system will provide an integrated air operational

picture ensuring integration and deconfliction occur in near real time allowing employment of all systems to their maximum effectiveness. This execution process will allow dynamic near real time retasking for any action inside the normal planning cycle.

f. Effective AC2 is enabled by connecting the individual decisionmakers of the joint force through a joint networked infrastructure. Connecting the individual decisionmakers improves the speed and quality of their decision processes and the speed and quality of decisions throughout the whole organization. The improvements in speed and quality results from the decisionmaker's ability to collaborate during the decisionmaking process. Collaboration improves decisionmaking by managing uncertainty and increasing understanding of the OE because commanders are able to fill gaps in their SA through access to a common pool of information. Commanders can then tailor their AC2 procedures, personnel, and equipment to ensure mission success and still maintain unity of command and unity of effort. The result is that commanders and staffs will have an enhanced ability to make faster and more effective decisions and an improved ability to see to their execution. AC2 will also allow the following.

(1) Airspace users to interact with the directness, informality, and flexibility typical of small, cohesive teams or organizations and share a common air SA.

(2) Commanders and staffs to tailor AC2 capabilities as required by quickly assembling cohesive teams and by adopting AC2 procedures suited to each situation rather than relying on one size fits all procedures.

(3) The joint force to exploit the benefits of mission command—initiative, adaptability, and tempo—without sacrificing coordination and unity of effort. The concept envisions a dynamic, decentralized, distributed, and highly adaptive form of AC2.

g. Airspace control elements will have the capability to communicate with all airspace users (joint, Army, multinational, governmental and civil) to the platform level. This voice and data communication will be jam resistant, BLOS and NLOS and self-healing. The intent is to allow users down to platform and weapon system level to see the relevant portion of the COP (relevant to that platform) in near real time to see and be seen electronically thus enabling immediate hazard avoidance at the platform level as combatants react to battlefield action. This capability greatly mitigates risk while allowing the greatest latitude to those involved in the fight. It also allows those coordinating the fight to make simultaneous adjustments to coordination measures as required by the exigencies of the fight. However, the range of potential airspace users mandates that the communications links include both the most capable digital means as well as standard ground to air voice communications to include ICAO recognized emergency ultra high and very high frequencies, and international aircraft emergency frequencies.

4-4. Vignettes

a. The illustrative vignettes used in this CCP are built upon a notional scenario that depict how AC2 will enable the Army functional concepts at the operational and tactical levels during the 2015-2024 timeframe. It does not attempt to address all aspects of the campaign. While

METT-TC, coalition and joint considerations may create additional challenges, it does not affect the operations process.

b. TRADOC Pam 525-3-3. TRADOC Pam 525-3-3 concept focuses on future Modular Force commanders using the best available information in an uncertain environment to make tough decisions. As the focal point of decisionmaking and execution for all operations, the commander must rely on the staff and supporting technological aids, for support in achieving SU, making decisions, disseminating directives and following directives through execution. To attain SU commanders must apply their skilled judgment and that of their staff, to interpret information in the context of the mission, the higher commanders' intent, and the OE. Based on SU, the commander can utilize integrated C2 tasks and systems to make near real time decisions and disseminate orders and guidance in order to maximize the effects of all weapons and systems.

(1) Key to implementing this concept is the integration of all C2 systems into a collaborative network that enables rapid information sharing and analysis. AC2 systems employ fully-netted, organic and joint sensors and seamless, BLOS and NLOS voice and data communications to develop air and ground SA. Aircraft self-reporting, combined with radar and other interrogation, self-reported CID data, enables full identification of all aerial platforms. Full joint data interoperability enables AC2 personnel to determine all information about every aerial platform to include mission, status and priorities, providing commanders with near real time visibility and understanding of the aerial portion of the AO. Future joint doctrine and MTTP enable AC2 personnel to coordinate directly with airspace control nodes and airspace users in order to gather, collate, and analyze information needed for developing SU. Automated decisionmaking aides, enabled by shared data, will recommend integration and deconfliction actions based on commanders' priorities (joint and Army), air platform mission and levels of risk. These capabilities will allow commanders to rapidly retask and reprioritize assets in order to accomplish their highest priorities first, eliminate fratricide, and maximize the effectiveness of all available systems.

(2) Figure 4-2 illustrates how AC2 capabilities enable battle command.

(a) Terrestrial (AMD, ATS, organic) and non-terrestrial (joint and Army) sensors detect, classify and identify aerial objects in the AO.

(b) Friendly aircraft self-reporting, radar, or other interrogation and self-reported CID data, establish positive identification and mission data on all aircraft.

(c) AC2 systems at combined arms HQ (BCT, multifunctional brigade and above) correlate RI from organic. Joint and Army sensors to develop SA. The battle command C2 systems utilize this SA to coordinate and synchronize ground and air operations such as fires; reconnaissance surveillance and target acquisition; intelligence, surveillance, and reconnaissance; and protection.

(d) Data interoperability enables AC2 systems in the CP to coordinate directly with TAGS airspace control nodes (control reporting center), Airborne Warning and Control System

(AWACS)) to deconflict and integrate immediate operations (fires, air defense, and aviation dynamic retasking).

(e) The GIG provides the capability to collaborate with multinational, civil, and nongovernmental agencies.

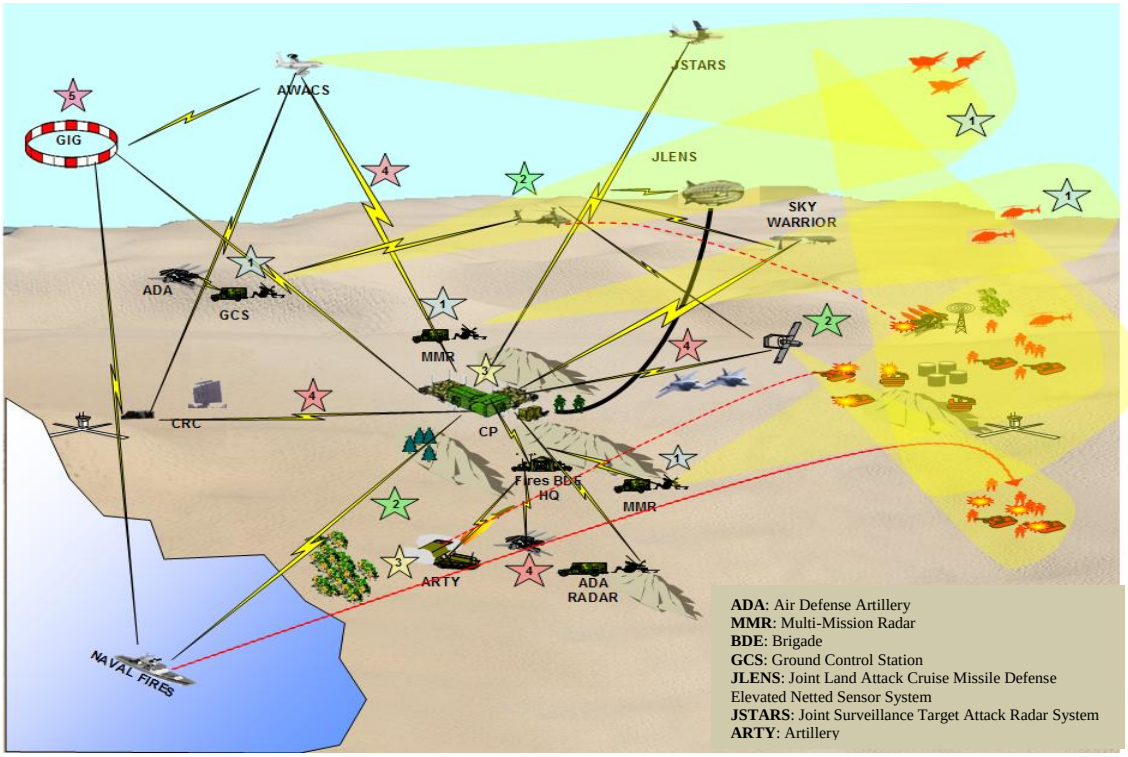

Figure 4-2. AC2 Enabled Battle Command

c. TRADOC Pam 525-3-4. TRADOC Pam 525-3-4 describes how future Modular Force commanders will employ a tailored mix of organic and available joint, allied, and coalition fires, integrated with information operations and capabilities. Effective strike operations rely on SA obtained through the GIG, joint data networks, and interoperable C2 systems. Fires planning and execution will incorporate target prioritization, allocation, and airspace C2 through common language and procedures. It will also include positive targeting identification and tracking, an integrated network to ensure timely and accurate assessment, force capability interfaces (including joint, Army, multinational, governmental, and civil) and continuous access to the COP.

(1) AC2 systems support the *Strike* concept by providing near real time air SA allowing for immediate integration and deconfliction of joint fires assets with ongoing aerial operations. Future fires systems will pass planned and immediate missions to AC2 systems in order to integrate and deconflict these missions with affected aerial platforms. Using the air portion of the COP, developed from fusing organic and joint sensors, AC2 elements will identify any conflicts and use automated decisionmaking tools to develop alternative courses of action in near real time, based on the commander's priorities, risk criteria and higher HQ orders and directives. Joint interoperability and secure, BLOS and NLOS data and voice communications along with

joint doctrine and MTTP will allow AC2 elements to coordinate directly with all affected TAGS control nodes and airspace users. Critical data elements such as flight paths, trajectories, launch and impact points and commanders priorities are displayed at each node to ensure complete SA. Additionally, this near real time SA enables the commander to decide which joint fires assets to employ against specific targets, increasing lethality and effectiveness.

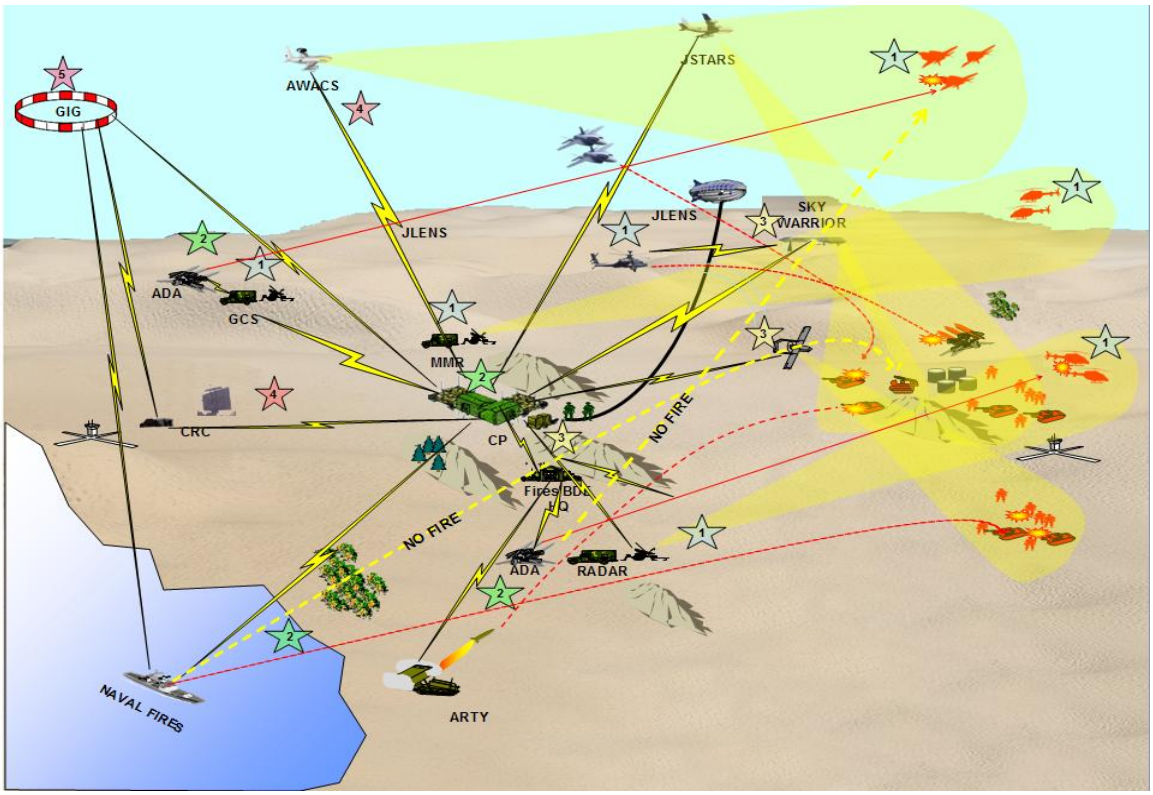

Figure 4-3. AC2 Enabled Strike

(2) Figure 4-3 illustrates how AC2 capabilities enable the *Strike* functional concept.

(a) Similar to battle command, AC2 systems develop SA from organic, joint and Army sensors employing interoperable data and voice BLOS and NLOS communications, coupled with self-reporting and radar or other interrogation and self-reported CID data.

(b) From this SA, C2 systems automatically calculate trajectories for firing platforms and identify conflicts with aerial objects.

(c) Collaborative planning with TAGS control nodes, joint C2 nodes, and Service component C2 nodes enables the C2 system to select the most effective firing platform with no conflicts ensuring fratricide avoidance by rejecting solutions that conflict with airspace users. If the C2 system cannot determine a solution without conflicts then, if practical, the airspace user will be redirected or decisionmakers will be notified to coordinate a solution.

(d) Data interoperability enables AC2 systems in the CP to coordinate directly with TAGS airspace control nodes (control reporting center, AWACS) to deconflict and integrate immediate fires.

(e) The GIG provides the capability to collaborate with multinational, civil, and nongovernmental agencies.

d. TRADOC Pam 525-3-6. TRADOC Pam 525-3-6 focuses on strategic force projection and operational agility in support of joint campaign objectives. Future Modular Forces will exploit multiple entry points and simultaneous force flows by air and sea to achieve a level of deployment momentum that helps overcome enemy anti-access efforts and increase the opportunity for operational surprise. As the theater matures, force elements deploy from outside the theater directly into forward areas rather than through forward operations bases or lodgment areas, where improvements in speed, mobility, and protection enable commanders to conclude tactical actions and engagements more rapidly and decisively than what is possible today.

(1) In order to support the initial force flow, AC2 systems will enable near real time planning and coordination with the ACA for air movement into the area of responsibility. Joint interoperable data exchange will allow immediate deconfliction of en route airlift with all other aerial systems in the area, to include civil aviation. Fully integrated C2 systems allows full SA enabling AC2 elements to redirect aircraft away from hostile air or ground activities and retask organic air platforms to support movement or resupply operations. As the AO expands, in-theater AC2 elements will fuse data from joint sensors and the GIG into an integrated air picture with all aerial platforms identified in order to develop SA. Through secure and reliable BLOS and NLOS voice and data communications, AC2 elements will use this SA to coordinate directly with TAGS control nodes to ensure safe passage of intra- and intertheater maneuvering forces. Future joint doctrine and MTTP will enable AC2 units to coordinate directly with controlling authorities in order to coordinate these actions in near real time.

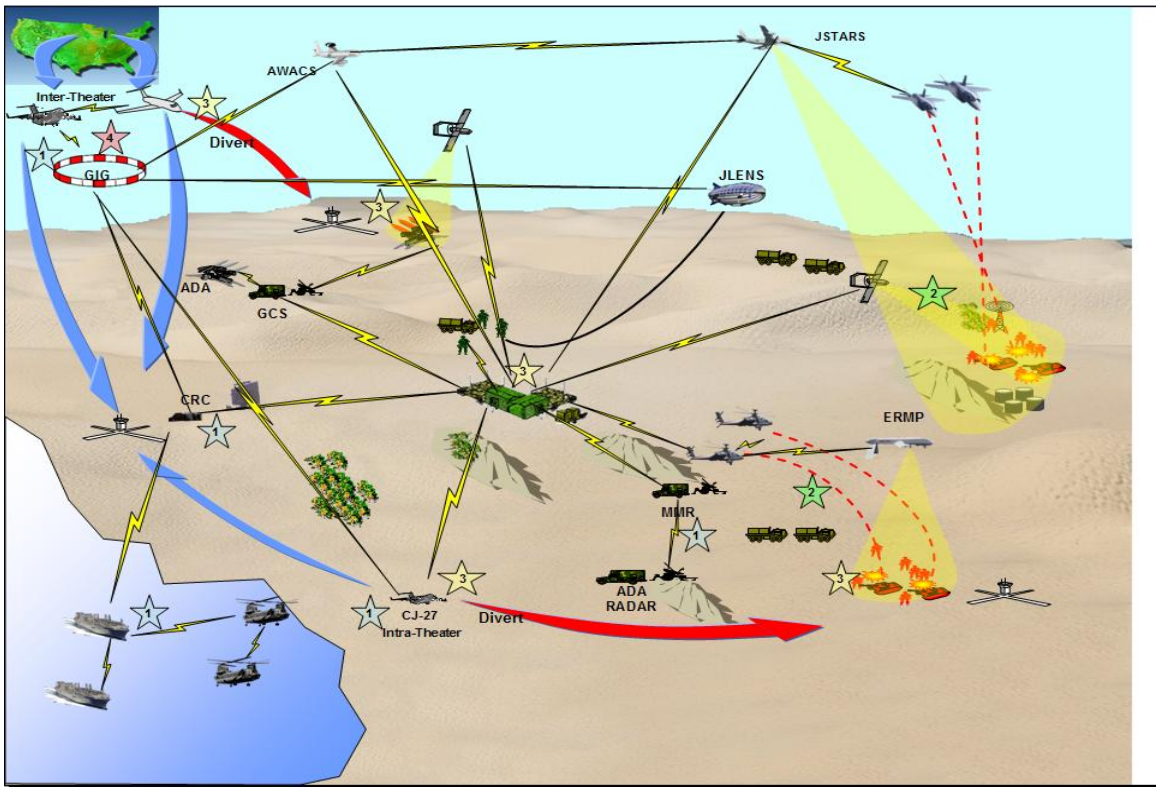

Figure 4-4. AC2 Enabled Move

(2) Figure 4-4 illustrates how AC2 capabilities enable the *Move* functional concept.

(a) AC2 C2 systems in the CP allow near real time, collaborative planning with TAGS control nodes for en route intra- and intertheater lift aircraft enabling delivery of personnel and equipment to forward locations.

(b) Full air and ground SA developed by RI from joint networked sensors, enable the CP to retask assets in support of ground convoys under attack. RI from CPs, joint sensors and ground forces is shared with aircraft allowing aviators to develop required SA for immediate engagement of threat forces.

(c) Fully networked organic, joint and Army sensors enable CPs to determine composite threat to airfields and aircraft. This SA coupled with BLOS and NLOS data and voice communications enable direct communications with en route aircraft to divert missions to a secure area based on threat air defenses and ground situation.

(d) The GIG provides the capability to collaborate with multinational, civil, and nongovernmental agencies.

e. TRADOC Pam 525-2-1. TRADOC Pam 525-2-1 describes how the future Modular Force will acquire and generate knowledge of itself, its opponent, and the OE. The key ideas of the *See*

functional concept are: Acquire information, transform information into knowledge, provide relevant, timely information to decisionmakers, and data exploitation.

(1) Future AC2 forces will contribute to the *See* concept by gathering, collating and distributing information on all airspace users. Networked organic and joint sensors along with self-reporting aerial platform information will be fused into an integrated air picture. Information from self-reporting aircraft coupled with radar and other interrogation, self-reported CID data, will be employed by AC2 systems to reference joint airspace and air tasking documents to provide additional information about each platform. Information such as mission, weapons loads, targets, routes, and mission priorities will transform basic air SA into true understanding of the aerial portion of the AO. AC2 systems' ability to detect and track battlefield events will enable trend analysis and assist with development and refinement of collection plans. Lastly, the combined capabilities of netted sensors, joint interoperable data and MTTP, will enable AC2 elements to coordinate airspace requirements necessary for dynamically retasking air sensors within the commander's intent and priorities.

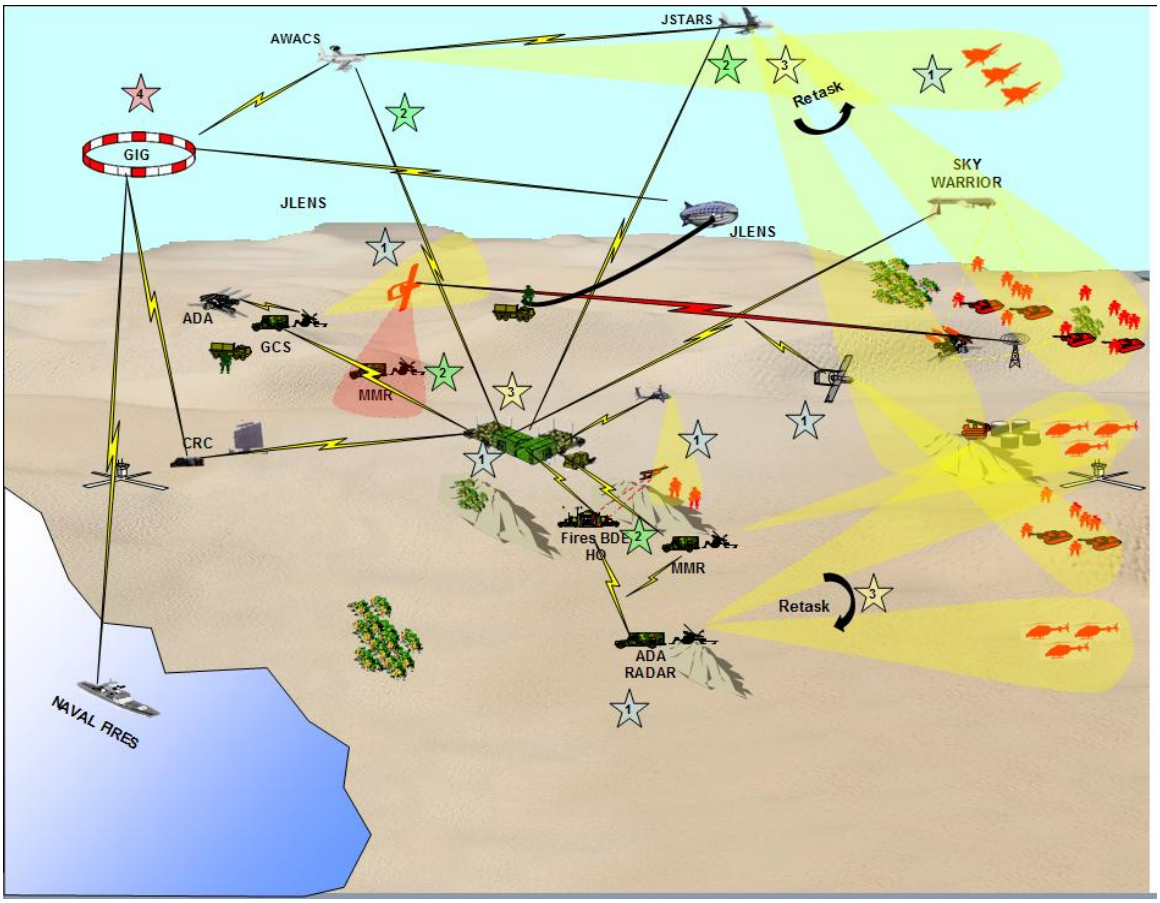

Figure 4-5. AC2 Enabled See

(2) Figure 4-5 illustrates how AC2 capabilities enable the *See* functional concept.

(a) The CP draws RI from all terrestrial (AMD, fires, ATS, organic) and non-terrestrial (joint and Army) sensors. AC2 systems collate data and integrate with self-reporting data and

radar or other interrogation, self-reported CID data to produce a single integrated air picture with identification and mission data for each aircraft.

(b) AC2 systems' automated analysis coupled with SA, radar and other interrogation, self-reported CID data of threat air platforms enable C2 systems to promulgate threat warnings across the AO.

(c) Fully integrated COP enables battle command C2 systems to dynamically retask aerial sensors based on threat actions and evolving priorities.

(d) The GIG provides the capability to collaborate with multinational, civil, and nongovernmental agencies.

f. TRADOC Pam 525-3-5. Future Modular Forces, from individual Soldiers to units, along with information systems and infrastructure, will require advanced protection capabilities comprised of both passive and active measures. Key to active protection is the ability to detect threats at the earliest possible moment and employ active measures to counter an adversary before it is capable of affecting friendly operations.

(1) AC2 systems will provide critical capabilities to enable future force protection. The air portion of the COP, composed of fused data from organic and joint sensors, along with CID data will enable AC2 elements to coordinate directly with TAGS control nodes and AMD forces to identify threat systems before they can affect friendly forces. Through future joint doctrine and MTTP, enabled by joint interoperable data and C2 systems, all affected commanders will have the SU to determine collaboratively the correct actions to counter the threat and the ability to execute the required coordination to enable these actions. The ability of AC2 systems to interface seamlessly with joint and civil airspace systems allows the dual capability or protecting noncombatant civil aviation while simultaneously identifying potential threats from civil aircraft.

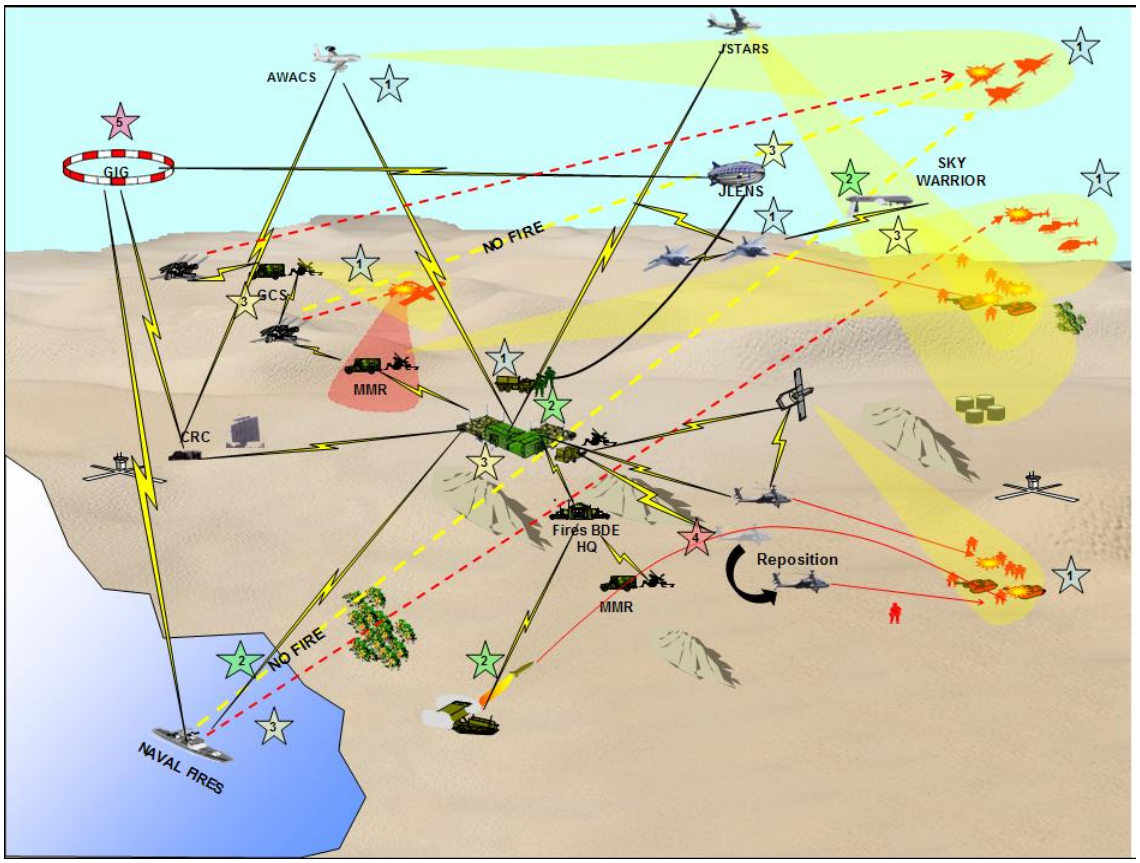

Figure 4-6. AC2 Enabled Protect

(2) This vignette illustrates how AC2 capabilities enable the *Protect* functional concept.

(a) Networked terrestrial and non-terrestrial sensors coupled with radar and other interrogation, self-reported CID data, enable the CP to detect and identify both air and ground threats at extended distances.

(b) From this SA, C2 systems automatically calculate trajectories for all possible firing platforms (including joint fires platforms), identify conflicts with aerial objects and select the platform with no conflicts. Resulting fires serve to protect friendly forces from both threat and fratricide.

(c) Similar processes occur in the C2 systems to deconflict air defense fires. C2 systems coordinate and collaborate with ground AMD forces and joint air defense capable forces in order to engage and destroy enemy air threats while protecting friendly aircraft.

(d) AC2 systems' automated integration and deconfliction of airspace users together with RI to platform level enable airspace users to be redirected or reprioritized by AC2 nodes or to reroute themselves. Airspace users become active, collaborative participants in the AC2 task, serving to increase friendly protection and fratricide avoidance.

(e) The GIG provides the capability to collaborate with multinational, civil, and nongovernmental agencies.

g. TRADOC Pam 525-4-1. TRADOC Pam 525-4-1 is characterized by the decreased ability to depend on ground lines of communication. The future Modular Force will rely on air and sea based delivery platforms and reach back, and will maximize direct delivery of tailored packages at the tactical level in order to support distributed operations.

(1) In order to deliver sustainment packages directly into the forward area, the future Modular Force must be able to provide safe transit routes, trans-loading and landing areas. AC2 elements employing joint MTTP enabled by interoperable airspace C2 systems rapidly coordinate with the TAGS control nodes to establish or modify required transit routes and corridors. Continuous monitoring of these routes via the air portion of the COP allows AC2 elements in coordination with all other TAGS control nodes to identify potential threats and conduct the necessary coordination to defeat or neutralize those threats in order to protect the air corridors and the transiting aircraft.

(2) Figure 4-7 illustrates how AC2 capabilities enable the *Sustain* functional concept.

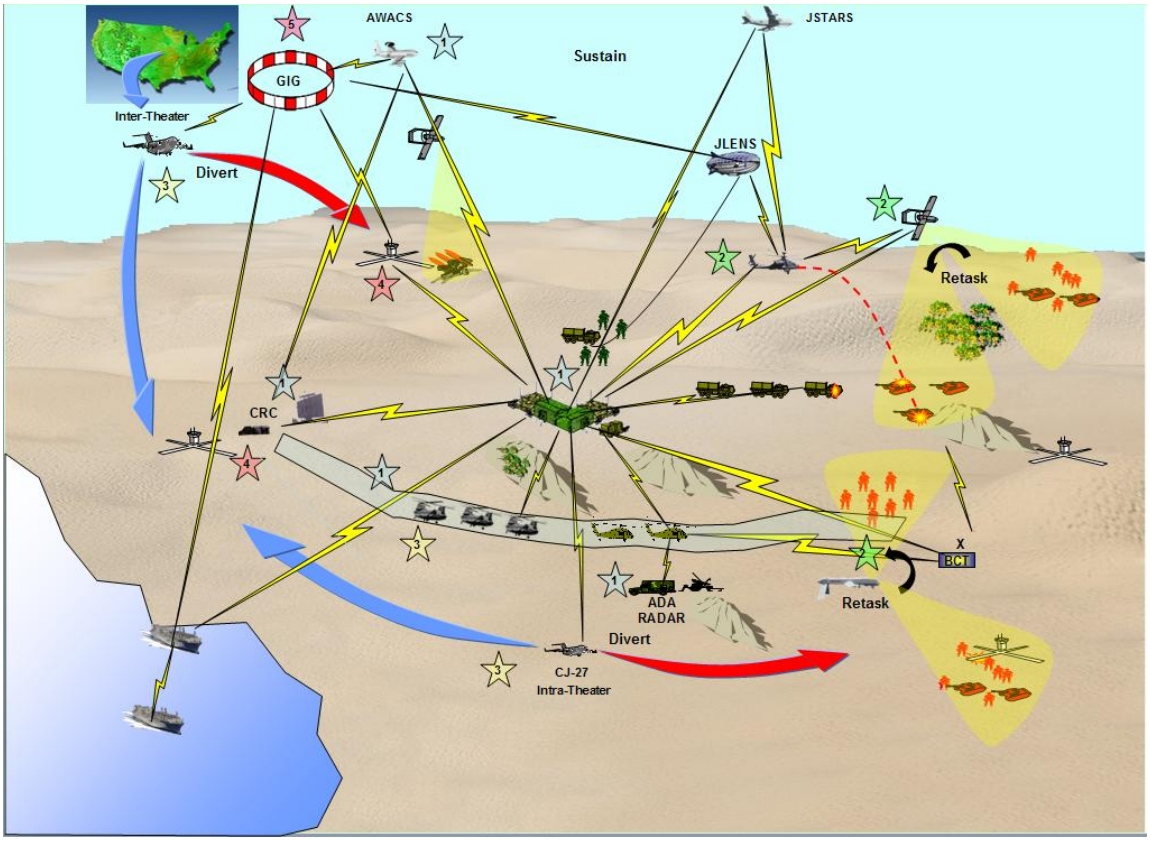

Figure 4-7. AC2 Enabled Sustain

(a) Similar to the enabling capabilities for the *Move* functional concept, AC2 systems in the CP allow near real time, collaborative planning with TAGS control nodes in order to

establish air corridors for sustainment aircraft enabling delivery of personnel and equipment to forward locations.

(b) Full air and ground SA, developed by RI from joint networked sensors, enable the CP to retask assets (maneuver, fires, reconnaissance surveillance and target acquisition, intelligence, surveillance, and reconnaissance, and others) in support of sustainment convoys under attack. SA and networking to the platform level allows immediate response to ground unit situation.

(c) Fully networked organic, joint and Army sensors enable CPs to reroute aircraft based on composite ground and air situation. Interoperable BLOS and NLOS data and voice communication enables direct coordination with TAGS control nodes to establish immediate flight plan changes.

(d) AC2 links to ATS (joint and Army) nodes and aircraft assist prioritization for airspace users in controlled airspace around division airfields.

(e) The GIG provides the capability to collaborate with multinational, civil, and nongovernmental agencies.

Chapter 5
Required Capabilities

5-1. Required Capabilities Introduction

a. The Army functional concepts provide explicit and implicit descriptions of the C2 capabilities necessary to achieve the future Modular Force objective state. As an enabling function of C2, AC2 must provide the ability for the future Modular Force to integrate and control airspace and airspace users in a unified action OE (with joint, Army, multinational, governmental, and civil airspace users). The capabilities required to conduct AC2 are similar to the capabilities needed to conduct C2 for ground AOs with the addition of joint interdependencies. This chapter will further identify each required capability in context of DOTMLPF.

b. Improvements in airspace management will not result from a single event or innovation, but from the collective contributions from a number of changes. Lessons learned, detailed DOTMLPF analysis, and emerging technologies will drive numerous joint and Army doctrinal changes, organizational and equipment modernization, and training and educational revisions. The key to improved AC2 will be the complete integration of all AC2 activities within the overall C2 warfighting function, rendering AC2 an enabling task of combined arms C2 vice a distinct task performed by specialists. To accomplish this integration, AC2 capabilities must integrate the C2 of all airspace and airspace users into the operations process used by ground maneuvering forces.

c. This list of required capabilities should be interpreted as the objective capabilities during the 2015-2024 timeframe. This list is not all inclusive and will be further refined and developed

as joint, Army C2 and AC2 concepts and doctrine emerge, and as the Joint Capabilities Integration and Development System analysis is executed. The broad capability statements which drive the DOTMLPF capabilities breakout are listed below.

(1) Capability 1. The capability to view and contribute to an all-altitude, integrated, consolidated air picture in near real time.

(2) Capability 2. The capability to maintain reliable, secure, long-range (BLOS and NLOS), all-altitude, jam-resistant, voice and data communications in all required frequency spectrums between all airspace users (joint, Army, multinational, governmental, and civil) down to platform level.

(3) Capability 3. The capability of the AC2 system to automatically integrate airspace users in accordance with commanders' intent, priorities and risk assessment during planning and execution.

(4) Capability 4. The capability for Army AC2 systems to interoperate with joint and intergovernmental C2 systems (data and voice).

(5) Capability 5. The capability of the AC2 system to control all airspace users (joint, Army, multinational, governmental, and civil) operating over an Army AO in accordance with all joint and Intergovernmental standards for airspace control in a combat zone.

5-2. Doctrine

The future Modular Force will require joint and Army doctrine that establishes these capabilities.

a. Provide responsibilities of all TAGS control nodes which clearly articulates the capabilities and limitations of AC2 organizations at each echelon in order to enable commanders to command and control operations within the four dimensional AO.

b. Develop MTTP that delineate joint airspace control processes in order to facilitate coordinated actions between components, units and airspace users.

c. Provide solutions to assess and mitigate risk for all airspace users in a joint, Army, multinational, governmental, and civil environment in order to fully integrate all airspace operations with commander's priorities. Solutions must address decisionmaking authorities when multiple, conflicting operations overlap supporting commander designations.

d. Develop MTTP for the integration of all joint and Army sensors with platform self-reporting C2 systems into a shareable air picture for the highly complex future OE, in order to achieve near real time air SA.

e. Develop MTTP for integrating Army battle command systems with joint airspace C2 systems in the unified action OE. The MTTP must enable the conduct of complex operations in a coordinated and synchronized manner with access through the GIG to real world exercises from remote or reachback locations.

f. Common set of control measures affecting all airspace users (joint, Army, multinational, governmental, and civil).

5-3. Organization

The future Modular Force will require AC2 organizations to perform these capabilities.

a. Coordinate with joint airspace control nodes for planning and integrating all airspace user requirements in an unified action OE in order to enable immediate operations.

b. Function as a subordinate node of the TAGS in order to control volumes of airspace and airspace users in an unified action OE.

c. Rapid coordination between authorized decisionmakers, Army control elements and airspace users to platform level to enable near real time AC2.

5-4. Training

a. The future Modular Force will require AC2 joint training capabilities to meet these requirements.

(1) Provide challenging, live, virtual, or constructive exercises to train leaders through the practice and application of AC2 as an integrated C2 task.

(2) Train and educate senior commanders at the battalion and higher levels in AC2 tasks, functions, organizations, capabilities, and others. Solution must emphasize enhancing decisionmaking using an integrated (air and ground) operations process, while accounting for mission accomplishment versus risk.

(3) Provide modular, scalable, interactive exercises and scenarios on AC2 systems and at home station training facilities that enable Soldiers and AC2 elements to execute individual and collective training.

(4) Produce real world collective task AC2 events where all joint Service airspace users and managers have the opportunity to train and work together in joint collaborative conditions.

(5) Providing training devices, exercises, experiments, simulations, and simulators that provide AC2 personnel sufficient fidelity to replicate actual conditions encountered during full spectrum operations.

(6) Enable AC2 elements to perform AC2 in the event that all or some future technologies are unavailable or hindered by adversaries. AC2 personnel must be trained to operate procedurally in the absence of sensors, air pictures, and voice communications.

b. AC2 is not an Army military occupational specialty (MOS) but requires an additional skill identifier in order to ensure the training, tracking and assignment of qualified personnel. The

future Modular Force will require the training and continual assignment of AC2 personnel capable of the following.

(1) Planning airspace use that integrates airspace requirements generated by all airspace user communities (maneuver, fires, protection), both joint and Army, while meeting commander's guidance for mission and risk.

(2) Controlling all airspace users during current operations using both battle staff procedures and near real time procedural control to platform level to resolve airspace use conflicts in accordance with commander's guidance for mission and risk.

5-5. Materiel

The future Modular Force will require joint materiel solutions capable of providing the following requirements.

a. The ability to view and contribute to an all altitude, integrated, consolidated air picture (with CID). Army airspace users will be capable of self-reporting position, classification, and identification data in the absence of sensors. Reporting can be by non-radar-dependent IFF, self-reporting by the platform to the C2 network, or reporting to the C2 network by the airspace user's launch or control station. This capability provides near real time four dimensional RI supporting development of SA of current and projected airspace use.
Note. This capability is not required for line of sight or direct fire weapon systems. Line of sight systems rely on procedural control and assume that the line of sight system operator has sufficient SA during the engagement to clear airspace.

b. The ability to maintain reliable, secure, long range (BLOS and NLOS), all-altitude, jam-resistant, data and voice communication in all required frequency spectrums between all airspace users (joint, Army, multinational, governmental, and civil) down to platform level. The range of potential airspace users mandates that the communications links include both the most capable digital means as well as standard ground to air voice communications to include ICAO recognized emergency ultra high and very high frequencies.

c. RI to the platform level in near real time. The intent is to allow users down to platform and weapon system level to see the relevant portion of the operational picture (relevant to that platform) in near real time to see and be seen electronically thus enabling immediate hazard avoidance at the platform level as combatants react to battlefield action.

d. AC2 system that integrates airspace users in accordance with commanders' intent, priorities and risk assessment during planning and execution. Integration will be automatic when the solution does not degrade capabilities or exceed risk guidance. The AC2 system provides automated assistance to decisionmakers when integration results in a degradation of at least one user's capabilities or if risk guidance is exceeded.

e. Capability to compile, edit, and visually present a comprehensive and accurate, collective portrayal of airspace objects to C2 personnel with the ability to digitally record, track and playback air tracks on the COP.

5-6. Leadership and Education
The future Modular Force will require joint AC2 leadership and education to perform the following responsibilities.

a. Educate senior commanders at the battalion and higher levels in AC2 task, functions, organizations, capabilities, and others., with emphasis of enhancing decisionmaking using an integrated (air and ground) operations process to optimize employment of all assets while minimizing risk.

b. Implement AC2 instruction in professional military education courses focused on C2 systems interoperability, joint C2, TAGS control nodes and authorities, AC2 functions, organizations, capabilities and limitations and integration of AC2 into the overall operations process.

c. Design and implement dedicated AC2 functional training course to educate personnel assigned to AC2 positions in joint C2, AC2 functions, organizations, capabilities and collective tasks in a scenario-based environment. Completion of this course will result in the award of an additional skill identifier.

d. Implement assignment oriented AC2 instruction for aviation and AMD Soldiers in initial military training designated for assignment to AC2 positions. Instruction will include battle command systems integration, AC2 functions, and AC2 collective tasks.

e. Develop and implement a leader education paradigm incorporating continuing education coupled with experiential learning through repetitive assignments.

f. Develop and implement an AC2 personnel education paradigm that delineates required education by position and echelon, incorporates joint training opportunities and encourages repetitive assignment to AC2 positions.

5-7. Personnel

a. Future personnel managers must approach AC2 assignments and personnel selection from the perspective that AC2 is joint in nature and will include multinational and civil considerations. The personnel system must ensure personnel are afforded the opportunity to become highly qualified and experienced in AC2 through both formal education and training, and repetitive assignments. To meet the needs of future Modular Force, the personnel management system must accomplish the following:

b. With the absence of a dedicated MOS for AC2 personnel, the personnel management system must identify and select Soldiers to fill AC2 positions based on competency in joint operations and combined arms operations.

c. Ensure personnel assigned to dedicated AC2 positions attend the appropriate institutional education courses and training events that will develop their understanding of joint and Army air operations.

d. Implement a permanent identification code for AC2 personnel that will ensure continued AC2 education, training and assignment of these personnel.

5-8. Facilities

The future Modular Force will require joint AC2 facilities capable of the following requirements.

a. Facilities and installations must be able to replicate capabilities such as a common air picture, direct downlink and dynamic retasking and other AC2 tasks for home station and deployed units. Deployed units and personnel must be able to train from remote locations and assignments to keep proficient in AC2 doctrine, MTTP. Facilities must be able to coordinate with national airspace authorities to provide access into the National Airspace System for unit training.

b. Fixed facilities must be able to support reachback operations to enhance and support the SA of deployed tactical units. Mobile facilities may be virtually or physically linked to operational and tactical commanders and the role of these facilities will expand to include both intertheater and intra-theater operational support.

Chapter 6
DOTMLPF Implications and Questions

6-1. Introduction

a. Fundamental differences in the nature of the expected threat, equipment employability, and the speed and intensity of operations require the Army to change the way it trains, equips, organizes, and conducts operations in the future. The challenge is to find the optimal balance between the tactical environment, diminishing resources, and the enduring requirement to remain the world's preeminent land force. The Army must be capable of employing decisive ground and air combat power across the full spectrum of operations with assured access to airspace and freedom of action with minimum restrictions and negligible risk of fratricide.

b. Emerging technology offers revolutionary and evolutionary potential for greater tactical efficiency and effectiveness, however, technology alone will not guarantee success. To take advantage of this potential, the Army must understand the nature of war; possess the warrior spirit; produce competent, well trained Soldiers and leaders; focus on mission accomplishment, and execute with speed, precision, and violence of action. To produce such a force, the Army must continue to emphasize and investigate the human side of warfare as well as the effects of emerging technology on the users, the Soldiers, and the leaders. The Army must incorporate technology insertion that is standard based as soon as it becomes available in order to capitalize on new capabilities.

6-2. Past and Future Experimentation and War Games and Studies

a. TRADOC and its proponent schools have conducted extensive experimentation that has implications on the AC2 CCP. Major experiments and war games conducted over the last two

years demonstrate shortfalls in current and projected AC2 capabilities. Experiments and war games studied include Earth Wind and Fire 2007-2008; South West Asia-11 TRADOC Analysis Center experimentation 2008; Air Land Sea Application Center MTTP wargaming; and future force focused experiments and events on Future Combat System brigade operations. They also include Omni Fusion 2007; Urban Resolve 2006; Division Warfighting Experiment 2006 and 2007; the Center for Army Lessons Learned joint AC2 Combined Arms Assessment Team 2006; and Virtual Flag 2007-2008.

b. Each of the above experiments and studies describes shortfalls in the future Modular Force's AC2 capabilities to enable a fully integrated operations process. While exact details varied, the broad characterizations of these shortfalls are the following.

(1) Future Modular Force organizations could not synchronize all joint and organic airspace users due to lack of aerial SA.

(2) There is no clearly defined joint process for the immediate clearance of airspace and no defined process for adjudicating priorities among airspace users.

(3) The inability to communicate and share data with all joint C2 nodes and airspace users limits AC2 nodes' ability to integrate all airspace users in near real time.

(4) There is no current joint or Army doctrine that delineates risk assumption authorities regarding airspace users. It is unclear who has authority to assume risk and make decisions when multiple overlapping supported commanders are involved.

(5) Lack of full digital interoperability between joint C2 nodes delayed critical AC2 decisions as data was passed manually.

6-3. Implications and Questions

a. There are significant implications for the joint and Army community as it evolves Army airspace and the required synchronization of these operations across the DOTMLPF domains. Because of the inherent jointness of airspace operations, some issues cannot be resolved fully by Army only DOTMLPF solutions. In these instances, the Army must influence the design and development of the range of DOTMLPF solutions for the joint force. Specific areas of C2 and risk should be thoroughly examined as the joint community moves to integrated joint C2. Some additional questions with joint implications will require further study and analysis to refine the capabilities described within this CCP.

(1) What is the DOTMLPF impact on component Services of implementing AC2?

(2) What are the objective and threshold capabilities required for Army C2 systems to interoperate with joint C2 systems and achieve the AC2 capabilities as written?

(3) What future organizational and operational changes will be required as technology matures and new technologies emerge?

(4) What are the most effective joint C2 organizational designs for implementation of AC2?

(5) What airspace training and training support capabilities does the Army have to provide to other Services or integrate with other Services to implement the train as you fight paradigm?

(6) How will the joint Services and Army coordinate with ICAO to establish common rule sets for AC2 in a combat zone?

(7) How will joint doctrine resolve multiple supported commanders in overlapping AOs?

(8) How will joint doctrine address risk decisions when multiple systems belonging to more than one component Service is in conflict?

(9) What are the AC2 interoperability requirements for operating with multinational formations?

b. The Army concepts used in the development of this TRADOC Pam 525-7-3 include a discussion of the DOTMLPF implications of the concepts. Few of the AC2 specific implications are explicit enough to generate changes within the DOTMLPF domains by responsible proponents and agencies. While this document adds detail to the required AC2 capabilities, some questions cannot be answered fully based on uncertainty of future events. The following sections detail these questions within DOTMLPF domains.

6-4. Doctrine

a. Army doctrine must seamlessly integrate with joint doctrine to optimize planning and execution of warfighting operations at all levels. Future doctrine development must be responsive enough to capture the new organizations and concepts of operations produced by the accelerating rate of Army transformation and technological advances. As the future Modular Force nears operational readiness, the joint capstone, operational, functional, and integrating concepts as well as the Army concept strategy will continue to evolve. Consequently, new doctrine and MTTP will be required to effectively plan and manage battles collaboratively.

b. Doctrine questions include, but are not limited to, the following.

(1) What constraints and limitations will joint airspace and C2 doctrine impose on airspace C2?

(2) Is current joint airspace and C2 doctrine adequate to implement near real time, collaborative decisionmaking?

(3) How will joint interdependencies change with technological advances and how will joint doctrine address these changes?

(4) What are the impacts of international aviation law on joint and Army airspace doctrine?

(5) Is AC2 adequately addressed in Army doctrine for the theater, corps, and division doctrinal publications?

(6) Are current MTTP adequate to execute AC2 requirements?

(7) Which emerging airspace technologies, processes, and capabilities need codification in Army doctrine?

(8) How will joint doctrine address multiple supported commanders in overlapping AOs?

(9) What AC2 doctrine changes must be made to facilitate operations with interagency and civil organizations?

6-5. Organization

a. The future Modular Force will require flexible and tailorable organizations, capable of rapidly assembling, analyzing and presenting relevant operational information to commanders in order to facilitate rapid decisionmaking and execution. These organizations will be designed to integrate with joint, Army, multinational, governmental, and civil agencies in order to fully synchronize and integrate all available information and assets. In order to adapt to the variability of the OE, future Modular Force AC2 organizations must be organized to enable distributed operations, with sufficient capabilities at all C2 nodes to integrate all airspace users into the overall C2 system.

b. Organizational questions include, but are not limited to, the following.

(1) Are future Modular Force AC2 organizations capable of executing this concept of AC2 without augmentation?

(2) Are future Modular Force AC2 organizations adequate to interface with joint C2 nodes for collaborative planning and execution of AC2 operations?

(3) Which future Modular Force units require dedicated AC2 organizations and what is the required composition?

(4) How does AC2 organizational design differ between tactical and operational echelons?

(5) What are the manning and equipping requirements for AC2 elements to interoperate with joint, Army, multinational, governmental, and civil agencies?

6-6. Training

a. Future Modular Force AC2 training must focus on joint interdependencies, collaborative planning and execution. AC2 is both an art and a science that needs nurturing throughout the Soldier's professional career. The art of AC2 is that of gaining experience, and using this experience to provide the commander with enough information to make decisions based on risk vs. mission accomplishment. The science of AC2 is that of being knowledgeable of all Service components' airspace elements of TAGS.

b. Future training simulations will include virtual operations requiring collaboration among all C2 nodes to support the development of SA, rapid information sharing, analysis and decisionmaking. Flexible training events and simulations will incorporate new technologies as they mature and become available, enabling units to maintain currency and interoperability with all C2 nodes. While training will be designed to produce proficiency in conducted AC2 operations in a fully networked, collaborative environment, units must also train to operate in degraded or stand alone mode, emphasizing adaptation, and innovation among Soldiers and leaders.

c. Training questions include, but are not limited to, the following.

(1) How will training events accurately replicate all C2 nodes necessary to train units on the integration of AC2 into the overall operations process?

(2) What changes to training events will be required to replicate the collaborative joint environment for AC2 and C2 operations?

(3) What type, scope, and frequency of AC2 training must the future Modular Force conduct to maintain proficiency in conducting AC2 operations in support of fully integrated C2, to include degraded, stand alone mode training?

(4) How will training events be designed to develop the art of AC2, requiring innovative and adaptive problem solving and decisionmaking?

(5) How will evolving technologies and planned changes in organization affect the ways in which Army units and leaders train AC2?

(6) How will changes in joint airspace doctrine alter training for units and leaders?

(7) How will training requirements differ for AC2 at the tactical and operational levels?

6-7. Materiel

a. The capabilities required to execute future Modular Force concepts and plans will only come to fruition if the research, development, test and evaluation and operations and maintenance, Army procurement funding is available. While the future is very difficult to predict with any degree of certainty, there are trends that seem undeniable: strategic

deployments, urbanization, non-traditional threats, and the increased density of airspace users (fires, UAS, aviation, joint platforms, civil aviation, and others.). Materiel solutions for the future Modular Force must focus on systems that reduce friction and uncertainty by enabling reliable secure communications, data sharing and decisionmaking with all forces. The tempo of continuous, distributed operations will require automated analysis and decision aids that capitalize on the networked, collaborative systems to enable commanders to make and disseminate decisions rapidly. As all airspace operations are inherently joint, AC2 systems must operate with C2 systems of all Services and span the entire AO.

b. Materiel questions include, but are not limited to, the following.

(1) Will BLOS and NLOS, secure, jam resistant data and voice communications to all airspace users, and platforms (joint, Army, multinational, governmental, and civil) be possible with integration of current or planned systems, or will a new start be required?

(2) What AC2 systems, aerial platforms and control stations, and munitions must be capable of interoperating with joint C2, and AC2 nodes?

(3) How will AC2 systems contribute to the establishment of a fully interoperable, joint, integrated C2 system?

(4) What new systems will be required to provide an all altitude, integrated air picture and what can be accomplished by integrating current systems?

(5) Are high altitude or space based sensors required to provide a complete SA of the low altitude threat airspace systems given the LOS limitations of terrestrial sensors?

(6) What AC2 systems will produce the RI required to generate the SA commanders need to make risk and benefit decisions?

(7) What joint interdependencies will the future Modular Force rely on to produce elements of RI?

(8) What solutions will enable classification and identification of all airspace users?

(9) What RI is required at the user control station/platform level and how will this contribute to effective AC2?

(10) Is there a need to record the air picture from the AC2 system, and if so, for how many hours per day, how many tracks and how long will the information be retained?

(11) What is the most effective and efficient method of protecting airspace users: building protected volumes airspace around each airspace user (in accordance with risk guidance) that moves with the airspace user or using control measures whose volume, duration and levels of protection can be made active for the period of time when an airspace user requires that portion of airspace to be restricted (segmented active and inactive)?

6-8. Leadership and Education

a. One of the keys in enabling effective Army operations will be the development of leaders and staffs who can perform effectively across the scope of full spectrum operations in a complex, uncertain, and dynamic OE. Future Modular Force leaders must be trained to aggressively manage information and trust the output of decision support tools that automated systems provide. Leaders must be educated, trained, and developed to be self-aware, innovative, and adaptive throughout training and operations. In the area of airspace operations they must think strategically, operationally, and tactically to successfully apply the joint and Army aspects of AC2. Other major implications include adoption of a lifetime education paradigm and the creation of knowledge centers configured to support professional leader education.

b. Leader and education questions include, but are not limited to, the following.

(1) How can the Army develop adaptive, innovative leaders who understand the complexity of airspace operations, its associated operating environment, threats, and interagency implications?

(2) What education will address collaborative problem solving and decisionmaking during AC2 planning and execution?

(3) What leader development programs must be conducted in residence versus distance learning or interactive multimedia instruction?

(4) How will a lifetime education paradigm be designed for functional areas with no dedicated MOS and primary military occupational specialty?

6-9. Personnel

a. Soldiers are the Army's greatest resource and the most important factor in building and maintaining unit readiness. The full integration of airspace and airspace users into all future Modular Force operations will depend on selecting and assigning the right personnel to AC2 related positions and providing opportunities for continuing education and repetitive assignments. The personnel management system must ensure that it provides the career paths needed to fully develop and utilize the expertise of the force. This will require the future Modular Force to identify critical AC2 positions and have a clear progression of professional training for each of these positions.

b. Personnel questions include, but are not limited to, the following.

(1) How does the Army select Soldiers with the required skills for assignment to AC2 positions?

(2) Without a dedicated MOS and primary MOS, how does the Army design a management system for skilled AC2 personnel to ensure continued professional development, and promotion and education opportunities?

(3) As all airspace operations are inherently joint, is it possible to create a joint airspace personnel management system to allow education and assignment of AC2 personnel in other component services?

(4) How does the Army retain trained AC2 soldiers?

(5) Current TOEs use 14 (14A/B, 140A, 14J) and 15 (15B, 150A, 15Q) series MOSs for AC2 positions. Can these MOSs continue to perform the AC2 mission in the future Modular Force?

(6) Would expanding the existing MOS provide greater career progression and assignment possibilities for these Soldiers?

(7) Would cycling Soldiers between branch assignments and BCT AC2 assignments help preserve the skills required to perform AC2 functions?

6-10. Facilities

a. While the areas of doctrine, training and leader development will constitute the preponderance of the transformation effort, each will have implications that effect existing and future Army facilities. The facilities and infrastructure of Army garrisons will require a significant investment of resources to train and deploy forces in accordance with future force concepts. Facilities need to be capable of supporting new equipment, sustainment, and training.

b. Facilities questions include, but are not limited to, the following.

(1) What unique facilities, equipment, training areas, and airspace does the Army require to support AC2 training and integration into all training events? This includes coordination for national airspace.

(2) What upgrades does the Army require for battle simulation centers to portray the joint, collaborative environment of airspace operations accurately?

(3) Are there adequate facilities available to Soldiers, leaders, battle staffs, and units to attain and maintain acceptable levels of AC2 training effectiveness?

(4) What infrastructure does the Army require at installations to support AC2 operations in both training and operational constructs consistent with joint, Army, and multinational concepts adequately?

6-11. Plan for Assessment

a. A fully integrated C2 warfighting function that includes AC2 is necessary to attain the future Modular Force objective state. Currently, there are no Army documents that provide a concept for conducting AC2 as a part of integrated C2. This AC2 CCP is the first document that attempts to establish a concept that capitalizes on operational, organizational, and technological

changes to implement an execution based AC2 system. There are many concepts referenced in the development of this document. References included in appendix A detail the numerous capabilities researched and the mission areas that were studied either prior to or during the formulation of the AC2 CCP. The following paragraphs detail assessment options and recommendations to assist in further developing this concept.

b. Experimentation, wargaming, and simulation. Experimentation is the process of exploring innovative methods of operation to assess feasibility, evaluate utility, and determine limitations of the concepts being explored. Wargaming is a process of discovery and assessment and is also a tool used in experimentation. Models and simulations are often used to make an informed assessment.

(1) The most common purpose of experimentation explores concepts, builds knowledge and clarifies unknowns. Additionally, experimentation can be used to examine emerging technologies that are nearing maturity and may be considered for fielding to the force. The Army also conducts war games using futuristic scenarios in support of the Joint Capabilities Integration and Development System efforts during the 2015–2024 timeframe to explore concepts in order to better identify which of those concepts should be the subject of experimentation.

(2) Wargaming develops insights into the impact of AC2 capabilities and aids in assessing the validity of strategic visions and emerging concepts while looking 20 to 30 years into the future. Wargaming begins by attaining operational research on future warfighting systems and concepts and applying them to simulated military operations in order to prove or disprove visionary ideas and to discover gaps and seams in future Army airspace operations. Wargaming examines concepts and generates insights that inform experimentation and guide the development of concepts, architectures, and systems that meet future Modular Force requirements.

(3) Scenarios or vignettes are built to look at one or more sets of conditions that will best help to evaluate hypotheses. However, the raw data is often not conclusive or requires reasoned review by seasoned subject matter experts to confirm the reliability of simulation or modeling outcomes. Models and simulations are often the primary tool used for experimentation.

(4) As noted previously, several joint and Army experiments have examined AC2 in the past. TRADOC Pam 525-7-3 addresses these findings, establishing an AC2 capabilities plan designed to correct the identified shortcomings. In order to continue to refine this concept and the required capabilities, experimentation must focus on the questions identified in this document.

(5) Experiments which provide insight and assist with continued AC2 developments include Unified Quest, which addresses operational C2 issues providing insight on supported and supporting commander relationships. Omni Fusion (Urban Resolve) which refines capability gaps for Army AC2 operations. The Division Warfighting experiment, which examines Army

AC2 procedures and their links to joint C2 nodes. And, finally, the Earth, Wind, and Fire experiment, which assessed capabilities and processes for integrating all airspace users.

Chapter 7
Risks and Mitigation

7-1. Introduction
This chapter examines potential risks associated with implementation of AC2 capabilities. It also considers possible risks related to alternatives, the most significant of which would be insufficient resourcing of required AC2 capabilities required for future OEs. This chapter describes three categories of risk associated with this AC2 concept and capabilities. The categories of risk are defined as operational risk, which is risk to the force if a less capable AC2 system is fielded or a less capable joint, multinational, governmental, or civil partner must be integrated into operations. Expectation risk, which is risk due to unrealistic expectations of the capabilities of new AC2 capabilities; and adversary action risk, which is threat actions that could diminish or negate the new AC2 capabilities.

7-2. Operational Risk

a. Failure to provide required AC2 capabilities will restrict the ability of the future Modular Force to fully integrate and synchronize air and ground actions and assets in support of full spectrum operations. The future Modular Force will rely on information and decision superiority enabled by fully networked, collaborative C2 systems that require complete data interoperability in order to pass RI and build SA. The joint nature of all airspace mandates that C2 systems interoperate to employ jointly developed common rules to all users. Lacking these capabilities will affect all aspects of operations but will severely constrain C2, near real time SA, rapid acquisition, analysis, and display of RI and collaborative planning and decisionmaking. Without these capabilities, the future Modular Force will be unable to perform all required tasks to synchronize air operations with ground operations in a near real time environment effectively. Additional force structure and equipment to perform these tasks manually will only alleviate a small portion of this shortfall.

b. Mitigation. Revise warfighting doctrine to reflect limitations of air operations compatible with reduced information exchange, limited collaboration, and slower decisionmaking, and reduced ability of commanders to make risk and benefit decisions in near real time.

7-3. Expectation Risk

a. Planning Capabilities

(1) Achieving required AC2 capabilities may create an expectation that near real time ability to integrate airspace users will eliminate the need for detailed planning and coordination with joint C2 nodes. The rapidly changing nature of the OE will require the ability for commanders to dynamically retask air platforms, clear and execute immediate fires, launch UAS with minimum advance planning and coordinate AMD fires, all of which will fall outside of the

published plan. As the collaborative capabilities of AC2 systems are implemented, they will further enable all C2 nodes to rapidly synchronize ongoing operations with immediate operations. The danger in this greatly enhanced capability to make execution changes is that the future Modular Force may inadequately plan airspace requirements and rely on the networked AC2 system to correct oversights.

(2) Mitigation. Commanders ensure airspace personnel are trained in the joint collaborative airspace planning process and they adhere to doctrinal standards. Training events should include requirements to plan and control airspace in the absence of network-enabled AC2.

b. Risk Decisions

(1) A potential risk is the assumption that AC2 automated decision aids will relieve commanders of risk decisions. Automated deconfliction and integration capabilities will ensure that all systems are employed in the optimal manner, consistent with the commander's intent and acceptable risk level. However, when conflicts exist such that one or more conflicting systems cannot accomplish assigned missions or the recommended solution exceeds risk tolerance, automated decision aids will assist the commander in determining which system will be employed or if he is willing to accept the risk of all systems being employed.

(2) Mitigation. Doctrine and training must reinforce the fact that AC2 systems are aids for routine deconfliction, but ultimately commanders must make risk decisions. Training events must be designed to force commanders to make risk decisions when thresholds for acceptable risk are exceeded.

c. Technology Dependency

(1) The future Modular Force may become dependent on AC2 capabilities to the point of being incapable of operating in a degraded network state. The ability of commanders and staffs to conduct effective operations with limited network services may diminish as network capabilities become more reliable and pervasive. Interoperable, networked AC2 systems provide near real time SA for all airspace and airspace users, enabling rapid integration and decisionmaking. The capability to generate this level of SA and conduct collaborative planning and execution with all joint C2 nodes will not be possible in near real time with degraded or inoperable network services.

(2) Mitigation. The conduct of operations in a degraded network environment must be addressed in doctrine, trained in service schools, and exercised frequently during training events.

7-4. Adversary Action Risk

a. Network Security

(1) The most significant risk associated with AC2 capabilities is a network security breach and the associated compromise of AC2 information. Integrating all airspace users and C2 nodes (joint, Army, multinational, governmental, or civil) will enable SA and rapid collaborative

planning and decisionmaking. The number and distribution of systems having access to AC2 information will be tremendous. Adversaries could gain access to AC2 information or the entire network from C2 systems on board disabled or destroyed aircraft, or at civil and commercial aviation facilities integrated into the network. While security features can be designed into AC2 systems, poor compliance with and enforcement of security and information assurance procedures could allow an adversary to penetrate the network and halt, slow, or misdirect information flow, and alter information used in the operations process. All of these actions can have both immediate and long-term detrimental impacts on future Modular Force operations.

(2) Mitigation. Maximize reasonable security design in AC2 systems, implementing permissions by platform, echelon and organization; train and enforce information assurance policies and procedures.

b. Direct Action

(1) Direct action may be taken by adversary elements against AC2 capabilities or against the network. This may occur both within the AO and in areas that host AC2 or network facilities outside the AO. Direct action may take the form of either physical attacks against facilities or people, or electronic attacks against the network and AC2 systems. Direct action may result in the complete or partial loss of AC2 support to operational forces.

(2) Mitigation. Doctrine and training events must address operations in degraded network. AC2 systems must be designed with self-healing capabilities, capable of distributed operations and able to operate in stand-alone mode.

Appendix A
References

(ARs, DA Pams, FMs, and DA forms are available at Army Publishing Directorate (APD) - Home Page. TRADOC publications and forms are available at TRADOC Publications. Joint Concepts are available at http://www.dtic.mil/futurejointwarfare/concepts)

Section I
Required References

TRADOC Pam 525-3-0
The Army in Joint Operations, The Army's Future Force Capstone Concept 2015-2024.

Section II
Related References

Air Force Doctrine Document 2-8
Command and Control.

Battlespace Awareness Joint Functional Concept.

Capstone Concept for Joint Operations.

Chief, Joint Chiefs of Staff Instructions 3170.01
Joint Capability Integration Development System Instructions.

Defense Planning Guidance.

Field Manual 3-0
Operations.

Field Manual 3-52
Army Airspace Command and Control in a Combat Zone.

Force Application Joint Functional Concept.

Joint Command and Control Joint Functional Concept.

Joint Publication 3-0
Joint Doctrine for Operations.

Joint Publication 3-01
Countering Air and Missile Threats.

Joint Publication 3-08
Joint Interagency, Intergovernmental Organization, and Nongovernmental Organization Coordination during Joint Operations.

Joint Publication 3-09
Joint Fire Support.

Joint Publication 3-09.3
Joint Tactics, Techniques, and Procedures for Close Air Support.

Joint Publication 3-17
Joint Doctrine and Joint Tactics, Techniques, and Procedures for Air Mobility Operations.

Joint Publication 3-26.1
Homeland Defense.

Joint Publication 3-30
Command and Control for Joint Air Operations.

Joint Publication 3-33
Joint Task Force Headquarters.

Joint Publication 3-52
Joint Doctrine for Airspace Control in the Combat Zone.

Joint Publication 3-60
Joint Doctrine for Targeting.

Joint Publication 6-0
Joint Communications System.

Joint Publication 6-02
Joint Doctrine for Employment of Operational/Tactical Command, Control, Communications, and Computer Systems.

Major Combat Operations JOC; the Stability Operations JOC; and the Homeland Defense and Civil Support JOC

Glossary

Section I
Abbreviations and Acronyms

A2C2	Army aviation command and control
AC2	airspace command and control
ACA	airspace control authority
AMD	air and missile defense
AO	area of operations
ATS	air traffic services
AWACS	Airborne Warning and Control Center
BCT	brigade combat team
BFT	blue force tracker
BLOS	beyond line of sight
C2	command and control
CCP	concept capability plan
CID	combat identification
CJCSI	Chairman, Joint Chiefs of Staff Instructions
CONOPS	concept of operations
COP	common operational picture
CP	command post
DOTMLPF	doctrine, organization, training, materiel, leadership and education, personnel and facilities
FAA	Federal Aviation Administration
FM	field manual
GIG	global information grid
HQ	headquarters
ICAO	international civil aviation organization
IFF	identification, friend or foe
JFACC	joint forces air component commander
JFC	joint force commander
JFLCC	joint forces land component commander
JIC	joint integrating concept
JOC	joint operating concept
JOE	joint operational environment
JP	joint publication
METT-TC	mission, enemy, terrain, troops, time, civil considerations
MOS	military occupational specialty
MTTP	multi-Service tactics, techniques, and procedures
NLOS	non line of sight
OE	operating environment
pam	pamphlet
RI	relevant information
SA	situational awareness
SU	situational understanding

TAGS	theater air ground system
TRADOC	U.S. Army Training and Doctrine Command
UAS	unmanned aircraft system
U.S.	United States

Section II
Terms

airspace command and control
The integration of all joint airspace users, in both planning and near real time execution in accordance with the commanders intent, priorities and acceptable level of risk, in order to maximize all airspace user's capabilities, while minimizing adverse impacts. (New definition).

air operations center
Principal air operations installation from which aircraft and air warning functions of combat air operations are directed, controlled, and executed. The senior agency of the Air Force component commander from which command and control of air operations are coordinated with other components and Services. (JP 3-56.1).

area of responsibility
The geographical area associated with a combatant command within which a combatant commander has authority to plan and conduct operations. (JP 3-0).

airspace user
Manned and unmanned aircraft systems, munitions and directed energy weapons operated by all components including Multinational forces and authorized governmental or civil agencies. (New definition).

battle command
The art and science of understanding, visualizing, describing, directing, leading, and assessing forces to impose the commander's will on a hostile, thinking, and adaptive enemy. Battle command applies leadership to translate decisions into actions—by synchronizing forces and warfighting functions in time, space, and purpose—to accomplish missions. (Field Manual (FM) 3-0).

capability
The ability to achieve a desired effect under specified standards and conditions through combinations of ways and means to perform a set of tasks (Chairman, Joint Chiefs of Staff Instruction (CJCSI), 3170.1E); the ability to achieve an effect to a standard under specified conditions through multiple combinations of means and ways to perform a set of tasks. (CJCSI 3010.02B).

characterization
The process of obtaining and assessing distinguishing characteristics of an object(s) in order to establish its nature, class membership, threat posed, intent, or other factors of tactical significance. (CID-Blue Force Tracker (BFT) Concept of Operations (CONOPS)).

classification
The process of characterizing a detected object by its type, model, variant, nationality, and any other distinguishing feature and attribute. (CID CONOPS, Army System of Systems Common Data Dictionary). Classification is a continuum of detail that includes class (such as, fighters), type (for example, the F-16 fighter), nationality (for example, the U.S.), mission, including categorization details (such as, reconnaissance, external fuel tanks, tail number), and behavior (such as, threatening or non-threatening, intent). While intent has world-wide applications, it is particularly important for homeland defense. (Integrated Air and Missile Defense Operational Concept).

combat identification
The process of attaining an accurate and timely characterization of detected objects in the joint battlespace: (1) sufficient to support an engagement decision; (2) to the extent that high confidence, timely application of military options and weapons resources can occur. (CID-BFT CONOPS). The result of the combat identification process will be at least, but not limited to, friend, enemy, neutral, or unknown (Army System of Systems Common Data Dictionary). (JP 1-02).

commander's intent
A concise expression of the purpose of the operation and the desired end state that serves as the initial impetus for the planning process. It may also include the commander's assessment of the adversary commander's intent and an assessment of where and how much risk is acceptable during the operation. See also assessment; end state. (JP 5-00.1).

common operational picture
A single identical display of RI shared by more than one command. A common operational picture facilitates collaborative planning and assists all echelons to achieve situational awareness. (JP 3-0). (Army) A single display of RI within a commander's area of interest tailored to the user's requirements and based on common data and information shared by more than one command. (FM 3-0).

control and reporting center
Subordinate to the air operations center and may be designated as the primary theater command, control, and air surveillance facility within the theater, or may share that responsibility with other tactical air control system elements such as AWACS. Responsibility as the region and sector air defense commander is also normally decentralized to the control reporting center, which acts as the primary integration point for air defense artillery fire control. The control reporting center may deploy mobile radars and associated communications equipment to expand radar coverage and communications range within its assigned operating area. These remote radars are capable of providing early warning, surveillance, weapons control, and identification functions. (Air Force Doctrine Document 2-8).

decentralized execution
Delegation of execution authority to subordinate commanders. (JP 3-30).

discrimination
The ability to distinguish real from other (such as, a recreational vehicle from debris or decoys, targets from spurious signals) and militarily significant objects from those that are not. Discrimination typically employs the same means as classification (such as, high resolution radar) and is particularly critical to ballistic missile defense. (Integrated Air and Missile Defense Operational Concept).

execution
The initiation of an operation; a military response with operations being conducted. (C2 JIC).

four dimensional
A plane of reference referring to latitude, longitude, altitude, and time. (New definition).

full spectrum operations
Army forces combine offensive, defensive, and stability or civil support operations simultaneously as part of an interdependent joint force to seize, retain, and exploit the initiative, accepting prudent risk to create opportunities to achieve decisive results. They employ synchronized action—lethal and nonlethal—proportional to the mission and informed by a thorough understanding of all variables of the operational environment. Mission command that conveys intent and an appreciation of all aspects of the situation guides the adaptive use of Army forces (FM 3-0).

high-density airspace control zone
Airspace designated in an airspace control plan or airspace control order, in which there is a concentrated employment of numerous and varied weapons and airspace users. A high-density airspace control zone has defined dimensions which usually coincide with geographical features or navigational aids. Access to a high-density airspace control zone is normally controlled by the maneuver commander. The maneuver commander can also direct a more restrictive weapons status within the high-density airspace control zone. (JP 3-52).

identification
The process of determining the friendly or hostile character of an unknown detected contact. (CID-BFT CONOPS) Identity may include: Pending, unknown, assumed friend, friend, neutral, suspect, and hostile (or enemy). (Military Standard 6016C).

interoperability
The ability of systems, units, or forces to provide services to and accept services from other systems, units, or forces. This also includes the ability to use the services to operate effectively together. (Adapted from JP 1-02).

joint forces air component commander
The commander within a unified command, subordinate unified command, or joint task force responsible to the establishing commander for making recommendations on the proper employment of assigned, attached, and made available for tasking air forces; planning and coordinating air operations; or accomplishing such operational missions as may be assigned.

The joint force air component commander is given the authority necessary to accomplish missions and tasks assigned by the establishing commander. (JP 3-0).

joint force commander
A general term applied to a combatant commander, sub unified commander, or joint task force commander authorized to exercise combatant command (command authority) or operational control over a joint force. (JP 1).

joint forces land component commander
The commander within a unified command, subordinate unified command, or joint task force responsible to the establishing commander for making recommendations on the proper employment of assigned, attached, and made available for tasking land forces; planning and coordinating land operations; or accomplishing such operational missions as may be assigned. The joint force land component commander is given the authority necessary to accomplish missions and tasks assigned by the establishing commander. (JP 3-0).

joint task force
A joint force that is constituted and so designated by the Secretary of Defense, a combatant commander, a sub unified commander, or an existing joint task force commander. (JP 1).

mission command
The conduct of military operations through decentralized execution based on mission orders. Successful mission command demands that subordinate leaders at all echelons exercise disciplined initiative, acting aggressively and independently to accomplish the mission within the commander's intent. (FM 3-0).

near real time
Pertaining to the timeliness of data or information which has been delayed by the time required for electronic communication and automatic data processing. This implies that there are no significant delays. (JP 1-02).

operations process
The major command and control activities performed during operations: planning, preparing, executing, and continuously assessing the operation. The commander drives the operations process. (FM 3-0)

real time
Pertaining to the timeliness of data or information which has been delayed only by the time required for electronic communication. This implies that there are no noticeable delays. (JP 1-02).

relevant information
All information of importance to commanders and staffs in the exercise of C2. (FM 3-0).

situational awareness
Immediate knowledge of the conditions of the operation, constrained geographically and in time. (FM 3-0).

situational understanding
The product of applying analysis and judgment to relevant information to determine the relationships among the mission variables to facilitate decisionmaking. (FM 3-0).

task
A clearly defined and measurable activity accomplished by organizations and individuals. (FM 7-0).

target identification
The accurate and timely characterization of a detected entity or object on the battlefield as friend, enemy, neutral, or noncombatant that is being considered for possible engagement or other action (additional characterizations may include class, type, nationality, and intent of the object or entity). This aspect of CID is time-sensitive and directly supports the warfighters' engage don't engage decision. (CID-BFT CONOPS and IAMD Operations Concept).

unassigned area
The area between noncontiguous areas of operations or beyond contiguous areas of operations. The higher headquarters is responsible for controlling unassigned areas within its area of operations. (FM 3-0).

unified action
The synchronization, coordination, and/or integration of the activities of governmental and nongovernmental entities with military operations to achieve unity of effort. (JP 1).

warfighting function
A group of tasks and systems (people, organizations, information, and processes) united by a common purpose that commanders use to accomplish missions and training objectives. (FM 3-0).

Section III
Special abbreviations and terms

This section contains no entries.