



**The United States Army  
Concept Capability Plan  
for**

**Army Aviation Operations  
2015-2024**

**Version 1.0**

**12 September 2008**





## Foreword

*From the Director  
U.S. Army Capabilities Integration Center*

The warfighting requirements identified in the Army's functional concepts require the Army's future Modular Force to develop the capabilities necessary to achieve strategic force projection and operational agility in support of joint campaign objectives. It is clear that the Army will depend on an array of capabilities from other Services and the larger joint community to maximize effectiveness. Army aviation will be a responsive, campaign quality force, dominant across the full spectrum of operations and fully integrated with the joint, interagency, and multinational framework. During the 2015-2024 timeframe, Army aviation, in concert with the joint force and other elements of national and multinational power, will contribute to integrated, tempo-controlling actions in multiple domains concurrently to dominate any adversary and help control any situation.

Army aviation is an integral element of the new joint, interagency, and multinational power full spectrum operations paradigm. New emerging threats from great powers, new strategic alignments and geopolitical pivotal influences increase the probability that U.S. forces will operate in a complex political military terrain. The realization of these capabilities is essential to achieving the Army's capstone concept objective of being a strategically responsive, campaign quality force.

In the coming decades, the U.S. will see major changes in adversarial intent, force array, and strength. TRADOC Pamphlet 525-7-15 serves as the basis for developing changes, focused on required capabilities and solutions for Army aviation operations. Concept capability plans continually evolve as new technology develops. TRADOC Pamphlet 525-7-15 will be refined and updated as new learning emerges from research, joint and Army wargaming, experimentation, and combat development. Many of the Army aviation operations capabilities introduced in this concept capability plan are being addressed in other joint efforts. As this pamphlet crosses so many joint and Army functional areas, I strongly encourage its use in our interaction with other proponents, Services and joint organizations.



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## Executive Summary

TRADOC Pamphlet 525-7-15, *The United States Army Concept Capability Plan for Army Aviation Operations 2015-2024* depicts and explains how aviation supports the future Modular Force and describes the required aviation capabilities needed to realize the objectives of our joint and Army concepts. It focuses on the capabilities required to enable the effective employment of aviation, both manned and unmanned, as a critical member of the future Modular Force in joint, interagency, and multinational operations. Although the focus for many of these capabilities is during the 2015 – 2024 timeframe and some are yet to be realized, they will bridge the gap between the current force and the future Modular Force. TRADOC Pamphlet (Pam) 525-7-15 serves as the basis for developing doctrine, organizations, training, materiel, leadership and education, personnel and facilities changes, with focus on required capabilities and solutions for Aviation operations. The purpose of this plan is to assist in the development of an aviation focused capabilities-based assessment. It is a continuing work in progress and will be updated as new learning emerges from operational experience, joint and Army wargaming, and experimentation.

The Army's functional concepts provide both explicit and implicit descriptions of the aviation capabilities and functions necessary to achieve the objective state of the future Modular Force. The influence of aviation capabilities in most cases is not confined to a single Army functional concept but often span across one or more of the functional concepts and multiple proponent areas of responsibility. The required capabilities listing is aligned in relationship to each of the six Army functional concepts. The list is not all inclusive and will be further refined and developed as the concept emerges and as the Joint Capability Integration and Development System analysis is conducted.

TRADOC Pam 525-3-6: The *Move* concept focuses on strategic force projection and operational agility for the future Modular Force in support of joint campaign objectives, including tactical maneuver considerations. Fielding of advanced lift platforms—not dependent on improved air and sea ports—will enable future Army formations to deploy in combat-ready unit configurations with integrated sustainment, in a matter of days rather than weeks—with units prepared for immediate employment. The key aviation capabilities required to support the *Move* concept are: enhanced aircraft (manned and unmanned) performance (increased range, speed and payload); ability to tactically transport fully combat-configured future platforms and crews from land or sea bases out to operational depths, utilizing austere landing zones; enhanced navigation systems that will provide precise location accuracy for intelligence information; and advanced lift aircraft to rapidly move high priority (time sensitive) cargo and supplies directly to the deployed units.

TRADOC Pam 525-2-1: The *See* concept describes how the future Modular Force will acquire and generate knowledge of itself, its opponent, and the operational environment. Aviation makes its primary contributions to the *See* concept through actions to gather and collect information. The key aviation capabilities required to support the *See* concept are: conduct aerial armed reconnaissance with platform sensors to provide target acquisition at survivable standoff ranges, in day, night, adverse weather, obscured visibility, and in the presence of camouflage, cover, concealment, and deception countermeasures; mine and explosive device

detection sensors for unmanned aircraft systems; systematically observe geographic areas with continuous observation with capability to range any point in the expanded division area; efficiently utilize the battle command common operational picture in performing reconnaissance and surveillance operations and quickly report information in compatible formats; and the capability of manned aircraft to have full motion control of unmanned aircraft, including launch and recovery, to conduct manned-unmanned teaming.

TRADOC Pam 525-3-4: The *Strike* concept 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. The key aviation capabilities required to support the *Strike* concept are: an air-to-ground weapons suite to provide sufficient range, precision effects, and flexibility to engage diverse target sets at survivable ranges; direct access to Army and joint fire delivery systems; and to correctly identify detected friendly objects/entities with 95 percent probability.

TRADOC Pam 525-3-3: The *Battle Command* concept describes how future Modular Force commanders must exercise the art of battle command using the best available information in an uncertain environment to make tough decisions—decisions which put Soldiers' lives on the line. The key aviation capabilities required to support the *Battle Command* concept are: aircraft, both manned and unmanned, to be self-reporting and self-identifying in real- or near real time with time-stamped positional and identification data; Army and joint, interagency, and multinational interoperable communications during all flight modes and at extended ranges (voice, data, imagery, full motion video); 4-dimensional visual airspace planning and real time airspace deconfliction; and over the horizon control and information transfer for aviation reconnaissance/surveillance missions through satellite links.

TRADOC Pam 525-3-5: The *Protect* concept describes how future Modular Force units, along with information systems and infrastructure, will require advanced protection capabilities. The key aviation capabilities required to support the *Protect* concept are: minimize aural, visual, infrared and radio frequency signatures to enhance active aircraft survivability equipment; defeat or suppress enemy air defense systems both radar and infrared guided with active and passive countermeasures; provide maximum protection to Soldiers (crew and passengers) and critical aircraft flight components from ballistic, flame, thermal, overpressure, chemical, biological, radiological and nuclear and electromagnetic weapons' effects; and pilotage and navigation systems to enable safe aircraft control when visual cues to the surrounding terrain and aircraft attitude are degraded or lost.

TRADOC Pam 525-4-1: The *Sustain* concept describes how the future Modular Force will have decreased ability to depend on ground lines of communication in the future will result in an increased reliance on air and seabased delivery platforms and reachback, and will maximize direct delivery of tailored packages at the tactical level. The key aviation capabilities required to support the *Sustain* concept are: establish a condition based two level maintenance process; provide aviation ground support equipment with designed-in deployability, reliability, maintainability, and sustainability; provide a fully deployable aviation sustainment maintenance organization which can be either land based or sea based; sustain a high operational readiness rate, compatible with the common logistics operating environment and more affordable, realistic

and sustainable training aids, devices, simulators, and simulations with embedded training and mission rehearsal capability.

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TRADOC Pamphlet 525-7-15

12 September 2008

Military Operations


**THE U.S. ARMY CONCEPT CAPABILITY PLAN FOR  
ARMY AVIATION OPERATIONS 2015-2024**

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**History.** This publication is a new United States 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 (CBA) process.

**Summary.** TRADOC Pamphlet (Pam) 525-7-15, *The U.S. Army Concept Capability Plan for Army Aviation Operations 2015-2024* provides a method for integrating Army aviation operations capabilities in the future Modular Force and will result in aviation operations focused capabilities based assessments (CBA). The CBA(s) will be the basis for developing doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) solutions or solution sets for aviation operations capability gaps during the 2015–2024 timeframe. TRADOC Pam 525-5-17 focuses on the strategic, operational, and tactical application of integrated aviation operations capabilities across the full spectrum of military operations. This concept draws from approved and draft documents that address future Modular Forces, such as, division, corps, and Army service component commands, in addition to the emerging joint and Army concepts relevant to Department of Defense (DOD) and Army transformation.

**Applicability.** This pam applies to all TRADOC, non-TRADOC Army proponents, and Department of the Army (DA) activities that identify and develop DOTMLPF solutions to field required Army aviation operations capabilities. Active Army, Army National Guard, U.S. Army

## TRADOC Pam 525-7-15

Reserve operating forces, and U.S. Army Materiel Command may use this pamphlet to identify future Army aviation operations trends. This pamphlet may also serve as a reference document to agencies within the joint community that are planning or are concerned with Army aviation operations and 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. The purpose of this concept capability plan (CCP) is to identify required aviation capabilities based on a detailed analysis of the Army's operational and functional concepts. This CCP will serve as a bridge between the new Army concept strategy and the Joint Capability Integration and Development System (JCIDS) process. It serves as the basis for developing doctrine, organizations, training, materiel, leadership and education, personnel and facilities (DOTMLPF) changes, focused on requirements and solutions for Army aviation operations. This CCP provides the framework to describe the capabilities required for Army aviation. The description of these aviation capabilities will be sufficient to develop DOTMLPF solutions, and will provide a focus for future, aviation wargaming and experimentation efforts. The potential solutions will enable greater exploitation of the vertical dimension in joint and Army operations, at all echelons across the spectrum of military operations.

b. This CCP will result in one or more aviation-operations focused capabilities based assessments (CBAs). The CBAs will identify DOTMLPF solutions for Army aviation operations capability gaps in the 2015–2024 timeframe. Experiments, tests, and exercises are needed to inform concepts and changes in warfare to assist in developing and fielding these ideas. This CCP presents technical and non-technical capabilities that enable the effective employment of aviation assets and capabilities in an interdependent, joint, and multinational environment.

### 1-2. Functional Area

The Army Aviation Operations CCP identifies capabilities required to conduct full spectrum operations during the 2015–2024 timeframe. This plan reaches across the joint functional areas of battlespace awareness, command and control (C2), force application, Focused logistics, net-centric environment, and protection. Additionally, it is fully nested in the Army concept strategy documents from the capstone concept, *The Army in Joint Operations*, through the six, Army functional concepts.

### 1-3. Scope

The scope of Army aviation operations, as depicted in this CCP, is consistent with current joint and Army concepts, and focuses on the timeframe 2015–2024. The primary basis for analysis are the *Capstone Concept for Joint Operations*, *Major Combat Operations Joint Operating Concept (JOC)*, *Homeland Defense JOC*, *Civil Support Operations*, *Stability and Support Operations JOC*, and the *Deterrence Operation JOC*; along with *The Army in Joint Operations*, the Army *Operational* and *Tactical Maneuver* concepts, and the six, Army functional concepts.

### 1-4. Relation to the Family of Army Concepts

a. *The Army in Joint Operations*. The Army's capstone concept focuses on the theater-strategic level of war and reinforces the fact that Army forces will always conduct operations as an integrated component of a joint force. It is clear that the Army will depend on an array of

capabilities from other Services and the larger joint community to maximize effectiveness. The future Modular Force will be a strategically-responsive, campaign-quality force, dominant across the full spectrum of operations and fully integrated with the joint, interagency, and multinational (JIM) framework. It is within this context that the campaign is linked firmly to theater strategy and the emerging threat challenges of traditional, irregular, catastrophic, and disruptive threats posed to the Army in support of joint operations. The Army capstone concept lays out seven, key, operational ideas across the spectrum of conflict to achieve full- spectrum dominance and address the diverse threats and the volatile conditions expected to characterize the future operating environment. Aviation systems and capabilities are contributing enablers and integral components to each of the seven operational ideas. The concept also describes that the future Modular Force “will need to conduct integrated strike, maneuver, and information operations with powerful joint and interagency teams of ground, space, maritime, air and special operations forces and routinely exploits Army aviation and joint advanced lift and integrated strike capabilities”.

b. *The U.S. Army Operating Concept for Operational Maneuver* addresses the operational level of war and focuses on the ways and means by which future Modular Force commanders link a broad array of tactical actions to achieve a joint force commander’s (JFCs) campaign objectives. The concept presents a detailed discussion of the seven key operational ideas identified in the Army capstone concept and how they are applied at the operational level of war across the full spectrum of operations. The concept reinforces the idea that the Army requires advanced air-ground and combined arms capabilities with respect to mobility; long-range, precision fires; multi-capable intelligence; surveillance and reconnaissance (ISR); flexible, multi-modal sustainment; and advanced communications networks. “Simultaneous engagement by air-ground maneuver elements, employing future advanced lift, reconnaissance, and attack aviation assets, supported by joint fires and suppression of enemy air defenses, will allow Army forces to transit the joint operations area (JOA) on United States (U.S.) terms, in any terrain.” The required capabilities for operational maneuver described in this concept, particularly the movement of mounted, protected formations by air to locations in proximity to critical enemy objectives, represent one of the most important future means of conducting direct attack. In addition, improved capabilities for organic, long-range fires and the employment of joint fires and effects complementary to and in support of ground operations, represent other important means of direct attack. Collectively, these capabilities will reinforce the effects of fires, present a set of multidimensional options to paralyze and overwhelm the enemy, and lead to rapid collapse of enemy forces. The concept characterizes aviation-enabled capabilities as critical enablers for implementation of the fundamental principles of the operational maneuver concept as they pertain to the key operational ideas.

c. *The U.S. Army Operating Concept for Tactical Maneuver* describes the future Modular Force within the framework of tactical operations—battles and engagements. The Army's future Modular Force must be able to conduct decisive tactical operations in complex, lethal environments to support directly the achievement of campaign objectives across the spectrum of military operations. Tactical maneuver involves full-dimensional maneuver throughout every domain of the operational environment and features the generation of joint and combined arms synergy. “Tactical vertical maneuver is critical to both operational disintegration and dislocation of the enemy force. It is envisioned that future Modular Force divisions will be mission-tailored

with the capabilities required to conduct battalion-sized vertical maneuver operations, augmented by dedicated ISR, attack aviation, and long-range fires.” “Mission-tailored aviation assets provide multidimensional support, including sufficient capability to conduct battalion-sized vertical maneuver, aerial C2, and aerial sustainment.” The concept presents a detailed discussion of five key ideas as defining the most important vectors of change in tactical operations. Underpinning these five key ideas is the need to develop and maintain a deep understanding of the increasingly complex tactical environment. The five key ideas are simultaneous and continuous operations, decisive maneuver, routine employment of joint capabilities at tactical level, self-synchronizing and cooperative engagement, and the quality of firsts.

d. To achieve this level of tactical maneuver, the “key enablers for higher tactical operations include advanced aviation, long-range precision fires, multifunctional sensor and or attack unmanned aircraft systems (UAS), agile distribution capabilities, and advanced command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) networking.”

e. The final concept documents describing the Army’s role in the future Modular Force are the six, Army functional concepts: TRADOC Pam 525-2-1, *See*; TRADOC Pam 525-3-3, *Battle Command*; TRADOC Pam 525-3-4, *Strike*; TRADOC Pam 525-3-5, *Protect*; TRADOC Pam 525-3-6, *Move*; and TRADOC Pam 525-4-1, *Sustain*. These functional concepts describe the Army capabilities needed to conduct successful operational and tactical maneuver. The following paragraphs address each Army functional concept and identify capabilities enabled by Army aviation systems.

(1) *Battle Command*

(a) TRADOC Pam 525-3-3 provides a visualization of how Army future Modular Force commanders will exercise command and control of Army operations in a JIM environment. Battle command will continue to be a combination of art and science in which commanders use their experience, knowledge, and insights to plan and execute operations to accomplish the mission. The primary differences will be in the speed and quality of decisions that outpace adversary decision cycles and the degree to which advanced technology will assist in the battle command function. Technology will also allow for advanced levels of collaboration and increased speed of information exchange. Central to the technical component is the concept of a single, integrated Army battle command system (ABCS) enabled by an agile, ubiquitous communications network. Regardless of these technological advances, however, the leadership of the human decision maker will remain central to the battle command function and is the most critical element of employing military power.

(b) Many of the key ideas within the *Battle Command* concept relate to or are enabled by aviation capabilities. These include mission command (airborne C2 and airspace C2 (AC2), collaborative planning; accelerated military decisionmaking process (MDMP), continuous battle assessment, information and decision superiority, interagency and multinational interoperability and integration, horizontal and vertical fusion (aircraft and UAS sensors), and redundant and continuous communications network (UAS communications relay).

(2) *See*

(a) TRADOC Pam 525-2-1 describes how the future Modular Force will acquire and generate knowledge of itself, its opponent, and the operational environment. The function of seeing and creating knowledge of the operational environment is the essential element of transforming to a knowledge-based, net-enabled force capable of seeing first, understanding first, acting first, and finishing decisively. Aviation will be both a provider and receiver of information for the joint force. In many cases, aviation will provide greater fidelity to information collected by joint and national platforms, particularly in early-entry operations or immature theaters. Aviation units are one of several organizations that conduct reconnaissance to fill information voids and conduct security operations to provide early warning and protection from unexpected, enemy movements. Every aspect of future Modular Force operations derives increased effectiveness through the ability to see and know, and from that, the ability to anticipate, comprehend, integrate, and exploit information.

(b) The continuous acquisition and synthesis of data and information from joint and interagency capabilities, coalition partners, and non-traditional sources permits the future Modular Force to maintain an accurate understanding of the operational environment. See supports the rapid and reliable determination of friend or foe to maximize engagement opportunities, especially since U.S. and allied forces are heavily using the same airspace used by the enemy to disrupt operations. Situational awareness (SA) and situational understanding (SU) for all aviation missions and functions including airspace management and coordination, air threat warning, friendly protection, and all other airspace functions are crucial in decisionmaking. Any hesitation in decision making in engaging enemy air and missile threats due to uncertainty could have devastating consequences as weapons of mass destruction and precision munitions proliferate.

(c) Many aviation systems and enablers support the main ideas put forward in this concept. These ideas include acquisition of data from organic and non-organic sources, including joint and interagency. This includes the subordinate functions of gathering, collecting, and fusing data, and transforming data through the rapid and continuous fusion of data and analysis of information to produce knowledge, across all domains and disciplines to develop relevant knowledge. It consists of awareness, assessment, and anticipation through integrated and persistent ISR. The provision of timely, precise and tailored knowledge, input to the command for decision-making, force application, movement, protection and sustainment. Aviation will be a contributor to the common operational picture (COP).

(3) *Move*

(a) TRADOC Pam 525-3-6 focuses on strategic responsiveness and operational agility in support of joint campaign objectives, including tactical maneuver considerations. The future Modular Force conducts operational maneuver from strategic distances to secure positions of advantage for prompt engagement of the enemy in operations that may often be of uncertain scope and duration. Fielding of advanced lift platforms (sea and air), not dependent on improved ports or airfields, will enable future Modular Force formations to deploy in combat-ready, unit configurations with integrated sustainment, in a matter of days rather than weeks. The



achievement of deployment momentum by air, sea, and ground, coupled with capability for intratheater operational maneuver, permits commanders to seize the initiative more rapidly, confront the enemy with multiple dilemmas, generate dislocating and disintegrative effects, and accelerate the enemy's defeat.

(b) The Army approaches the overall requirements for strategic responsiveness through a prompt and sustained framework. This framework depends on aviation enablers to support the key ideas of prompt response, sustained response and operational agility, and tactical movement and mobility, based on the functions: operational maneuver—from strategic and operational distance; intratheater operational maneuver—mounted and dismounted, sustained force projection, seabasing. C4ISR fully integrated within the joint contingency force structure for entry operations, ground-based capabilities for precision fires and long-range, manned and unmanned armed reconnaissance for air and sea joint counter-precision and counter anti-access, en route knowledge-building and continuous connectivity, and self deployment.

#### (4) *Strike*

(a) TRADOC Pam 525-3-4 describes how future Modular Force commanders will employ fires, including available joint and multinational fires, in support of full spectrum operations and will integrate fires with information capabilities and operations. It uses a joint campaign framework as a model to illustrate how commanders may consolidate and employ strike capabilities throughout the range of military operations. Future Modular Force commanders will have fully integrated strike assets that deliver long-range, precision, highly responsive, and sustainable fires. It also describes how commanders employ strike to protect friendly forces, fix, or isolate enemy formations and create multiple dilemmas for the adversary, to include executing aviation interdiction attack operations. Organic strike capabilities, in conjunction with joint fires, will create an interdependent joint fires system of systems that provides lethal and nonlethal effects for joint forces in a JIM environment.

(b) The *Strike* concept is built around five key ideas, of which aviation enablers directly support four. They are to provide continuous integration and employment of networked strike from strategic to tactical levels, attack all target types in all environments and terrains with unprecedented effectiveness, seamless employment of lethal and nonlethal effects, and guarantee responsiveness and scaled lethality through joint interdependence.

#### (5) *Protect*

(a) TRADOC Pam 525-3-5 lays out a set of enabling tasks and capabilities by which the future Modular Force protects people, physical assets, air and ground freedom of maneuver, and information against the full-spectrum of threats. Air and missile defense is a key component of the protect function. "Full dimension protection will be achieved through the employment of Soldier, platform, unit, and information capabilities in fixed, semi-fixed, and mobile environments." The function of protect will take place on land, in the air, on the seas, in space and in or on the electronic domains. During early entry operations or when the COP is still developing, manned and unmanned aviation as part of the air-ground team will conduct security,

reconnaissance and interdiction attack operations to provide early warning and protection from unexpected enemy movements.

(b) Aviation can also provide security along extended lines of communication (LOCs) and/or movement of quick reaction forces throughout the extended operational environment of the future. These aviation missions play a role in accomplishing each of the five enabling tasks of the protect concept: *detect, assess, decide, act, and recover*. These tasks are interconnected and represent the processes of a full dimensional protection environment. Aviation capabilities enable the following protect key ideas: Soldier, platform, and unit protection, fixed, semi-fixed and mobile protection, and active protection (Army and JIM forces).

(6) *Sustain*

(a) TRADOC Pam 525-4-1 establishes the overarching framework for logistics support to the future Modular Force. At the strategic and operational level, future Modular Force logistics is envisioned as a single, coherent, joint system that senses and interprets the operational environment. It responds through advanced distribution platforms, precision delivery systems, state of the art command, control, and communications networks, from the source-of-support to the last, tactical mile. With the need to reduce the logistics footprint and the decreased ability to depend on ground lines of communication, logistics will rely heavily on air and sea based delivery systems. This increased reliance on air mobility and advanced distribution platforms places a heavy burden on aerial logistics operations. “Army aviation is a key enabler for the Army Vision and brings unique capabilities that contribute to the Army’s ability to fulfill mission requirements across the full-spectrum of military operations. Aviation systems provide the combatant commander with a sustainable capability to move rapidly, focus combat power on multiple targets, and enhance near–real time SA.” Aviation will perform crucial tasks in providing logistics support to maneuver forces, primarily during sustainment replenishment operations (SRO) and mission staging operations (MSO). Future Modular Force logistics operations include supply and field services, medical support, maintenance, transportation, force health protection, Soldier services, and aviation logistics support.

(b) Aviation capabilities form much of the backbone of this single, coherent, joint system needed to support future Modular Force sustainment operations by enabling sustainment C2, two-level maintenance force SA and SU, and in-transit visibility (ITV).

(c) Ultra-reliable, intelligent diagnostics and prognostics for aircraft, able to detect system failures prior to occurrence (using on-board collection systems), and to automatically transmit aircraft systems data to logistics units, maintenance facilities, and forward area, arming and refuel point (FARP) personnel.

(d) Reducing in-theater logistics footprint and enabling a distribution system that emphasizes speed, precision, accuracy, visibility, and centralized management. Medical evacuation (MEDEVAC) will enhance the rapid extraction of combat casualties through the health care system to definitive levels of care.

(e) Enabling component modularization, theater aviation sustainment maintenance capability (TASMC), and advanced lift platforms.

(f) While the joint and Army concepts provide word pictures of the capabilities required for future Modular Force operations in the 2015–2024 timeframe, the vignettes in chapter 2 put these concept capabilities into an operational setting.

### **1-5. Assumptions**

This CCP development is based on some key assumptions. They are:

a. The acquisition community will be able to deliver required technologies in accordance with future Modular Force threshold capabilities, blocking strategies, recapitalization schedules, and resources will be available.

b. Sufficient strategic lift, air, sea, (including civil reserve air fleet and commercial) and intratheater air, land, and sea lift will be available to accomplish future Modular Force deployability timelines.

c. Aviation units will be required to operate in noncontiguous areas for extended periods of time and function widely separated from friendly units.

d. Adequate ground security will be available for aviation tactical assembly areas and forward operating bases.

e. Aviation units sustain operational momentum through multiple battles by cycling forces in and out of contact.

f. Aviation will be integrated into the future Modular Force battle command network.

### **1-6. References**

Required and related publications and prescribed and referenced forms are listed in appendix A.

### **1-7. Explanation of Abbreviations and Terms**

Abbreviations and special terms used in this pamphlet are explained in the glossary.

## **Chapter 2**

### **Concept Capability Plan**

#### **2-1. Introduction**

a. Why this CCP is needed. Current joint and Army concepts do not adequately describe Army aviation's role in the future Modular Force. This CCP will serve as the basis for developing DOTMLPF changes, focused on required capabilities and solutions for Army Aviation operations. It provides the framework to describe the capabilities required for Army Aviation which are further aligned with one or more of the six Army functional concepts.

b. Problem statement. Instead of the phased, attrition-based, time consuming campaigns of the past, future joint operations will emphasize rapid, strategic response and immediate synchronized, shaping, and decisive operations throughout the depth and breadth of the JOA, of which Army Aviation is a key enabler. This will require permeation of a joint and expeditionary mindset throughout the Army component force. Leap ahead improvements in Army force capabilities will help assure realization of the future joint and Army concepts, especially with vertical mounted maneuver from strategic distances and intra-theater heavy lift as a means to obtain operational agility and surprise. In fact, without modernized ground-force capabilities—including Army aviation—significant elements of the future joint concepts will be unrealized or left out of reach. In order to implement future concepts, the Army has a responsibility to influence and shape the design, development, and employment of the future Modular Force, aviation capabilities.

c. Role of aviation. Army aviation, both manned and unmanned, is an integral member of the joint and combined arms team conducting full-spectrum operations. During deployment and early entry operations, aviation will perform vital reconnaissance, security and attack operations, vertical maneuver, and air movement of critical personnel and equipment, battle command, and crucial logistical support. These core missions allow aviation units to develop the situation, maneuver themselves and ground forces to positions of advantage, engage enemy forces at survivable standoff, destroy them with accurate fires, and provide close support to the tactical assault at the time and place of the commander's choosing. Additionally, aviation units will operate at a tempo that supports the ground commander's scheme of maneuver and quickly seizes the initiative from the enemy—forcing him onto the defensive, affording him no rest or relief and no means of responding effectively and defeating him in detail by establishing land-force dominance. Support of homeland defense operations will likely involve significant Army aviation assets, particularly heavy lift rotary and fixed wing aircraft. Mission critical areas for homeland defense include supporting national, regional, and local agencies efforts in: border and transportation security; domestic counterterrorism; protecting critical infrastructure and key assets; defending against catastrophic threats and emergency preparedness and response.

## **2-2. Operational Environment**

a. In the next few decades, the U.S. will see major changes in adversarial intent, force array, and strength. New threats may emerge from aspiring great powers, new regional alignments, or non-governmental organizations. The proliferation of space-based communications, sensor networks, information technologies, and new military dual-use technologies, will allow relatively poor states and non-state entities, to bring their military capabilities to levels previously possible only for fully industrialized nations.

b. Global urbanization increases the probability that U.S. forces will operate in complex terrain. These forces will be more vulnerable to direct attack due to the proliferation of communications; sensor, missile, and night vision capabilities; an expanding array of precision munitions; and special operations forces (SOF), together with a growing threat of weapons of mass destruction. These threats will necessitate greater mobility to avoid detection and targeting. Most adversaries will become more successful in their adaptive use of camouflage, cover,

concealment, denial, and deception (C3D2). Combined with dispersion of forces and other adaptive tactics, C3D2 will affect intelligence gathering and targeting.

c. Vertical maneuver, utilizing advanced lift capabilities, will often be the only means to quickly influence and dominate the operational environment, as adversaries conduct simultaneous operations at multiple locations. Opposing forces will focus on two major U.S. capabilities—vertical maneuver, vertical assault, and rapid massing of fires—leading to new technologies, new tactics and operational concepts, and hybridized older systems—all designed to offset the advantages held by Army aviation. Several nations are pursuing technologies and systems to offset this advantage by developing means of attacking our stealth, low altitude, and precision strike platforms. Others are pursuing methods of neutralizing the effects of these capabilities while bringing the conflict to closure using asymmetric means.

d. Hostile Air Defense

(1) Direct attack to defeat U.S. air supremacy is a major goal of any hostile force. The key component of direct attack against aerial platforms is an integrated air defense system. The abundance of man-portable air defense systems (MANPADS) and anti-aircraft artillery (AAA)—now integrated into digital air defense systems have taken what were previously unit protection systems, and made them less predictable and more effective.

(2) AAA represents the most numerous form of dedicated threat to Army combat aircraft. Ranging in size from 12.7 to 130 millimeters, the most significant AAA threat is from self-propelled, AAA systems with on-board fire control. AAA is relatively inexpensive to acquire and operate, requires little training, works well autonomously, and provides adequate low-altitude air defense for enemy maneuver forces. While no radical change in the basic design of AAA is anticipated, advances in fire-control and ammunition, and the more widespread availability of medium-caliber systems, will result in more lethal AAA threats to rotary wing aircraft. Whereas AAA weapons are multi-use, tactical surface-to-air missiles (SAMs), are only used to attack aviation platforms beyond the range of AAA. MANPAD SAMs are in particular demand by lesser-developed nations and non-government-sponsored groups. The enemy will try to use UAS and SOF to identify aviation assets on the ground, and then use tactical ballistic missiles, cruise missiles, rockets, artillery, and mortars to strike aviation when static. In addition to lethal attack systems, electronic warfare will be used to jam and disrupt targeting, guidance and communications systems, and lasers will be used to blind pilots. Increased command, control, and communications sophistication will permit the effective coordination of all.

e. Early warning radars will detect approaching aircraft at distances of 300-400 kilometers, depending on the altitude, speed, and size of the target. Many nations can now acquire active and passive sensors (including space-based) to provide early warning and SA to both air defense and direct-fire ground systems. This early warning allows better implementation of avoidance techniques and repositioning to engage attacking aircraft. New weaponry will reflect this increased ability to see the battlefield with targeting accuracy.

f. Potential adversaries are re-designing tactical air defense systems to improve performance against low-altitude helicopters, UAS, and missile defense systems—to reduce the effectiveness

of cruise missiles and other precision weaponry. Countermeasures, decoys, and tactics will further reduce the effect of precision munitions. Additionally, point defenses will likely include global positioning system (GPS) signal jammers—to disrupt U.S. air and ground GPS dependent platforms.

g. Adversaries will seek sanctuary in complex terrain. Mechanized and armored units will be widely dispersed, forming and conducting operations as opportunities occur. This limits the effectiveness of air support, provides opportunities for hidden air defense assets to conduct ambushes, and avoids direct-fire exchanges. It also provides enemy forces the ability to blend in with the civilian population. Denial of low-altitude airspace will be based on direct attack using dedicated AAA and missile defense systems, combined with air defense ambushes, direct fire ground systems (rocket-propelled grenades, antitank guided missiles, tank main guns), and area denial measures (anti-helicopter mines, electronic countermeasures). Long-range precision weapon capability is degraded when operating in urban areas, where targeting is more difficult.

h. Vertical maneuver does not provide high-altitude sanctuary for helicopters that must rely on the effective use of terrain, and the partial safety of extremely, low-altitude, or nap of the earth flight. Systems have been developed that reduce very-low altitude advantages through improved detection, tracking, and engagement capabilities. Flying at nap-of-the-earth altitudes may deny engagement by some air defense systems, but it places helicopters well within the range of small-arms and crew-served weapons.

i. Operationally, the threat will seek to deny U.S. access to the region itself. The future adversary will use all means possible to prevent us from establishing a foothold in the region. Strategically, the adversary will attempt to destroy flagship systems, to reduce the confidence of allies or coalition partners. Future threats will seek to separate forces by disrupting the flow of personnel and supplies, giving himself time to transition to an adaptive posture. When entry is assured, and faced with the realities of capability overmatch, the threat will seek to conduct tactical actions that will have operational or strategic effect, focusing on attacking C4ISR assets. The adversary will attempt to deny SU. It will disperse to avoid massed targets for precision strikes. The adversary will operate in complex terrain - often urban areas - until he can set conditions for offensive operations. Future opponents will employ C3D2 to reinforce defenses, disrupt air targeting of high value assets, conceal intentions and frustrate information collection. High-value targets will be intermixed with urban structures and deliberately masked by local non-combatants to further complicate our targeting abilities. Threats will possess communications and signature reduction technologies equal to ours to coordinate their activities and frustrate target acquisition. It will use technology-enhanced weapons for low altitude air defense. Army aviation will face weapons with increased precision and ranges, advanced warheads, active and passive protection systems, improved signature management capabilities, directed energy weapons, and night vision capabilities, all of which are now available on the world's arms markets. The physical environment (including space, air, water, difficult terrain sets, subterranean areas, local populations, fabricated structures, weather, light, natural and manufactured hazards, and health threats) and adaptive learning of opponents' in the future operational environment also creates a challenge for aviation operations.

j. The major threat to Army aviation will remain MANPADS, light AAA, small arms, and crew served weapons potentially supported by a “networked” fires capability. However, there are risks that pertain specifically to Army aviation operations.

(1) MANPADS, towed and self-propelled anti-aircraft guns are generally tied to threat-maneuver forces during offensive/defensive operations, and therefore, may be templatable. Threat anti-aircraft systems, air defense radars, and SAM launcher systems are generally deployed forward, in expanded, security zones along air-avenues of approach to deny standoff from threat forces and high-value targets; and therefore, will not be generally “templatable.”

(2) Air defense will be offensive in nature rather than defensive. The enemy will make maximum use of air defense ambushes.

(3) Air defense systems may not be positioned in traditional locations with long, open fields of fire, but rather on the reverse slopes of hills oriented to fire into the rear of an air platform, or along restricted (keyhole) fields of fire.

(4) Adversaries will make optimal use stealth, defilade, camouflaged, and concealment for systems and troops.

(5) Adversary massed formations of troops and equipment will be the exception, rather than the rule. Aviation must go against small, fleeting targets of opportunity, or small sections of dug-in, high-value systems, which creates additional risks for aviation assets.

(6) Adversary weapons will be a mix of old, modified old, and state of the art technology.

(7) The tactical fighter threat to helicopters is moderate. Enemy aircraft with look-down, shoot down radar are able to detect and engage flying targets. However, there is no indication of potential threat countries training their pilots to engage helicopters, nor is there any indication of tactical fighters or interceptors being used for low-level air defense.

k. Army aviation must survive through a combination of SA and SU, speed, stealth, standoff, agility, improved ISR, improved sensor-shooter linkage, passive and active aircraft survivability features, and competent and capable leadership.

### **2-3. Joint Interdependence**

a. The synchronized employment of land, air, sea, space, and special operations forces provides the commander with the widest range of strategic, operational, and tactical options. The Army achieves joint interdependence through the deliberate reliance on the capabilities of each Service to maximize its own effectiveness, while minimizing its vulnerabilities. Key joint interdependencies include joint battle command; joint force projection; joint air and missile defense; joint sustainment; and joint fires and effects. The Army’s capstone, operational and functional concepts recognize and address each of these dependencies.

b. Army Aviation operations are joint in nature. It is clear that the Army will depend on an array of capabilities that must be provided from other Services and the larger joint community to maximize effectiveness while minimizing service vulnerabilities. It is critical that the subject-matter expertise, roles, and unique capabilities each Service and agency provides be leveraged in the conduct of future Modular Force operations.

c. Aviation is an adaptive, multifunctional force integral to all aspects of land campaign operations, from early-entry to shaping, to decisive, to transition and sustainment operations across the spectrum of conflict. The joint and Army concepts call for strategic response and decisive action at all points on the spectrum of conflict. Missions range from stability and support operations to major combat operations, against any threat, in any assigned area of operation. Fully integrated and synchronized aviation operations are only possible through the complementary and collaborative efforts of the joint and Army forces.

#### **2-4. The Central Idea**

The joint and Army concepts recognize that to be faster, more lethal and nonlethal, more precise, and more effective than today; the U.S. must continue to invest in and develop new military capabilities. To enable these concepts, aviation will contribute through the new concepts of operations as described in this chapter. Army aviation is organized into multifunctional brigades that are expandable and tailorable to the mission, with various numbers and types of units. Aviation can move by strategic airlift, sealift, or self-deployment to support future Modular Force missions across the full spectrum of operations.

#### **2-5. The Plan**

a. Army operations within a joint campaign framework. The joint force will conduct a phased campaign to achieve assigned objectives. The phases, as elements of the joint campaign, can be inferred from the current joint operations concept and major combat operations JOC. Joint Publication 3-0 specifies six phases: shape, deter, seize the initiative, dominate, stabilize, and enable civil authority. U.S. Army Training and Doctrine Command (TRADOC) Pam 525-3-0, describes the following four phases: prepare and posture, shape and enter, conduct decisive operations, and transition. The Army future Modular Force will conduct operations fully integrated within the joint operational or campaign framework across the spectrum of conflict. Army operations will enable the joint force commander to seize the initiative early, transition rapidly to decisive operations, and sustain operations to achieve strategic objectives and maintain stability thereafter. Within the context of the joint campaign framework, the future Modular Force will apply adaptive combinations of seven key operational ideas: shaping and entry operations, operational maneuver from strategic distances, intratheater operational maneuver, decisive maneuver, concurrent and subsequent stability operations, distributed support and sustainment, and network-enabled battle command.

b. Vignette operational setting. The illustrative vignettes and narratives used in this CCP are built upon aviation capabilities that support and enable the six Army functional concepts. Appendix C describes the aviation core and enabling missions. The influence of aviation capabilities in most cases are not confined to a single Army functional concept but often span across one or more of the functional concepts and multiple proponent areas of responsibility.



Each of the core and enabling operations are only represented on the most appropriate aviation concept of operation in the paragraphs below.

## 2-6. Aviation Move Concept of Operations

a. The Army *Move* functional concept key ideas include: Prompt and sustained framework, prompt response, sustained response and operational agility, tactical movement and mobility, and relevance across the range of military operations.

### b. Supporting and Enabling Aviation Relevant *Move* Key Ideas through Aviation Capabilities

(1) Prompt response. Future modular aviation forces must be able to rapidly deploy and immediately employ in response to worldwide crises. New and innovative strategic air and sea lift assets will be required in order to meet the required deployment objectives of delivering a robust, brigade combat team (BCT) anywhere in the world within 4 to 7 days. Overcoming an aggressor's anti-access capabilities requires entry into areas of operations without reliance on conventional aerial and sea ports of debarkation (APODs and SPODs), where denial efforts will be focused. In order to help defeat anti-access or area denial, aviation task forces will deploy with the maneuver brigades. The remainder of combat aviation brigades (CAB) of the division and theater aviation command (TAC) assets must follow closely in the deployment sequence or be embedded with the deploying force. Once air and missile defense and security from conventional and unconventional ground threats can be ensured, use of developed ports and airfields can enhance deployment of later arriving aviation forces. U.S. military response will be far more effective if the units do not require extended reception, staging, onward movement, and integration (RSOI) and are immediately employable. Prompt response also applies to support for humanitarian crisis, reinforcement in civil disturbances, domestic relief, major disasters, and homeland security.

(a) Self-deployment from strategic distances. Heavy lift vertical take off and landing (HLVTOL), joint cargo aircraft (JCA) and future utility aircraft (FUA) capabilities will provide the future modular aviation force an organic limited capability to self-deploy from strategic distances. The HLVTOL will support the early deployment of aviation forces through its ability to self deploy up to 2100 nautical miles. The JCA and future utility aircraft have a requirement for self deployment ranges of 2400 nautical miles. Achieving these self deployment capabilities is dependent on the development of significantly improved fuel efficiencies by Army aviation advanced aircraft. Aviation unit design must also continue to incorporate increased modularity to achieve greater strategic deployability. Sustained, uninterrupted movement of aviation forces will continue to rely on air and sealift capabilities for strategic deployment.

(b) Self-deployment from operational distances. Future Modular Force aviation units must be capable of self-deploying from intermediate staging bases or conducting increased seabased operations to achieve rapid in-theater employment. Aviation units must have enough inherent self-sufficiency to conduct initial tactical operations without augmentation, and the organic ability to exploit the full range of joint enablers from information to standoff fires. It is imperative that aviation task forces self deploying to support the maneuver brigade arrive

simultaneously, ready for immediate employment. Embedded en route mission planning and rehearsal (EMPRS) packages will permit deploying forces to build SU while in transit and refine plans for immediate operations upon arrival. This approach will further accelerate simultaneous force flow, sharply enhance strategic and operational agility, help deceive the enemy, and reduce his ability to deny access.

(c) Air transportability. Aviation modules, based on required capabilities, will be planned and integrated into the maneuver force deployment flow. Modularity designs provide the flexibility to package the right size force with all required maintenance and operational requirements (split-based operations) capable of sustaining units until the remainder of the brigade arrives. Army Aviation provides a capability to reduce deployment lift requirements when self-deployment meets mission requirements. Aviation units are organized in both functional and multifunctional pools to facilitate force tailoring to meet the demands of ground force commanders and to enable operational maneuver from strategic distances. Aviation must be transportable by inter- and intratheater land, sea vessel and airlift anywhere in the world; be more deployable with reduced deployment tonnage; and be transportable by the Air Force cargo airplane, C130-profile aircraft with essential combat load (especially aircraft that can not meet the operational or strategic self deployment distances).

(2) Sustained response and operational agility. Future operations will require a greater reliance on operational maneuver and sustainment missions; thereby amplifying the requirement for organizations and systems with significantly increased range and endurance, and advanced lift platforms that can accommodate the transport of fully combat configured future platforms to operational depth.

(a) Intratheater operational maneuver. The future Modular Force must be capable of executing joint-enabled operational maneuver to extend the reach of the JFC, enabling him to respond to uncertainty, isolate portions of the battlefield, exploit success, and accomplish key campaign objectives. Operational maneuver repositions forces in depth for immediate operations, exposing the entire enemy area of operations (AO) to direct attack, separating enemy echelons, preventing massing and synchronization of combat power, and denying reinforcement and sustainment. Operational maneuver can also be focused on seizing key terrain and decisive points, and destroying key enemy forces and capabilities. A key capability of the future Modular Force will be the ability of aviation to conduct intratheater operational maneuver. For Army aviation, this means the ability to move medium weight mounted forces, combat-configured (with crew, ammunition, fuel and spares) ground combat systems, by vertical maneuver, to positions of advantage; enabling them to rapidly secure objectives and speed the conclusion of the campaign. This task entails the ability to operate routinely in and out of unprepared landing sites.

(b) The concept to achieve this required capability is a HLVTOL platform, which will be a rotary wing system possessing the required attributes. The dispersed and decentralized nature of the future battlefield will place great demands on these heavy lift assets. They will provide essential lift and capabilities to enable and support future Modular Force and the Future Combat System (FCS) operational concepts in joint and combined arms operations, particularly in the conduct of operational maneuver and vertical envelopment. Operational maneuver by air, via

heavy lift, requires the suppression or destruction of enemy air defenses and the security of landing areas. Operational maneuver by air will be most effective when supported by the rapid advance of ground-mobile forces to reduce risk, reinforce, expand and exploit the results of the air-based maneuver, and keep the adversary from isolating the air-delivered force.

(c) Intratheater operational sustainment and distribution. Army aviation (current and future aircraft) will perform crucial tasks in providing aerial sustainment support to the force as a whole, during SRO, MSO or to provide time sensitive and mission critical resupply. Future Modular Force operations will be sustained through a globally-networked, distribution based logistics system. Increased operational distances, non-secure LOCs and a noncontiguous operational environment will result in a greater reliance on aerial distribution platforms as a means of providing responsive and agile support from multiple locations within the theater. This, coupled with increased vertical maneuver support requirements to include preparedness for quick repositioning of inserted units, will likely result in increased aviation lift requirements. Future capabilities for Army aviation aircraft will include:

- JCA. The Army currently uses cargo helicopter, CH-47, to provide the majority of aerial movement of its time-sensitive/mission-critical supplies and personnel. While this accomplishes the tasks, it does so at high operating costs and with significant aircraft service life impacts. These logistical operations are costly, maintenance intensive and serve to reduce the availability of CH-47 aircraft for tactical missions. The JCA will be an integral part of the joint force and will assist the JFC in achieving full-spectrum dominance through the interdependent application of focused logistics. The JCA will enable the Army to meet its inherent core logistics functions by providing specialized tactical airlift of time-sensitive/mission-critical resupply to Army Forces across the non-linear battlefield, a critical capability for sustaining a high operational tempo (OPTEMPO). With dispersed forces operating at greater ranges in a noncontiguous operational environment, the range from the forward operating bases (FOB) to the maneuver units has extended beyond the logistical resupply range of the Army's rotary wing aircraft. The JCA will bypass the unsecured land lines of communication and deliver sustainment items directly to the unit or to forward supply bases. The JCA, with its extended range and speed, can meet the time sensitive/mission critical resupply needs of the future Modular Force. The JCA will easily cover these distances and free the rotary wing fleet for their primary tactical missions. The JCA will be initially stationed outside the JOA to help reduce the logistics burden within the JOA. Within the JOA, Army JCA will generally be located in the vicinity of selected Army sustainment brigades. Cargo will be delivered as far forward as feasible, either directly to the tactical maneuver units or the closest forward support base for further movement by Army rotary wing aircraft or ground transportation.
- HLVTOL. HLVTOL will provide inter-theater and intratheater aerial extension to the joint deployment, employment, and sustainment and distribution process; contributing to a fully integrated national-to-theater-to-tactical distribution system from early entry through conflict termination. By virtue of its long-range, high-speed, and large capacity; the HLVTOL will significantly expand current mounted maneuver, maneuver sustainment, distribution and resupply capabilities, and broaden

the future Modular Forces' capability to provide continuous, precise, assured provisioning of deployed forces in virtually any environment, guaranteeing their ability to generate, maintain and employ combat power throughout the campaign. In theater, it will be capable of moving mounted forces up to 250 nautical miles radius and to 500 nautical miles range, with vertical capability throughout the mission profile. These distances will increase with rolling take-off and landing.

(d) Seabasing. Seabasing will provide the capability to conduct shipboard operations from or through the joint sea base for early entry, personnel movement, or sustainment operations. This includes the ability to conduct vertical maneuver (mounted or dismounted) of forces from specifically configured seabased platforms to counter anti-access. The forcible entry capability such as, the afloat forward staging base concept, would provide a sea base for an air assault brigade combat team with an air assault brigade task force aboard a ship. The task force (TF) would be capable of projecting its combat power ashore directly from the ship. Seabasing will allow Army aviation to maintain a projection platform that can be globally deployed while limiting the effects of anti-access efforts within a theater of operations. Modification of future aircraft to support sea basing is required to fully realize the seabasing capability.

### (3) Tactical Movement

(a) Vertical maneuver. Vertical maneuver operations are used to quickly reposition dismounted or mounted forces, equipment, and munitions to positions of advantage. These operations assist in bypassing enemy strong points; in quickly overcoming restrictive, complex or difficult terrain; in supporting direct attack of key terrain, decisive points, centers of gravity and deception operations; and to keep the enemy off balance. These operations will be highly synchronized, yet distributed operations, moving units into positions where they can mass effects, without massing forces, and will be conducted during period of darkness whenever possible. Employing mission configured HLVTOL aircraft as mobile FARP assets, current vertical maneuver capabilities can be extended to operational depth while reducing risk to the force. Enhanced navigation systems will provide precise location accuracy for intelligence information, reporting accuracy, quick response to changes in mission, precise target handovers for engagement of targets, and use of civilian and military airway and precision approach structures. Mounted vertical maneuver may be an independent action but is normally conducted as a complementary part of a larger operational maneuver of multi-modal means in support of the JFC's mission. Aviation provides lift, aerial reconnaissance, AC2, and attack aircraft to support the air maneuver of dismounted or mounted elements of the brigade combat teams. The airborne C2 aircraft can be used by the air-ground commander to synchronize all phases of the vertical maneuver operations. Future Modular Force aviation brigades will air assault the dismounted combat elements and required support equipment of a battalion in one lift and provide air assault security. Similarly, mounted vertical maneuver requires the capability to lift mounted battalions, supplies, and crews to unimproved areas.

(b) Air movement. Air movement includes the transport of units, personnel, supplies, and equipment, including airdrops and air landings. Future Modular Force operations will be sustained through a globally networked, distribution based logistics system. Increased operational distances, non-secure LOCs and a noncontiguous operational environment will result in a greater reliance on aerial distribution platforms as a means of providing responsive and agile support from multiple locations within the theater. This, coupled with increased vertical maneuver support requirements to include preparedness for quick repositioning of inserted units, will result in increased aviation lift requirements. Also, aviation forces provide movement support for humanitarian crisis, reinforcement in civil disturbances, domestic relief, and major disasters.



Figure 2-1. Aviation Move Concept of Operations

(c) Concept vignette description: Figure 2-1 shows Army forces conducting deployment operations, joint forcible entry operations, operational maneuver, air movement, and vertical maneuver operations across the entire spectrum of military operations enabled by aviation. Aviation enhances the ground commander’s capability to sustain combat operations and maintain tactical and operational flexibility, and vertical maneuver operations occur during the period of darkness. In this illustration, Army rotary wing aircraft from the CAB (reinforced by the TAC) are moving elements of an air assault BCT<sup>1</sup> off the sea base to secure objectives between the APOD and SPOD. Attack and reconnaissance aircraft controlling extended range multi-purpose (ERMP) UAS (manned and unmanned (MUM) teaming<sup>2</sup>) scout air axis of advance and suppression of enemy air defenses (SEAD) assets prior to air assault aircraft flying the routes,

<sup>1</sup> Not a full BCT.

<sup>2</sup> The acronym MUM is only used when discussion teaming.

and provide escort and security for the main air assault force. After friendly forces land in the objective area, UAS remain on station to support the ground maneuver phase, conducting communications relay, reconnaissance and surveillance and/or target attack, while Army ground fires and joint aircraft in and around the objective area continue conducting SEAD.

Concurrently, FUA are transporting senior service chiefs and their staffs over strategic distances from the continental U.S. (CONUS) to the theater secured APOD.

d. The remainder of the aviation assets (CAB and TAC) move via strategic mobility assets to the APOD and SPOD. The arrival of HLVTOL aircraft (which have self-deployed to the theater) assist in moving bulk sustainment supplies from the seabase to the APOD or SPOD and directly to forward brigade support areas. JCA (which also self deployed from CONUS) and Army rotary wing aircraft are moving time-sensitive and mission-critical supplies to the forward BCTs and cross-leveling critical supplies between the brigade support areas. Fully combat configured future BCT elements (battalion size in one lift) are being quickly maneuvered within tactical striking distance of enemy forces by HLVTOL aircraft and followed by sustainment operations and dismounted elements carried by Army rotary wing aircraft. UAS remain on station to support the ground maneuver phase, conduct network extension, reconnaissance, surveillance, and target attack. Throughout the entire operation, airborne C2 aircraft are providing commanders with the capability to C2 the vertical maneuver operation from an airborne command post (CP). Aerial MEDEVAC accompanies the air assault task force and provides rapid aero-medical evacuation for the remaining ground forces. Finally, the network enables continuous information flow at all levels of command across the noncontiguous operational environment and provides SA and SU during the entire operation through the employment of UAS.

## **2-7. Aviation See Concept of Operations**

a. TRADOC Pam 525-2-1 ideas. The key ideas of the *See* functional concept are acquire, transform, provide, and data exploitation. Future modular aviation forces will play a major role in the overall collection plan making its primary contributions to the *See* operational concept through actions to gather and collect information as part of the acquire key idea.

b. Supporting and Enabling Aviation Relevant *See* Key Ideas through Aviation Capabilities

(1) Acquire consists of actions to gather, collect and fuse data. Aviation assets must fight for collection in many situations, constituting an operation against the enemy, in both the physical (for example, surveillance, and reconnaissance missions) and informational (for example, deception and counterintelligence) senses. Gathering on the other hand is uncontested by the enemy, and primarily involves readily available data. Data, information, and knowledge resulting from collection involve very little certainty and considerably more human analysis and estimation are required. Gathered data has a much higher confidence level, and requires less human intervention and analysis. Aviation will conduct reconnaissance and surveillance in order to collect information about the activities and resources of an enemy or to secure data concerning meteorological, hydrographic, or geographic characteristics. Future modular aviation force contributions to the gather function consist of the ability to gather and present the location, status and missions of all elements of the aviation force through blue force tracking (BFT) and

awareness, and through acquisition of flight, systems, parts data and information through the aircraft data exploitation capability (ADEC) concept. The self-knowledge provided through BFT is essential for the application of precise future Modular Force and joint strike capabilities. Given distributed and simultaneous operations, asymmetric threats, and complex physical environments, aviation cannot depend on today's painstaking and sometimes inaccurate process for identifying and clearing friendly units and noncombatant locations. The exploitation of available data from aircraft can improve readiness, training, safety, and operations.

(1) Reconnaissance. Aerial reconnaissance conducted primarily by aviation manned aircraft provides advanced capabilities to collect data on the enemy that is relevant to future Modular Force requirements. Future Modular Force aviation units must be capable of conducting aerial armed reconnaissance to produce actionable combat information. Combat information is a by-product of all operations, acquired as they are in progress. Reconnaissance, however, is a focused collection effort that produces actionable combat information. It is performed before and during other combat operations to provide information used by the commander to confirm or modify his concept. The operational outcome of the reconnaissance mission allows the follow-on forces to maneuver more freely and rapidly to its objectives. Reconnaissance allows the higher commander to keep other forces free from contact as long as possible and concentrated for the decisive engagement. Future Modular Force aviation units employing manned armed reconnaissance helicopters assist the maneuver commander to 'see first' with a man-in-the-loop decision maker well forward to provide proactive versus reactive decision making capability and fight for actionable combat information regarding dispositions of enemy forces and relevant terrain to permit friendly maneuver to positions of advantage. MUM teaming increases operational effectiveness, allowing UAS to assume the dangerous, dirty, and dull aviation roles while the decider placed forward integrates and fuses information on-scene and synchronizes the combat actions of the combined arms air-ground team. MUM teaming synergy allows manned platforms to focus on battlefield requirements while UAS add sensors, fires, and protection to the effort.

(2) Surveillance. Surveillance is performed by both manned and unmanned aviation in the course of mission execution. Long dwell, persistent surveillance in support of the commander's priority intelligence requirements is conducted primarily by unmanned aircraft operating either autonomously or teamed with manned aircraft. UAS assigned to Future modular aviation forces must be capable of systematically observing geographic areas, facilities, and mobile forces with the ability to observe specific named areas of interest (NAI) and target areas of interest (TAI) continuously or with persistent stare. These systems must be capable of ranging any point within the division AO and provide minimum 24-hour continuous observation in complex terrain. Level of interoperability (LOI) 3 and 4 control is required for MUM teaming, and the systems require the capability for air-ground teaming.<sup>3</sup> Sensor systems must be responsive and capable of being retasked dynamically in real time. They must provide a capability to perform wide area search to cue other sensors, conduct emitter mapping, electronic attack, meteorological survey, long endurance wide area surveillance, and wide band network extension.

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<sup>3</sup> See appendix B, UAS operations for more detail on LOIs 1 through 5.



Figure 2-2. Aviation See Concept of Operations

c. Concept vignette description (see fig 2-2). Joint forces conduct reconnaissance and surveillance operations across the entire spectrum of military operations to development of the COP. In this illustration, attack helicopters ((AH)-64s) conduct an aerial screen as part of a security operation. The attack aircrews are provided LOI 3 and 4 control of an ERMP UAS that has been launched and handed over to them by a ground control station (GCS). Armed reconnaissance helicopters (ARH-70) are also teaming with ERMP UAS in the conduct of a reconnaissance mission to determine the dispositions of enemy forces and provide early warning, reaction time and maneuver space to the main body. Advanced sensors on board both the manned and the unmanned aircraft provide increased resolution and standoff range. An aviation airborne C2 aircraft is coordinating receipt of imagery from joint sensors to provide to the supported tactical operations center (TOC) for distribution to other elements as necessary. Elements of the CAB are organized into a task force containing AH-64s, utility helicopters ((UH)-60s) and ERMP UAS to conduct insertion and extraction operations in support of the battlefield surveillance brigade (BFSB) long range surveillance detachment (LRSD). Aerial platforms at altitude for extended (longer than traditional aviation assets) periods of time provide persistent wide area surveillance to conduct missions such as but not limited to: ISR; network extension; counter-rocket, artillery, and mortar (C-RAM); air and missile defense support, including SA and SU engagement support; force and convoy protection; base security; meteorological monitoring; and chemical, biological, radiological, and nuclear (CBRN) monitoring. The airborne intelligence system conducts airborne signals intelligence, imagery intelligence and measurement and signatures intelligence gathering throughout the spectrum of military operations and collaterally, to provide joint and theater commanders with an accurate



and reliable integrated operational environment picture. All aviation elements provide continuous position location reporting through BFT to aid in providing near real time shared SA that enables strike and other operations conducted by joint forces and the CAB. ERMP UAS are launched by the CAB and control is handed over to an ERMP GCS collocated with the BFSB to systematically observe geographic areas, facilities, and mobile forces with the ability to provide ‘persistent stare’ of specific NAI and TAI in support of the division commanders critical information requirements.

## **2-8. Aviation Strike Concept of Operations**

a. TRADOC Pam 525-3-4 key ideas include providing continuous integration and employment of networked Strike from strategic to tactical levels, providing seamless integration of lethal and nonlethal fires, attacking all target types in all environments and terrains with unprecedented effectiveness, maintain routine access to space capabilities, and guarantee responsiveness and scaled lethality through joint interdependence.

b. Supporting and Enabling Relevant Aviation *Strike* Key Ideas through Aviation Capabilities

(1) Provide continuous integration and employment of networked Strike from strategic to tactical levels. Future Modular Force aviation must have direct access to Army and joint fire delivery systems from external sources to provide extended range, networked, responsive precision or volume fires on demand in support of tactical maneuver and be able to provide and/or integrate close air support (CAS) on demand. Aviation brigades may accept other branch enablers and maneuver elements when required by mission, enemy, terrain and weather, troops available, time available, and civil considerations (METT-TC). For example, during the conduct of an interdiction attack the aviation brigade will normally have operational control (OPCON) of, or direct support from, long range fire assets of the fires brigade. Aviation force commanders will exploit the network-enabled battle command to lead from forward locations where they are needed in order to influence the outcome of battles. Technologies such as terrain evaluation and problem solving and decisionmaking tools will enable them to perform their roles during tactical operations. Leaders and staffs will conduct continuous ‘running’ estimates of the situation while on the move collaboratively and through an integrated COP that enables early understanding of threat actions and intentions. The COP provides critical combat information (enemy, terrain, and weather, noncombatant and friendly) tailored to unit mission, task, and purpose. When used in combination with a dynamically updated COP, battle command tools will enable leaders to move from one tactical engagement to the next with an integrated ISR, fire, and maneuver plan ready to support, control, distribute, and prioritize fires. Future Modular Force aviation forces must have continuous access to the global information grid (GIG). They must also be networked with external ISR assets and have direct access to the full array of line of sight (LOS), beyond line of sight (BLOS) and non line of sight (NLOS) fires, joint and Army, with sensor-to-shooter links that receive fire support in seconds.

(2) Provide seamless integration of lethal or nonlethal fires. Future Modular Force aviation must have the capability to conduct responsive lethal and nonlethal SEAD and ability for integration with joint assets for joint SEAD to increase mission success. The future modular

aviation weapons suite must include designs that overmatch projected enemy capabilities in the areas of range, probability hit, and probability of kill, LOS and BLOS, with scalable lethal, nonlethal kinetic energy, chemical energy, and directed energy effects.

(3) Attack all target types in all environments and terrains with unprecedented effectiveness. Aviation forces provide significant mobility and targeting sensor advantages, along with organic precision fires capability, and a man in the loop (MITL) decider forward in the operational environment to coordinate delivery of fires against high payoff, fleeting targets. Manned platforms teamed with UAS can place large areas of complex terrain under observation; exploiting third dimension perspective to help defeat enemy camouflage, concealment, and deception efforts. Army rotary wing and UAS contribute to the theater air and missile defense mission by conducting offensive counterair attack operations against surface targets such as missile launch sites, airfields, naval vessels, command and control nodes, munitions stockpiles, and supporting infrastructure.

(a) Achieve near real time SA for strike employment. Future Modular Force aviation units must be capable of reliable and routine access to a continuously updated collaborative information environment, and be capable of routinely teaming manned with unmanned platforms that can provide intelligence and targeting information as well as battle damage assessment (BDA). Aviation units assist the ground commander in gaining and maintaining dominant SU continuously throughout an operation. Aviation units require the capability for immediate, secure, automated query of blue force position updates to prevent fratricide when conducting air-to-ground strikes in close proximity to friendly ground forces.

(b) Eliminate response gaps between organic and other available Strike capabilities. Aviation forces contained in the CAB operate as maneuver elements in support of air-ground operations. The bulk of combat power of Army aviation resides in the CAB, which is normally employed by a tactical division. Aviation brigades are tailored to support the operational and tactical aviation mission tasks at each echelon- maneuver brigade, division, corps, theater, joint TF or multinational headquarters (HQ). Army aviation attack and reconnaissance helicopters constitute its primary strike assets. These aircraft essentially operate in the ground regime and their capabilities are optimized for support of ground operations. FCS equipped BCTs will have an organic reconnaissance, surveillance, and target acquisition squadron to conduct reconnaissance and security missions and decisive integrated air-ground operations. While aviation assets are not organic to future Modular Force BCTs, the BCTs are assigned a brigade aviation element (BAE). The BAE is a planning and coordination cell whose major function is to incorporate aviation into the ground commander's scheme of maneuver. The BAE focuses on providing employment advice and initial planning for aviation missions, UAS employment, airspace planning and coordination, and airspace management and airspace deconfliction and synchronization with the air liaison officer, the fire support coordinator, and the BCT air defense coordinator in the air defense airspace management (ADAM) cell. The BAE also coordinates directly with the CAB or the supporting aviation TF for detailed mission planning. The BAE creates a relationship for aviation support by providing close coordination and planning to eliminate response gaps.

(c) Deliver immediate, precision, or sustained fires. Future Modular Force aviation units routinely conduct air-ground operations integrated with the ground scheme of maneuver and coordinated through habitual relationships. Army aviation manned platforms provide immediately responsive, precision and area fires during close combat attacks in direct support of ground forces as well as long range precision fires during interdiction attacks to support shaping operations. ERMP UAS also provide precision air-to-surface fires. Aviation forces must have the capability to detect, identify, and affiliate friendly and enemy forces to include target identification through both cooperative and non-cooperative means. Key enablers include LOS and BLOS on-board fires, including guns, precision rocketry, and improved missiles, as well as networked links to other joint and Army fires.

(4) Maintain routine access to space capabilities. Future Modular Force aviation systems are equipped with on board embedded global positioning system with inertial navigation systems to provide real time position location contributing to improved transfer alignment accuracy for on board precision munitions as well as improved target locating capability for both on board and off board fires. Aviation must have the capability to directly interface with space-based transport systems, and receive national intelligence broadcasts.

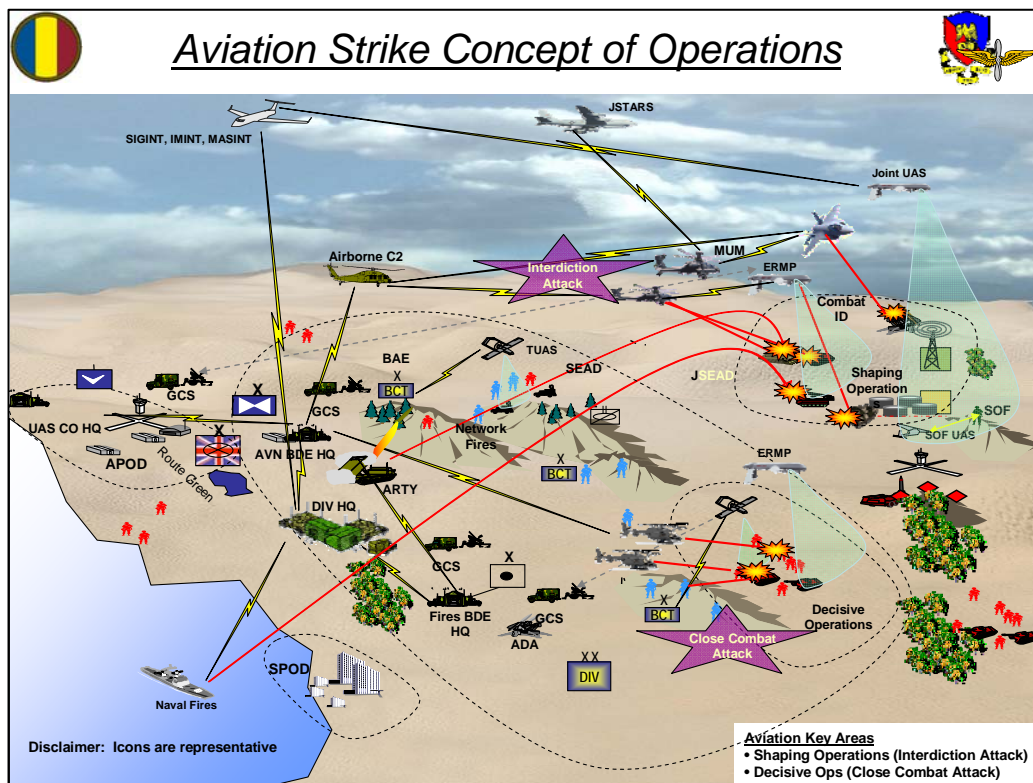


Figure 2-3. Aviation Strike Concept of Operations

c. Concept Vignette Description (see fig 2-3)

(1) The joint force commander must gain and maintain near real time SA, overcome enemy anti-access capabilities, shape the operational environment, seize and maintain the initiative, exert and maintain continuous pressure, and destroy, dislocate, or disintegrate an

adversary by lethal or nonlethal means. Aviation contributes to the division's fire support capabilities used to support the maneuver of subordinate brigades. Aviation conducts interdiction attacks that combine the mass effects of ground-based fires, attack aviation, and joint assets to isolate friendly forces as they maneuver out of contact. Aviation forces also conduct close combat attacks in integrated air-ground operations to close with and destroy the enemy through fire and maneuver. Aviation elements employ onboard and supporting fires in close proximity to ground forces and help to synchronize available reconnaissance, surveillance, fires (joint and Army), and maneuver against the enemy force, while integrating air and ground fires with maneuver to win the close fight.

(2) In this illustration, the CAB employs AH-64s teamed with ERMP UAS to conduct an interdiction attack as part of joint shaping operations. ERMP UAS are handed over from the GCS to the AH-64's, which exercise LOI 3 and 4 control of the airframe and sensors in a MUM teaming arrangement. The AH-64 crews, in coordination with staff elements aboard the airborne C2 aircraft, are synchronizing their own fires, Army and joint surface-to-surface fires, and attacks from joint CAS aircraft to destroy threat forces or capabilities. Combat identification is achieved through accurate and timely blue force situation awareness on aircraft displays, cooperative and non-cooperative target identification and doctrine, tactics, techniques, and procedures (TTP) and rules of engagement (ROE). SOF in the engagement area provide eyes on-the-ground intelligence and targeting guidance. Additional ERMP UAS launched by the CAB are handed over to an ERMP GCS collocated with the fires brigade to conduct air-to-surface strike missions. SOF in the engagement area provide eyes on-the-ground intelligence and targeting guidance.

(3) In a simultaneous operation, ARH-70s participate in an integrated air-ground operation, conducting close combat attacks against enemy forces in support of the BCT's scheme of maneuver. Additional AH-64s, UH-60s, and ERMP UAS elements of the CAB have been organized into an aviation TF assigned the mission of insertion and extraction of the LRSD. Elements of the TF remain in a standby status for the duration of the LRSD mission to support emergency extraction if necessary.

## **2-9. Aviation Battle Command Concept of Operations**

a. TRADOC Pam 525-3-3 key ideas include centrality of the commander, role of the commander, mission command, self-synchronizing forces, collaborative planning, accelerated and streamlined MDMP, decision (or information) superiority; central, critical, role of high SA, SU, and the COP, and single, integrated ABCS(s), joint capable to lower levels.

b. Supporting and Enabling Relevant Aviation *Battle Command* Key Ideas through Aviation Capabilities

(1) Centrality of the commander. The role of the aviation commander is vital in achieving understanding in any discussion of the function of battle command. Commanders drive the process to produce and execute effective decisions. However, they do not do this alone; they use their enabling C2 systems, staffs, and all the tools available defining and focusing them in the direction they desire. C2 tools and other capabilities the future Modular Force

aviation commander offer new and expanded capabilities to perform the essential functions of visualizing, describing, and directing forces under his command. The role of the staff and supporting technological aids is to provide the commander with a SU, SA, and a COP that assists in making decisions, issuing clear orders along with intent and end state, and conducting self-synchronizing operations during execution. Aviation commanders must stay abreast of changing situations in order to see the need to issue fragmentary orders and dynamically retask units. The commander must also decide when and where he needs to be on the battlefield to use his direct presence and personal influence. This battle command on the move (BCOTM) capability with seamless network connectivity must exist for both ground and air vehicles to allow the commander the capability to provide C2 while he moves throughout the AO. Lastly, all authority and responsibility of battle command rests exclusively with the commander.

(2) Role of the commander. The commander's role includes framing, planning, preparing, executing, assessing, and reframing operations. An extension of the idea of the commander's centrality is the roles he must play simultaneously. The aviation commander's task of leadership runs parallel to the continuous process of assessment. The process requires a continuous analysis in understanding, visualizing, describing, directing, assessing, and reframing operational problems. Aviation brigade and below commanders consider the factors of mission, enemy, terrain and weather, troops available, time available, and civil considerations to achieve the necessary level of understanding of existing conditions to identify and articulate the problem. The aviation commander must conduct this continuous analysis supported by his staff and C2 systems, while preparing, planning, and executing one or multiple operations simultaneously, and furthermore plan branches and sequels for the next operation or operations. At any given time, subordinate aviation units of the same command may be performing different operations processes and activities. For example, one or more aviation battalion task force size units may be engaged in offensive operations while other subordinate organizations are performing stability or humanitarian assistance operations. This is usually the norm rather than the exception.

(3) Mission command. Field Manual (FM) 6-0 establishes mission command as the C2 concept for the Army. It focuses on the premise that commanders exercise C2 over forces to accomplish missions. It emphasizes fundamentals and concepts rather than specific equipment or systems, although it discusses the role of equipment and systems in supporting C2. Mission command for aviation leaders at all levels permits disciplined initiative by subordinates within the commander's intent to accomplish missions and requires leaders capable of operating in a future Modular Force environment of uncertainty and ever changing operational conditions. It allows units to adjust to changing situations in the absence of orders; when they clearly understand the commander's intent, see the battlefield through a common operating picture enhanced by a network-enabled battle command system, providing collaborative planning capabilities, and accelerated decisionmaking processes.

(4) Self-synchronization. The ability of subordinate commanders to adjust without specific orders is derived from mission command. When a commander exercises subordinates' initiative, mutual trust gives other commanders at the same level the confidence to act to resynchronize their actions with those of the commander. Such actions bring the operation back into synchronization without requiring detailed instructions from higher echelons. All aviation operations are combined arms operations and require the capability to not only synchronize

organic forces but also joint assets, maneuver, fires, airspace, movement, and sustainment operations on the battlefield. Commanders achieve SA and SU by applying judgment to the COP. Doing this is neither simple nor automatic. The COP consists primarily of knowledge, which the staff provides through analysis and evaluation. Accurate, timely intelligence--a major category of this knowledge that the intelligence warfighting function produces--is indispensable to a complete COP and achieving accurate SU. Intelligence, supported by ISR synchronization is a critical integrated part of C2. Sharing of knowledge through the COP contributes to achieving a more complete, timely, and comprehensive shared SU. An accurate COP ensures the commander's SU and accurately reflects the actual situation.

(5) Collaborative planning; accelerated MDMP. The capability for aviation commanders and staffs to conduct collaborative planning in future Modular Force operations is essential for mission command. Aviation units will be dispersed across the depth and breadth of the AO, beyond line of sight, conducting; maneuver, maneuver support, and maneuver sustainment missions. Collaborative planning technologies assist in streamlining and speeding the MDMP while enabling commanders and staffs at all levels the ability to conduct planning and execution of missions with a COP while geographically separated, as will often be the case in a distributed operational environment. En route mission planning and rehearsal technologies can further enhance aviation MDMP and support commanders decisions during, prepare and posture and prior to shape and entry operations. Once the fight begins collaborative planning allows units to react to changing situations, dynamically retask and self synchronize forces, sensors, or both. As a part of Army transformation, each BCT and selected support brigade will have a BAE.

(6) Decision (or information) superiority plays a central, critical role in attaining high SA and SU and a common operating picture.

(a) Information sharing with future technological capabilities supports a shared SA and SU and promotes unity of effort. When used expeditiously, information can give aviation commanders a decisive edge over enemies by reducing decision cycles, improving combined arms coordination and synchronization. Aviation sensors, manned and unmanned, play a key role in obtaining critical information and assist in populating the COP. Battle command focuses on interoperability to generate desired effects through linking sensors, delivery systems, and effects across the unified action environment. Processing, fusing, and filtering information to make information useful to the aviation commander will be critical in wading through the plethora of available information on the future battlefield. Decision superiority in the air domain includes contributing to, and leveraging from, the objective single integrated air picture and exploitation of wide-band communications for data distribution.

(b) Knowledge of self. Future Modular Force aviation commanders need to operate in an environment that provides accurate knowledge of and the capability to see friendly forces on the battlefield. The communications suites, consisting of the enhanced position locating and reporting system, BFT, satellite communications (SATCOM) for BLOS capability and Link-16<sup>4</sup>, enables connectivity with Army and joint force and provides SU for the JFC. . Link 16 also provides positive identification self-reporting. These are imperative to eliminate fratricide and

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<sup>4</sup> Link 16 is an improved data link used to exchange near real time information. It is a communication, navigation, and identification system that supports information exchange between tactical command, control, communications, computers, and intelligence (C4I) systems

clear fires both air-to-surface and surface-to-surface, and provide airspace management for aviation operations, and to assist in synchronizing forces. An over the horizon sensor that will allow airspace SA, SU, and combat identification of friend and foe, and a communications capability with aircraft beyond line of sight, mounted on a near space or space based platform, is critical in future operational environment awareness and positive and procedural control of aircraft and fires. High tempo operations on a distributed battlefield will require aviation commanders to synchronize not only maneuver operations but also sustainment of self and other commands in the AO. Movement of logistics along air lines of communication is critical to force application of combat power. Furthermore, status factors such as aircraft maintenance, Soldier and aircrew member fatigue, supply, and overall condition of the aviation force along with confidence, morale, and welfare are critical to the commander and the command as knowledge of self.

(c) Knowledge of the environment. Aviation commanders have always had a keen sensitivity to terrain and meteorological factors that affect combat operations. However, in the future when weapons systems and platforms are operating at operational maneuver distances in an expanded operational environment, knowledge of over the horizon weather and terrain is essential. Human factors become critical in understanding the characteristics of the enemy, local population, cultural factors, the government, nongovernmental, and private volunteer organizations; what they are doing and when and where are they operating in the AO. Aviation commanders must ensure all the environmental factors are considered when conducting both lethal and nonlethal effects planning.

(d) Knowledge of the enemy. The aviation commander directs the actions of his forces and imposes his will on the enemy. Through command and control, he initiates actions, influences, and synchronizes the elements of combat power to impose his will on the situation and defeat the enemy. Once the fight starts, the commander must have the capability to express his intent, execute decisions, and adjust operations to reflect changing reality and enemy actions. A clear understanding of the enemy through a COP allows commanders to modify their personal visualization to account for changing circumstances and see first, understand first, act first, and finish decisively decreasing the options available to the enemy and creating or preserving options for their own forces. The intelligence information requirements about the enemy from supported units, the division and higher headquarters is paramount, and horizontal and vertical fusion must make the information useful to commanders in the understanding and execution against an intelligent and adaptive enemy.

(7) Single, integrated ABCS(s), joint capable to lower levels. Future Modular Force aviation commanders' expansive AO, noncontiguous environment and span of C2, requirements for an accelerated MDMP, continuous operations assessment and self-synchronizing requirements for battle command on the move mandate a ubiquitous, redundant and continuous network. The network requirements include but are not limited to seamless non-line of sight connectivity for voice and data communications; battle command; air and ground SA and SU, including combat identification of ground systems and forces; and contributing to and fully exploiting the integrated air picture (such as, the single integrated air picture) for airspace management and UAS control. The network must enable knowledge management through enhanced information management and dissemination capabilities that provide for the aviation

commanders' COP from the joint HQ to the platform level. The battle command system(s) must support net-centric military operations. The battle command system must be able to enter and be managed in the network, and exchange data in a secure manner to enhance mission effectiveness. The battle command system(s) must continuously provide survivable, interoperable, secure, and operationally effective information exchanges to enable a net-centric military capability. Lastly, the battle command system must be both backward and forward compatible to enable operations with non-modernized units, FCS, interagency and multinational groups and forces.

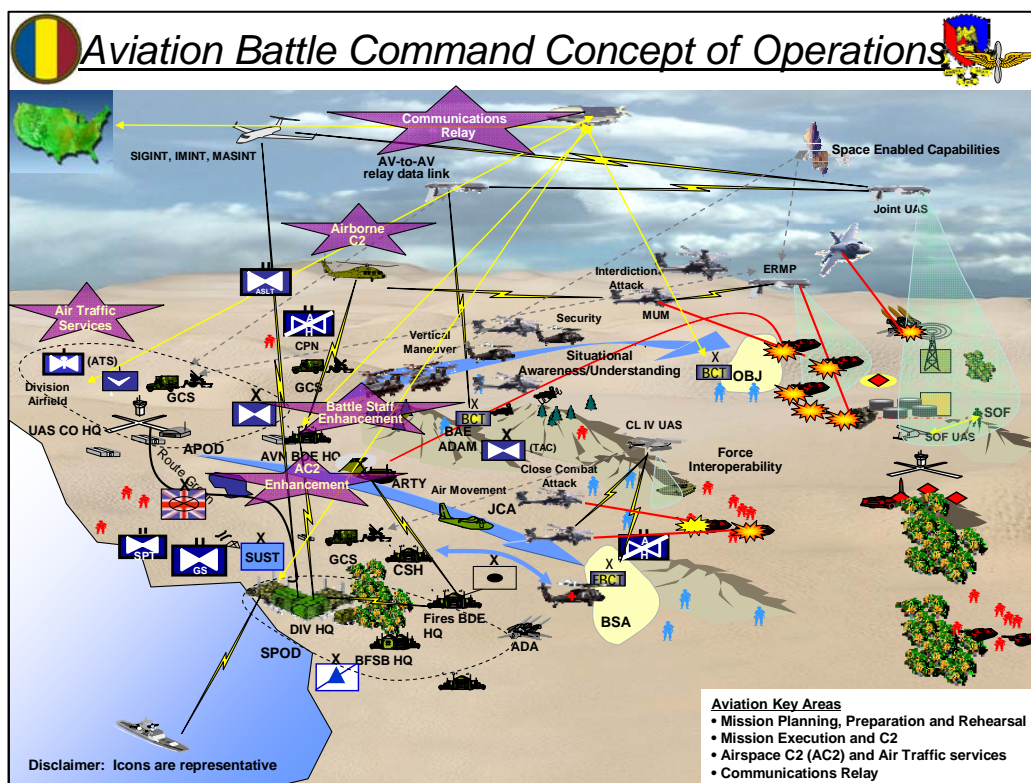


Figure 2-4. Battle Command Concept of Operations

c. Concept Vignette Description

(1) The TAC and CAB support the operations of the entire joint force with task organized aviation capabilities across the entire spectrum of military operations. The bulk of Army Aviation's combat power resides in the multi-functional CAB organized to support the division, the BCTs and support brigades. The TAC reinforces the division and provides theater support. The CAB collaborates directly with the division, supported brigades and subordinate battalions and companies for operational details of the support required. In figure 2-4, the aviation brigade requires continuous joint and Army network access to the brigade main command post, brigade tactical command post, air traffic services (ATS) company, UAS company, and every subordinate battalion. This provides the minimum capability for the aviation brigade to conduct C2 within a net-centric environment from the joint level to its subordinate commands and platforms. This illustration further depicts the ATS company operating the division's airfield and collocated with the UAS company. The aviation brigade main CP located in the division main area with the TAC CP further forward in the AO



supporting a BCT air assault operation with an assault and attack reconnaissance battalion task force. The aviation brigade commander can C2 the air assault from the TAC CP or the airborne C2 aircraft depending on METT-TC and his required presence on the battlefield. The aviation support battalion and general support aviation battalion (GSAB) are collocated in the division area with the operational level logistics command's (OLLC) sustainment brigade, assisting in receiving and distributing sustainment items throughout the division AO. Lastly, the aviation brigade's additional attack reconnaissance battalion is depicted under the operational control support relationship, to a BCT, providing close combat attack for a ground maneuver commander.

(2) Based on METT-TC, the aviation brigade commander task organizes available aviation resources into mission packages that are controlled either by a supported brigade or by the aviation brigade. The net-centric capability for future Modular Force aviation commanders' to enable C2 is illustrated with the various links required to connect not only C2 elements, but also force users at the first tactical mile.<sup>5</sup> Those warfighters at the "tip of the spear" will receive perhaps the greatest benefit from the net-centric operational environment as it vastly improves their decision-making capabilities across the full spectrum of military operations. ISR platforms (sensors) and weapon systems (shooters) also need to be networked. The goal is for the entire division and mission partners to have the technical connectivity and interoperability necessary to rapidly and dynamically share knowledge amongst decision-makers, communities of interest, and others, while protecting information from those who should not have it—all to facilitate the coherent application of action. The net-centric operational environment will translate information superiority into combat power by effectively linking (both horizontally and vertically) knowledgeable entities throughout the operational environment thus making possible dramatically new ways of operating and, by extension, decisive advantages in warfighting.

## 2-10. Aviation Protect Concept of Operations

a. TRADOC Pam 525-3-5 key ideas include Soldier protection, platform protection, unit protection, fixed, semi-fixed, and mobile protection, information protection, active protection, and multi-partner protection.

b. Supporting and Enabling Relevant Aviation *Protect* Key Ideas through Aviation Capabilities

(1) Soldier protection. The individual Soldier is the cornerstone that all other protection capabilities must support. The air warrior ensemble is an example of a Soldier protection system. Individuals will require different levels of protection based on the assigned mission and threat levels. For protection, all individual Soldiers will require advanced ballistic protection from small arms, indirect fire, improvised explosive devices (IEDs), and non-kinetic weapons for mounted and dismounted Soldiers. They will require modular body protection "kit" that allows the Soldier to remain mobile and physically flexible based on the Soldier's tactical mission; holistic, integrated protection of extremities and face (eyes and ears). They will also require uniforms and equipment that protect them from climatic conditions, fire, environmental effects,

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<sup>5</sup> The "first tactical mile" refers to the support, which the net-centric operational environment will provide to warfighters directly involved in executing the mission.

and CBRN weapons, to include non-military toxic industrial chemicals and materials; and integrated Soldier biological sensor system to monitor and diagnose wounds and injuries.

(2) Platform protection. Aircraft must be equipped with active and passive protection measures. These features must be considered in the design and production of all new aircraft. Survivability features work best and are more affordable if they are part of the aircraft design. Passive protection such as engine exhaust suppression, ballistic blankets, armored seats, and redundant systems are more effective when included in the aircraft design and are crucial in protecting the aircraft, aircrew, and passengers. Active protection systems, the other part of aircraft protection, should be balanced with the passive protection features. For example, efficient engine exhausts will require less active jam signals to defeat threat heat seeking weapons. Aviation weapon systems should be immune from most common electronic interference, “spoofers” or false target generators to ensure crew confidence and desired weapons accuracy and effectiveness. The Common Missile Warning System (CMWS) is an example of an active protection measure. Additionally, aircraft must have the ability to place accurate counterfire on the adversary through self-synchronizing knowledge systems executing cooperative engagement from mutually supporting assets. Other active and passive counter measures are discussed in chapter 4.

(3) Unit protection. Unit protection begins with the accumulative affect of protection of the individual Soldier and aircraft. The addition of knowledge systems, C2 systems, and tactics that detect and identify friendly and enemy forces and locations completes the unit protection capability. These systems will decrease incidents of fratricide, provide warning, and employ protective systems that counter enemy weapons and reduce the effects associated with these weapons. Protection must include protection from cyber attacks against friendly computers, networks and intelligence gathering systems.

(4) Fixed, semi-fixed, and mobile protection. Aviation supports mobile protection through security and interdiction attack operations (see app B). Aviation conducts screening missions to provide early warning and long range observation of air and ground threats. Aviation supports the guard mission by screening an exposed flank of the main body to prevent surprise enemy attack. During convoy operations, aviation conducts route reconnaissance ahead of the convoy, assists in route clearance and applies direct and indirect fire against enemy forces. Aviation can perform LOC security as part of convoy security or as a separate mission. While performing area security aviation has the capability to detect, neutralize, and defeat the enemy in a specified area. Interdiction attack combines ground based fires, attack aviation, unmanned systems, and joint assets to mass effects, in order to isolate and destroy key enemy forces and capabilities and to protect friendly forces as they maneuver out of contact.

(5) Information protection. Information protection is accomplished through comprehensive passive and active measures to achieve real time defense from threats. It provides defense against intercept, jamming, viruses, worms and other internal and external exploitation. Network protection includes intrusion detection and prevention, vulnerability assessment and monitoring, integrated security, net filtering, and a centralized management system to maximize network operating time and minimize the need for human involvement. Aircraft, ground platforms, and operations centers integrate and enforce the network protection

measures. Operators have a role managing and employing network protection measures. These measures ensure secure transmissions and delivery of information that can be acted on with confidence. Aviation mission planning and aircraft processors must incorporate these measures to protect aviation networks and information.

(6) Active Protection

(a) Active protection will use systems that detect and act against threats to Soldiers, platforms, and facilities and allow for unit mission accomplishment. Aircraft active protective measures should include a capability to detect, warn, engage, and defeat, anti-aircraft missiles by employing kinetic and non-kinetic defense systems that destroy the projectiles a safe distance from their intended targets and cause minimal secondary damage to Soldiers and equipment. Active protection should begin with the ability to destroy the threat before the threat is able to engage friendly personnel, units, or facilities. Lethal engagement not only provides self-protection but will provide protection for other aircraft and personnel. Additionally, the ability to detect with sensors, automatically warn, and engage enemy shooters with lethal and nonlethal weapons based on audio and visual detection, to include non line of sight situations, may prevent first or subsequent attacks. Aviation supports this key area by performing security operations (screen, guard, convoy security, LOC security, and area security).

(b) Aviation sensors provide the ability to sense during all sensing conditions (weather and visibility). This is crucial for the safe operation of aircraft but is just as crucial for protection of personnel and equipment while on the ground. Whether in flight or during ground security operations, the ability to shoot first and kill first is a major tenet of protection. Survivability of future Modular Force aviation units improves significantly as capabilities increase in the areas of all terrain, all weather tactical mission support. Aircraft platform enhancements give the JFC greater potential to exploit the vertical dimension and protect aviation assets operating in close proximity to enemy forces. Aircraft equipped with the capability to conduct safe operations in degraded visual environment (DVE) and complex and urban terrain will not be restricted by these difficult terrain conditions. Assault aircraft will plan and execute vertical maneuver (multi-ship missions at night) missions to tactical landing zones (LZ) at night that provide the greatest maneuver support to the JFC. These formations will be unhindered in their LZ selection as they will be able to safely land as a flight in totally obscured conditions. Attack and reconnaissance aircraft crews will have enhanced SA and survivability capabilities that will allow them to operate over complex and urban terrain engaging the enemy at will without fear of collision with wires, towers, or other obstructions.

(c) UAS are crucial to future protection capabilities. Unmanned systems will decrease the risk to the individual Soldier and provide the capability for standoff threat detection and neutralization but at the same time, unmanned systems require some of the same protection as manned systems, including assured means of self-identification to minimize risk of fratricide and enable operations in friendly defended airspace.

(d) Aviation provides C2 platforms for ground and vertical maneuver. The C2 platform allows the ground commander to control operations from a mobile platform, and receive and

pass data through joint assets. For mounted vertical maneuver, the ground or air commander can control operations.

(e) Aviation enhances the commander's ability to seize the initiative and take an offensive stance using the ability to detect and strike an adversary with precision and non-precision weapons from multiple platforms through cooperative engagement and from outside of the enemy's weapons capability. The ERMP UAS, AH-64, and ARH-70 give the commander long range eyes and ears and a quick reaction force capability.

(7) Multi-partner protection. En route to the JOA, the Army may initially rely on the other services to protect the air and sea lanes. The joint maritime air support concept is the simultaneous use of joint air and naval surface combatants to protect afloat logistics force (Army, U.S. Air Force and Marine) while transiting chokepoints. Due to the increased threat of small attack watercraft to support type vessels in areas close to shore and in constricted water passages, Army aviation may be tasked to provide support upon arrival into the JOA. Additionally, UAS support will be an intricate piece of the ground maneuver plan and could be expected to begin operations prior to the arrival of other Army aviation assets. Finally, the protection of the domestic critical military and civil infrastructure and the defense industrial base to support military operations, as well as the need to protect the American populace and their way of life will require interdependent protection from military and civil organizations. Army National Guard security and surveillance squadrons will provide critical security and play a key role in a domestic crisis. Army aviation assets in general will play a role in homeland defense within the limits of current laws and ROE.



Figure 2-5. Protect Concept of Operations

c. Concept vignette description. Joint forces have deployed to the JOA. Army aviation enhances the ground commander’s capability to sustain combat operations and maintain tactical and operational flexibility. Aviation forces enable maneuver by providing reconnaissance, surveillance, and security. In figure 2-5, Army attack aircraft from the seabase and Naval fire assets destroy small enemy watercraft to protect forces as they proceed to the SPOD. Army Aviation provides area security; supporting APODs FOBs by providing persistent stare and quick reaction capabilities. Attack assets are focused on close combat but are still able to shape the area of operations. Army UAS and rotary wing aircraft are performing screening operations to provide early warning, reaction time, maneuver space, and protection to air-ground movement and maneuver. AH-64 aircraft controlling UAS are performing the guard mission in front of the main ground force. Aviation units will frequently be called upon to provide traditional security operations such as screen and guard to ensure freedom of movement of the ground maneuver force. During early entry operations, aviation units as part of the air-ground team conduct reconnaissance to fill information voids and conduct security operations to provide early warning and protection from unexpected enemy movements. On the noncontiguous battlefield, aviation units will conduct screening operations in the intervening space outside the operational area of the BCT, or between the operational areas of two or more divisions or joint components. As the ground commander maneuvers units out of contact to positions of advantage, aviation units are conducting security operations to ensure maneuver units remain out of contact until the time and place of the commanders choosing. Army manned and unmanned aircraft also provide infrastructure, LOCs, and convoy security. The division commander has the ability to engage targets using UAS (joint and Army), rotary wing, and artillery assets. If the commander decides to use vertical maneuver against a high value target, aviation assets will provide escort and

security. The maneuver force is shielded throughout the operational environment with freedom of maneuver and enabled by “see first” imperative and seamless network access to conduct decisive operations in both contiguous and noncontiguous environments.

## **2-11. Aviation Sustain Concept of Operations**

a. TRADOC Pam 525-4-1 key ideas include a single joint capable network-enabled logistics system; high-speed, precision, accuracy, visibility, and centralized supply chain management with minimum essential forward stockage. It includes reachback capabilities; interdependent, capabilities based, modular, network-enabled organizations with increased commonality of equipment and organizational designs; highly mobile systems, advanced distribution platforms, precision delivery systems and state-of-the-art C2; and continuous support through global integrated management and sourcing of Army, joint, and combined partnerships.

b. Supporting and Enabling Relevant Aviation *Sustain* Key Ideas through Aviation Capabilities

(1) High-speed, precision, accuracy, visibility, and centralized supply chain management with minimum essential forward stockage and reachback capabilities.

(a) Aviation logistics organizations of the future must be tailorable, modular in design, rapidly deployable, and highly mobile. Total asset visibility (TAV) and capability to perform simultaneous operations and automated logistical functions will enable aviation support organizations to adequately support all Army aviation units, manned and unmanned. Diagnostic and prognostic test equipment, man-portable computer systems, and logistics information systems will be standardized, integrated, and securable. These systems will be linked horizontally across the organization and vertically throughout the maneuver sustainment community. Component modularization will decrease maintenance manpower requirements and repair times while increasing aircraft availability. Innovations in aviation technology will produce both manned and unmanned aircraft with greater functionality and reliability. Using integrated, diagnostic test equipment and automated information systems, embedded technologies will provide real time aircraft status information. Two level maintenance support concept is the goal for the future Modular Force, and will be implemented as the aviation fleet is modernized with aircraft designed for two level maintenance support. The transition will be gradual and will require operation of both two and three level systems for some time.

(b) The far-term goals for aviation logistics and maintenance equipment include intelligent diagnostics and prognostics, able to detect system failures prior to occurrence (using on-board collection systems) and automatically transmit aircraft systems data to maneuver sustainment units, maintenance facilities, and FARP personnel. This information will shorten the lead-time necessary for maintenance resupply, refit, and refurbishment, and will optimize the scheduling of maintenance actions with minimal impact on aircraft readiness. The following technological automation will be enablers to future Modular Force sustainment logistical operations.

(c) ADEC will exploit available platform data to improve operational readiness, training, safety, and operations. Initially ADEC will be introduced in increments, from initial capability (limited by current onboard data collectors and the Standard Army Multicommand Management Information Systems) to a fully integrated capability. It will provide a wide range of diagnostics, prognostics, trend analysis, causality assessments, norm deviation warnings, and other data correlation across the realms of safety, operations, training, and maintenance--from the individual aircrew member and maintainer, through unit level, to Army enterprise levels. ADEC encompasses the concepts of military flight operations quality assurance (MFOQA) and condition based maintenance (CBM). MFOQA will process flight information, achieved through digital data download from the aircraft, and analyze the data. The fully integrated MFOQA capability will provide diagnostics and prognostics to enhance safety, training, maintenance, and operations at company, battalion, brigade, and echelons above brigade. It will leverage existing and planned information systems for transport of data from the unit to enterprise level. It will provide computer based tools at unit level to enhance safety, training, maintenance, and operations. These will include animation products that will allow visualization and playback of flight data; analysis tools to assess trends and deviations in aircraft and aircrew performance; automated data entry devices to enable single-input, multiple use of key information; and a web portal that allows single point of entry, review and manipulation of information. It will also provide enterprise level data warehouses to enable fleet-wide and historical trending analysis.

(d) CBM is a set of maintenance processes and capabilities derived from near real time assessment of the aviation platform and its weapon system's condition obtained from embedded sensors and other decision support systems. Self-sensing and self-reporting aviation platforms will provide maintainers actionable information to prevent functional failure or to avoid the consequences of functional failure. The Army aviation vision for CBM is to establish enterprise-wide predictive maintenance and sense and respond logistics capability by developing information exchange requirements for the Army integrated logistics architecture and connecting self-reporting and self-diagnosing platforms to the logistics enterprise to improve operational availability, mission capability, and combat power while reducing the logistics footprint. At the strategic level, CBM is a set of maintenance actions based on real time or near real time assessment of equipment status, obtained from embedded sensors and external measurements or tests performed by man-portable equipment. Data collected from health usage monitoring system or man-portable equipment is then translated into predictive trends and metrics, which are capable of anticipating when component failures will occur based on actual operating environment. The predictive approach allows for the proactive acquisition and delivery of requisite spare parts to perform maintenance, prior to component failure. It also allows for adjustment of scheduled maintenance tasks based on actual equipment condition. At the operational and tactical level, CBM has the ability to translate aircraft condition data and usage into proactive maintenance actions that enable unit maintenance personnel to achieve and maintain higher aircraft operational availability

(e) The common logistics operating environment (CLOE) is a process to achieve the Army's vision for developing a technology-enabled force equipped with self-diagnosing equipment platforms that interact with a network sustainment infrastructure that supports condition-based maintenance. CLOE sets common data standards, specifications, and protocols necessary to integrate platform, information, and command, control, and communications

technologies for use in the future Modular Force logistics sustainment. CLOE capabilities represent a unique blend of embedded command, control and communications interfaces and equipment configurations designed to integrate platform-level equipment and consumable status information with the Army's logistics enterprise environment; therefore it is termed an "operating environment" even though it is not in itself an information system. The CLOE operating environment extends to all equipment platforms used in the future Modular Force, including ground combat, ground support, aviation, and watercraft.

(f) TASMIC. Aviation classification repair activity depots (AVCRADs) currently provide limited depot level aviation logistics and maintenance functions in support of the National Maintenance Program (NMP) as a land based component. The current AVCRAD table of distribution and allowances (TDA) is designed without the tactical vehicles and communications equipment or the personnel to sustain this equipment required of a Theater level sustainment organization. The combination of a trained, manned, and equipped theater aviation sustainment maintenance group (TASMG) employed using a containerized TASMIC is capable of providing the combatant commander with a tailorable aircraft depot maintenance capability. The TASMIC enables continuous logistics support and improves aircraft operational readiness by conducting sustainment maintenance forward and reducing the logistics tail. Additionally the TASMIC vessel provides dedicated deployment prioritization with no impact on other strategic lift assets. The TASMIC will provide limited maintenance capability, supply and ancillary support (ground support equipment, life support equipment, oil analysis) for the repair of components in support of the NMP while sea or land based.

(g) MEDEVAC and casualty evacuation (CASEVAC). Aeromedical evacuation will conduct timely and efficient movement of the wounded, injured, or ill, on medical equipped aircraft, while providing en route medical care to and between medical treatment facilities. Aeromedical evacuation also provides air crash rescue support, (less fire suppression), in combat search and rescue, the rapid delivery of whole blood, biologicals, and medical supplies to meet critical requirement. It also provides rapid movement of medical personnel and their accompanying equipment and supplies in response to mass casualty, reinforcement and reconstitution, or emergencies; and movement of patients between medical treatment facilities, airheads, and or ships. Aerial CASEVAC is the movement of casualties aboard non-medical aircraft.

(2) Interdependent, capabilities based, modular, network-enabled organizations with increased commonality of equipment and organizational designs.

(a) Future Modular Force logistics supports land component forces across the full spectrum of military operations under all environmental conditions. Sustainment under future Modular Force logistics generates and maintains combat power by allowing the commander to mass effects across the full spectrum of operations. At the operational level, sustainment operations focus on preparing for the next phase of the campaign or major operation. At the tactical level, sustaining operations determine the staying power of Army forces and operational reach.



(b) OLLC. The OLLC is the senior Army logistic headquarters, regionally focused, globally employable. It may project a forward presence as needed. The OLLC provides single Army logistics C2 in theater, simultaneously providing full spectrum support through its assigned sustainment brigades and other units attached or OPCON. The OLLC provides sustainment, as well as capabilities for theater opening, and theater distribution. An Army field support brigade will be OPCON to each OLLC to maintain national level support linkages to the Army Materiel Command, Army sustainment command, as well as to the Assistant Secretary of the Army for Acquisition Technology and Logistics Technology, program managers, and program executive offices. TAC assets will most likely be in direct support or OPCON to the OLLC for theater aerial distribution of supplies.

(c) Future Modular Force aviation sustainment organizations must be designed to place the right maintenance resources at the right location and accept modular “plugs” of both military and civilian personnel to meet workload surges. Aviation logistics organizations will primarily consist of the aviation support battalion (ASB) with each CAB and theater level aviation brigade and an aviation maintenance company (AMC) and forward support company (FSC) with each operational aviation battalion (except for the fixed wing battalion). Fixed wing aircraft maintenance will be conducted by contract.

(d) The ASB consists of four companies; the headquarters company, the distribution company, the aviation support company (ASC) and the signal company. Collectively they form the framework for aviation sustainment in the future Modular Force. The ASB can support split-based operations from two locations with a less-capable capacity at one location. The ASB can provide backup support to the AMC or task force and intermediate maintenance. The ASB carries the sustainment stocks that exceed the organic carrying capability of the brigade’s three days of requirements for mid to high intensity operations or seven days of requirements for low intensity operations. It plans and coordinates the brigade’s sustainment requirements. The ASB executes replenishment operations in concert with the operational plan and the future Modular Force theater or division and coordinates with the subordinate FSCs. The ASB will provide critical sustainment status through a logistics COP to inform the commander of critical logistical issues.

(e) The AMC can provide equal maintenance support to each of the three assigned operational flight companies at different locations within a single theater for short durations. The company is also designed to provide tailored aviation field maintenance support and battle damage assessment and repair (BDAR) for assigned aircraft and UAS. Each AMC is tailored to support the type of aviation battalion in which it is assigned.

(f) The FSC is designed to provide support for ground, air, missile, and aviation ground support equipment (AGSE) systems, provide refueling and rearming support, provide necessary maneuver sustainment, and coordinate with the ASB for additional sustainment support. The distribution platoon has the capability for a 4-point FARP<sup>6</sup> for approximately every eight aircraft within the unit operations either massed simultaneously or in multiple locations. It has the capability to transport one and a half day’s fuel supply and ammunition with organic assets, and relies on the ASB’s distribution company for additional supplies and sustainment replenishment.

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<sup>6</sup> Heavy expanded mobility tactical truck tanker aviation refueling system, which can refuel four aircraft simultaneously.

Each of the FARPs can be task organized to provide maintenance, armament support, rearming and refueling necessary to support continuous operations. The FSC also maintains 2 days of supply of Class I, provides field fielding and transportation support, maintains Class IX (ground) repair parts and conducts ground maintenance. The FSC will provide rapid forward-deployed maintenance capability and ability to provide efficient and rapid fuel and rearming support to the aviation battalions.

(3) Highly mobile systems, advanced distribution platforms, precision delivery systems and state of the art C2.

(a) Future Modular Force logistic units will rely on air mobility, advanced distribution platforms, precision delivery systems, and state of the art command, control and communications networks. Aviation assets will play a significant role in supporting sustainment operations with intratheater air movement of time-sensitive/mission-critical supplies and aerial resupply to forward-deployed troops and/or widely dispersed forces. Enemy anti-access measures may make aviation sustainment support critical in early entry operations. Aviation will provide increased operational speed, precision delivery while maintaining visibility during early entry anti-access operations, distribution of supplies, and other sustainment operations. Additionally, aviation will be able to provide a rapid and efficient movement of personnel and equipment from sea-to-air transshipment. Distribution of supplies requires significant mobility and protection planning, and an allocation of intra and intertheater transportation assets capable of rapid resupply of aviation logistical units anywhere in the AO. Aviation logistical units must be able to move rapidly throughout the AO, set up to support a mission, and then rapidly displace to a new location. Even when strategic sustainment relies on sealift, as it will have to in most major contingencies, intratheater air and sea distribution will remain vital. The sustainment system must permit smooth sea-to-air transshipment without prior establishment of large and vulnerable in-theater logistical staging facilities. This will mean greater ship-to-shore interoperability with Army cargo and utility helicopters, and likely increased requirements for Army aircraft to support sustainment missions.

(b) Future Modular Force units will employ the latest advances in battle command, SU, and maneuver sustainment processes to enhance the capability to meet the challenge of supporting operations at varying tempos. This will equate to aviation systems with increased readiness and reliability as well as modular and versatile organizations that can sustain operations for longer periods without external support. Additionally, reduced demand, anticipatory logistics, total asset visibility, and a distribution-based logistics system will enable a reduced logistics footprint in the theater of operations. To support units over non-linear, non-secure LOCs, places increased emphasis on Army aviation assets to achieve a seamless flow of sustainment throughout the operational environment.

(c) HLVTOL. HLVTOL will provide inter-theater and intratheater aerial extension to the joint deployment, employment, and sustainment and distribution process, contributing to a fully integrated national-to-theater-to-tactical distribution system from early entry through conflict termination. By virtue of its long-range, high-speed, and large capacity; the HLVTOL will significantly expand current maneuver sustainment, distribution and resupply capabilities, and broaden the future Modular Forces' capability to provide continuous, precise, assured

provisioning of deployed forces in virtually any environment, guaranteeing their ability to generate, maintain, and employ combat power throughout the campaign.

(d) JCA. The JCA will provide the future Modular Force with a variety of airlift capabilities to include continuous operations.<sup>7</sup> The JCA will perform missions including passenger and cargo movement, combat employment and sustainment, aeromedical evacuation, special operations support, and operational support airlift. Additionally, when not conducting Army Service organic lift missions, Army JCA will be capable of conducting all airlift missions as part of the common user pool, or when required by the combatant commander to achieve operational or tactical objectives. Finally, in order to conduct continuous operations, it will require innovative sustainment concepts and capabilities, based on significant reductions in demand, improvements in reliability, split-based operations, and refined procedures for aerial delivery operations.

(e) UAS will provide a routine logistical link in the delivery of supplies and materials to forward deployed units. Unmanned cargo aircraft will conduct autonomous resupply operations as well as extraction of damaged parts for repair. These systems will also be capable of extraction of wounded and enemy prisoners of war.

(f) Seabasing will enable the rapid projection, agile maneuver, and sustainment of the future Modular Force across the full-spectrum of operations. The seabase could be augmented with support units such as water production and distribution elements, medical support elements, engineer support elements, aviation support elements, communication support and logistic support elements along with critical supplies such as food, water, and building materials. The Army will have forces that routinely operate from sea platforms and include command and control headquarters, light and mounted combat, aviation and logistic forces.

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<sup>7</sup> The Air Force's primary mission for the JCA is to conduct intra-theater airlift as a part of the common user pool (as defined in Joint Publication 3-17) in support of operational and tactical objectives.



Figure 2-6. Sustain Concept of Operations

c. Concept vignette description: The division conducts air movement and sustainment operations across the entire spectrum of military operations to support the division and subordinate maneuver brigades. In figure 2-6, the TASM (seabased) is providing aviation maintenance and repair parts support to aviation maneuver and sustainment units in the theater of operations. The TASM establishes the sustainment base for sustained aviation combat operations in a JOA, which reduces the aviation logistics tail. TASM supports the logistics principles of responsiveness, flexibility, sustainability, simplicity, supportability, economy, and attainability. Joint high-speed vessels are moving parts, equipment, and supplies along the coast to support division sustainment efforts. HLVOL and aviation lift assets from the TAC are providing intratheater aerial distribution of sustainment supplies from ship to shore and from the APOD to the forward brigade support areas. JCA are providing aerial movement of time sensitive, mission critical supplies and personnel from the APOD to FOBs of the maneuver brigades. Attack aircraft controlling ERMP UAS scout air axis of advance and provide escort and security for the air movement of supplies. FARP operations are conducted to support air movement over extended distances. The ASB is conducting split-based operations at the aviation brigade airfield and the aviation TF supporting the southern most BCT. The ASB is capable of providing both backup support to the AMC and intermediate maintenance for the task force. Downed aircraft recovery team (DART) and personnel recovery operations are conducted throughout the division AO. UAS are transporting critical supplies forward to the SOF units. Aerial MEDEVAC platoons are attached to the BCTs and provide timely and efficient movement of the wounded, injured, or ill personnel.

## 2-12. Summary

a. Army aviation is a crucial enabler for the future Modular Force in the conduct of full spectrum operations. Aviation manned and unmanned capabilities significantly contribute to the success of future joint and Army operations. Through execution of its enduring core competencies (reconnaissance, security, attack, lift, and battle command), aviation is instrumental to the future Modular Force in simultaneous, distributed and continuous, combined arms air-ground operations, day and night, in open, close, and complex terrain. Aviation is a major contributor in establishing land-force dominance, wresting the initiative from the enemy, forcing him onto the defensive, and defeating him in detail.

b. Future Modular Force aviation units are designed to operate at a tempo that supports the ground commander's scheme of maneuver to afford the enemy no rest or relief and denies him the means to respond effectively. The strength of Army aviation remains in its ability to deploy anywhere in the world, conduct aerial reconnaissance and security, maneuver rapidly, and focus tremendous combat power at the decisive place and time. Army aviation enables the future Modular Force through execution of the aviation concepts. Aviation operations depend on the successful joint and Army transformation and exploitation of the joint and Army capabilities.

## Chapter 3 Required Capabilities

### 3-1. Introduction

a. The Army's functional concepts provide both explicit and implicit descriptions of the aviation capabilities and functions necessary to achieve the objective state of the future Modular Force. Concept development work throughout TRADOC, including studies, analysis, experimentation, and professional military judgment, over the past few years provides the analytical underpinnings across DOTMLPF for these required capabilities. The influence of aviation capabilities in most cases is not confined to a single Army functional concept but often span across one or more of the functional concepts and multiple proponent areas of responsibility.

b. This listing of required capabilities should be interpreted as optimum capabilities during the 2015-2024 timeframe, but also are intended to bridge the gap between current and future Modular Force operations. The required capabilities listing is presented and aligned in relationship to the Army functional concepts. The list is not all inclusive and will be further refined and developed as the concept emerges and as the JCIDS analysis is executed. Technological and threat advances may drive changes to the listed aviation capability requirements.

### 3-2. Move Aviation Enabled Capabilities

a. TRADOC Pam 525-3-6 focuses on strategic force projection and operational agility in support of joint campaign objectives. Operational maneuver from strategic distances, and

achievement of the deploy equals employ paradigm are heavily reliant on accurate SU, reach, and the ability to execute en route mission planning and rehearsal.

b. Although full achievement of the capabilities described in the *Move* functional concept will require the integration of a wide range of DOTMLPF solutions, the following Army Aviation capabilities will contribute to achieving the Army's future Modular Force move capability requirements.

(1) Capability to transport tactically (mounted vertical maneuver) fully combat-configured future platforms (FCS sized vehicles) and crews from land or sea bases out to operational depths, utilizing austere or unprepared LZs.

(2) Capability of advanced lift aircraft to rapidly self deploy from strategic and operational distances.

(3) Capability to conduct shipboard operations to include vertical maneuver (mounted or dismounted) from or through the joint sea base in up to Sea State 4.

(4) Capability to transport cargo internally/externally with rapid loading and unloading of preconfigured pallets, automatic hookup, and external load stabilization that require minimum manpower or no off-board material handling equipment (MHE).

(5) Capability to meet mission requirements through enhanced aircraft performance (such as, range, speed, payload) and systems (highly efficient and more powerful engines, improved powertrain, lift and control systems and lighter weight subsystems, components and weapons) at terrain flight altitudes and higher, in worldwide geological and climatological conditions with low infrastructure support footprint, high fuel efficiency and high daily sortie rate.

(6) Capability for navigation systems that will provide precise location accuracy for intelligence information, reporting accuracy, quick response to changes in mission, precise target handovers for engagement of targets, and use of civilian and military airway and precision approach structures.

(7) Capability of advanced lift aircraft to rapidly move, retrograde, and recover high priority (time sensitive) cargo across the non-linear, noncontiguous battlefield, bypassing unsecured LOCs, and delivering sustainment supplies directly to the deployed unit.

### **3-3. See Aviation Enabled Capabilities**

a. TRADOC Pam 525-2-1 describes how the future Modular Force will acquire and generate knowledge of itself, its opponent and the operational environment. Without sensor/ISR superiority, the Army has limited capability for seeing first, understanding first, acting first and finishing decisively. Full achievement of the capabilities described in the See functional concept will require the integration of a wide range of DOTMLPF solutions.

b. The following Army aviation capabilities will contribute to achieving the Army's future Modular Force *See* capability requirements.

(1) The capability for sensors to provide target acquisition at standoff (beyond enemy direct fire engagement ranges); sufficient search speed, area coverage, and automation to enable responsive, survivable operations and accurate reporting; ability to penetrate foliage and C3D2; ability to detect changes in a 360 degrees spherical area and provide moving target indicator (MTI) alerts; mine and IED detection; size, weight, power, and cost reduction (particularly for UAS); and, the ability to operate in day, night, or adverse weather, including complex terrain, or in the presence of counter measures.

(2) The capability to conduct aerial armed reconnaissance to produce actionable combat information.

(3) The capability for LOI 3 and 4 control of unmanned aircraft (MUM teaming) and sufficient unmanned systems autonomy (increasing levels of mission and team autonomy and tactical behaviors) and crew and team decision aiding to allow manned platforms to focus on battlefield requirements while unmanned aircraft systems add sensors, fires and protection to achieve an overall team unity of effort.

(4) The capability to observe systematically geographic areas, facilities, and mobile forces with the ability to observe specific NAI and TAIs continuously or with persistent stare. Aerial system mission range capability to reach any point in a joint area of operations (up to 600 kilometers); provide a minimum of 24 hour continuous observation; perform wide area search to cue other sensors, conduct emitter mapping, electronic, counter sensor, C2 attack, meteorological survey, long endurance wide area surveillance, charge coupled device detection, tactical trends and patterns, and network extension. Includes possible launch and hide locations for threat systems and potential air threats.

(5) The capability for a persistent wide area surveillance for extended (longer than traditional aviation assets) periods of time, to conduct missions such as but not limited to; ISR, network extension, C-RAM, force and convoy protection, base security, meteorological monitoring, CBRN monitoring, and battlefield event detection and historical tracking.

(6) The capability to utilize efficiently the battle command COP in performing reconnaissance/surveillance operations and to report quickly information in battle command COP-compatible formats.

### **3-4. Strike Aviation Enabled Capabilities**

a. TRADOC Pam 525-3-4 addresses future Modular Force fires at the strategic, operational, and tactical levels. The concept explicitly describes aviation strike as a required capability. Access to the COP provides near real time SA, enables SU, enables precision strike operations, and is equally applicable to both lethal and nonlethal effects.

b. Although full achievement of the capabilities described in the *Strike* functional concept will require the integration of a wide range of DOTMLPF solutions, the following Army aviation capabilities will contribute to achieving the future Modular Force strike capability requirements.

(1) The capabilities found in a suite of air-to-ground weapons that provide lethal overmatch against anticipated target set; defeat anticipated target set in C3D2 environment; defeat anticipated target set in a countermeasure environment; provide increased precision (for guided and unguided munitions). The capabilities also provide increased range; provide scaleable effects (lethal and nonlethal) with controlled or minimized collateral damage even in environments with mixes of combatants and noncombatants; provide flexibility (additional weapon types and mixes); provide both LOS and BLOS engagement options; provide passive targeting and engagement to minimize munitions and launch platform detection; and provide MITL BLOS weapon control.

(2) The capability provided by a single variant, precision air-to-ground munitions, interoperable between both rotary wing and UAS platforms, providing both MITL precision terminal control after launch as well as through all weather fire and forget capability, with multi-mode weapon effects scaleable for defeat of all targets in the anticipated target set.

(3) The capability for direct access to Army and joint fire delivery systems from external sources to provide extended range, networked, responsive precision or volume fires on demand in support of tactical maneuver. Be able to provide and or integrate CAS on demand.

(4) The capability for smaller, lighter and cheaper munitions that provide improved aircraft performance margin, range and endurance, increased stowed kills, and allow employment of precision munitions in a greater percentage of engagements, reducing the potential for fratricide and collateral damage.

(5) The capability for target acquisition and identification at or beyond the range of the tactically preferred weapon.

(6) The capability for LOI 3 and 4 control of unmanned aircraft (MUM teaming) from manned platforms.

(7) The capability for acquisition and engagement timelines to be less than the threat decision cycle for its weapons.

(8) The capability for aircraft survivability equipment (ASE) to allow weapon delivery from higher altitudes.

(9) The capability for weapons system reliability and maintainability.

(10) The capability for modularity and reprogrammability.

(11) The capability for accurate and timely BDA to prevent unneeded re-attack and conserve weapons.



(12) The capability of reconnaissance and attack aircraft to receive air threat warning, alerting and cueing information and detect, correctly identify and defeat low, slow flying UAS and rotary wing threats as a secondary mission, along with the capability for reduced cost, multipurpose weapons and launchers.

(13) The capability to identify correctly detected friendly objects and entities with a 95 percent probability.

(14) The capability for networked links to other joint and Army fires and ISR assets.

### **3-5. Battle Command Aviation Enabled Capabilities**

a. TRADOC Pam 525-3-3 provides a visualization of how Army future Modular Force commanders will exercise C2 of Army operations in a unified action environment. The Battle command function is a blend of the cognitive and the technical. Central to the technical component is the concept of a single, integrated ABCS enabled by an agile, ubiquitous communications network. It is achieved by combining the art of well prepared leaders with the enabling science and technical systems of the future Modular Force. Many of the key ideas within the *Battle Command* functional concept relate to or are supported by aviation operations.

b. Full achievement of the capabilities described in the *Battle Command* functional concept will require the integration of a wide range of DOTMLPF solutions. The following Army aviation capabilities will contribute to achieving the future Modular Force battle command capability requirements.

(1) The capability to access a pervasive, extended range, intertheater and intratheater global NLOS communications relay capability and communicate between noncontiguous forces at the halt, at the quick halt and on the move. Communications include data, voice, imagery, and video.

(a) Manned and unmanned aircraft need to be self reporting and self-identifying in real or near real time with time-stamped positional and identification data and to have joint, combined arms, and multinational force interoperable communications (voice, data, imagery and full motion video) during all flight modes and at extended ranges (up to 600 kilometers). This includes NLOS and options for effective covert communications with lower probability of intercept and detection for high risk missions where surprise and team synchronizations is a premium. Aircraft must receive alerting and cueing information from integrated air and missile defense forces/systems.

(b) Access space links and processors enabling joint navigation, force location and deconfliction (for example, BFT), SA (joint BFT and SA) worldwide and accurate and assured tactical timing. This includes areas experiencing GPS or electronic warfare jamming.

(2) The capability to access a single integrated ABCS(s), joint capable to the lowest levels that is backward and forward compatible with joint, interagency coalition, and multinational forces.

(a) Networks that provide access to decisionmaking tools that accelerate the MDMP and mission execution.

(b) Multiple sensor and information fusion, multi-spectral sensor cross cuing to, share, push, pull and update the tactical knowledge base from a wide variety of sensors and access to that information simultaneously from multiple noncontiguous locations. Requires the capability to make information available down to small, highly dispersed units and teams, and dynamically retask units and platforms (near real time) with improved SA, SU, and a COP.

(3) The capability to access sufficient network transport (space, aerial, terrestrial) and network services (net-centric enterprise services, non-secure Internet protocol router, secure Internet protocol router, voice, data, video, and others) to meet all network needs, such as, tactical internet, fire support net, private net (targeting) and reconnaissance, surveillance reporting requirements to maintain up to LOI 4 control of UAS. Allows manned platforms to focus on battlefield requirements while unmanned aircraft systems add sensors, fires, and protection to the effort.

(4) The capability to conduct EMPRS both intertheater and intratheater utilizing the network-enabled battle command system and collaborative capable network.

(5) Capable efficient network services and communication systems-compatible protocols to ensure high priority messages are received with minimum latency for all participating systems.

(6) Capable protocols for controlling UAS from any C2-like terminal.

(7) The capability to conduct over the horizon control and information transfer for UAS and aviation reconnaissance/surveillance missions through satellite links (LOI 3 and 4 control).

(8) The capability for UAS common and standardized control architectures and interfaces for ground control stations.

(9) The capability for 4-dimensional visual airspace planning and airspace real time deconfliction during mission execution.

(10) The capability for network interoperable communications of airborne platforms with ATS.

(11) The capability for lighter more deployable ATS systems.

(12) The capability for tailorable ATS displays and more efficient controls and interfaces.

(13) The capability for ATS controller workload reduction and automation features.

(14) The capability for seamless, passive non-cooperative ATS reporting of air platforms.

(15) Capability for ATS to maintain controller visual cues in limited visibility and adverse weather conditions.

(16) Capability to generate ATS self-surveying and terminal instrument procedures (TERPs).

(17) Capability for ATS accident and incident voice and data recording.

### **3-6. Protect Aviation Enabled Capabilities**

a. TRADOC Pam 525-3-5 describes how the future Modular Force will protect people, physical assets and information against the full spectrum of threats. Each of the seven enabling tasks contained in the *Protect* concept: detect, assess, warn, prevent, deter, defend, and respond are enhanced by aviation systems and enablers.

b. Although full achievement of the capabilities described in the *Protect* functional concept will require the integration of a wide range of DOTMLPF solutions, the following Army aviation capabilities will contribute to achieving the Army's future Modular Force protect capability requirements.

(1) The capability for detection and reaction time against threats to positively identify ground and air threats beyond their engagement range and at the extended ranges of our future weapons systems with sufficient time to avoid or target.

(2) The capability to minimize aural, visual, infrared (IR) and radio frequency (RF) signatures to reduce detectability and enhance the effectiveness of active ASE.

(3) The capability to defeat or suppress enemy air defense systems both radar and IR guided (MANPADS) with active and passive countermeasures, and to defeat or suppress enemy small arms. This capability includes integration of joint assets and includes neutralization of ground and air electronic warfare directed against air and missile defense and communications.

(4) The capability to provide maximum protection to Soldiers (crew and passengers) and critical aircraft flight components from ballistic, flame, thermal, overpressure, CBRN and electromagnetic directed energy weapon (DEW) effects. Must have damage limiting hardened and redundant aircraft systems/components.

(5) The capability to detect and avoid anti-helicopter mines and improved explosive devices.

(6) The capability to provide embedded standoff sensor/detector capability for real time warning and dissemination to protect the force against chemical, biological, radiological, nuclear, explosive (CBRNE) hazards, anti-helicopter mines and improvised explosive devices.

(7) The capability to provide realistic virtual training and networked mission rehearsal against threat systems.

(8) The capability to provide hostile fire indications and accurate damage assessment of hit.

(9) The capability for pilotage and navigation systems to enable safe aircraft control when visual cues to the surrounding terrain and aircraft attitude are degraded or lost. Ability to conduct safe operations in DVE and complex terrain.

(10) The capability to detect obstacles around the aircraft to enhance crew SA and maintain safe spherical standoff distance.

(11) The capability to predetermine suitability of landing environments.

(12) The capability to ensure information assurance by preventing unauthorized access, interception, exploitation, and degradation of the battle command network.

(13) The capability to provide cognitive decision aiding.

(14) The capability for digital cockpit displays and advanced man-machine interfaces.

(15) The capability for lighter weight head-borne systems for manned crews.

(16) The capability to protect the network/information assurance from intercepts, jamming, viruses, through integrated and centralized network management.

(17) The capability to safeguard weapons systems from most common electronic interference, "spoofers," or false target generators to ensure crew confidence and desired weapons accuracy and effectiveness.

(18) The capability to detect and locate precisely and engage threat sensors (electronic-optical-IR, RF and others) and engagement C2 systems to allow effective countering of threat local situation awareness systems and disrupt the threat engagement cycle before trigger pull/initiation of an engagement.

(19) The capability for a proactive and reactive team-based kill capability for all elements of the manned and unmanned aerial system team.

(20) The capability for manned and unmanned systems to detect potential physical intrusions and engage anti-tamper measures (including human in the loop alerting and control options) to avoid system destruction or compromise when left unattended or on the ground during operations in non-secure areas that may include noncombatants for extended periods of time without direct human overwatch.

### **3-7. Sustain Aviation Enabled Capabilities**

a. TRADOC Pam 525-4-1 describes future Modular Force logistics as a single, coherent system that senses and interprets the operational environment and responds through network

capabilities. The ability to execute sustainment operations from the source of support, generally CONUS to the point of effect, generally an organization deployed in a theater of operation is heavily dependent on aviation-based and enabled systems.

b. Although full achievement of the capabilities described in the *Sustain* functional concept will require the integration of a wide range of DOTMLPF solutions, the following Army aviation capabilities will contribute to achieving the future Modular Force sustain capability requirements.

(1) The capability to establish a condition based two level maintenance process. Automate the maintenance process to work with a sense and respond parts delivery concept. Develop system interfaces and designs that minimize future parts obsolescence issues.

(2) The capability to provide aviation ground support equipment with designed-in deployability, reliability, maintainability, availability, sustainability, and interoperability to increase readiness and reduce logistics requirements and costs.

(3) The capability to provide a fully deployable aviation sustainment maintenance organization which can be either land based or seabased.

(4) The capability to sustain a high operational readiness rate, with minimal demands on quality and quantity of logistics manpower and compatible with the CLOE.

(5) The capability for aircraft to reconfigure systems in response to component degradation or failure during missions, so that the mission can be completed rather than aborted.

(6) The capability to provide affordable, lightweight, durable, survivable, and repairable airframes and auxiliary fuel systems.

(7) The capability to provide enhancements that enable aviation Soldiers and crewmembers stamina through prevention of disease and enhance endurance in hot, cold, dry, and wet weather.

(8) The capability for more affordable, realistic and sustainable training aids, devices, simulators and simulations (TADSS) with embedded training and mission rehearsal capability.

(9) The capability to perform audio and video communications between MEDEVAC aircraft and medical treatment facilities.

(10) The capability to minimize aircraft turn-around time for refueling and rearming through a flexible system of planned logistics support.

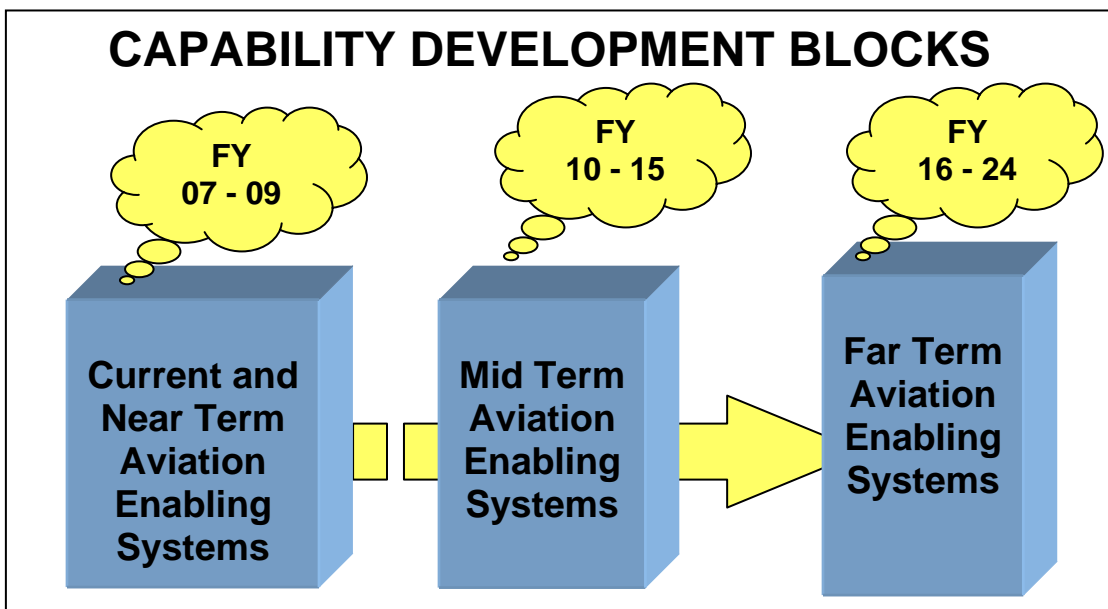
(11) The capability of UAS to provide rapid movement of planned logistics support that enables precise delivery of supplies to forward battlefield locations and repair parts to the ATS and air traffic control (ATC). Munitions should be packaged to accommodate rapid rearming and capable of being air transported and emplaced by UAS.

(12) The capability to have embedded joint ITV and tactical asset visibility of aviation air and ground systems for movement planning and tracking.

**Chapter 4**  
**Bridging Current to Future Capabilities**

**4-1. Introduction**

a. This chapter identifies the aviation enabled capabilities required by the future Modular Force and describes those capabilities with reference to a migration plan from current to far term needs. Chapter 2 of this CCP described the plan for Army aviation operations to support or enable the Army’s six functional concepts. The required capabilities listed in chapter 3 and 4 are also presented and aligned in relationship to the Army functional concepts and divided into three timeframes. All capability needs are not funded, but are placed in the most appropriate fiscal year (FY) when the technology becomes available and can be reasonably funded. Figure 4-1 represents the incremental steps associated with achieving the future Modular Forces’ required aviation enabled capabilities. These blocks are defined by the timeframes of the Department of Defense (DOD) program objective memorandum.



**Figure 4-1. Capability Development Blocks**

b. Bridging the gap between current and future aviation enabled capabilities is a complex task involving integration of all Army schools and centers and the joint community. The future capabilities described in this chapter, and the associated solution components, are crafted in the best possible scenario. They represent the optimum aviation-enabling facilities, personnel, organizations, and materiel for the timeframe, the threat, and the full-spectrum of military operations. Many of the aviation enabled capabilities identified in this chapter are or will be addressed in more detail in other CCPs such as, the ISR CCP, Distribution CCP, Seabasing CCP,

Forcible Entry CCP, Space CCP, battle command CCP, and Network Transport and Services CCP.

c. Figure 4-2 graphically represents the Army aviation aircraft modernization strategy and how aviation intends to support the future Modular Force with respect to manned and unmanned platform programs and way ahead. Although next generation future rotorcraft and UAS are depicted beyond the 2024 timeframe it is appropriate to note that those capabilities are still a long way from being mature and that other approaches might have to be considered as we analyze the needs for the future Modular Force. Some consideration might be appropriate for upgrades or replacements for the first generation FCS UAS (Class I and IV) during 2016–2024 timeframe since the initial solutions might generally meet threshold requirements, they will likely fall far short of the objective requirements in the FCS Operational Requirements Document (ORD). It also seems likely that something in Class II or III will be needed when the technology matures sufficiently to meet the original ORD capabilities.

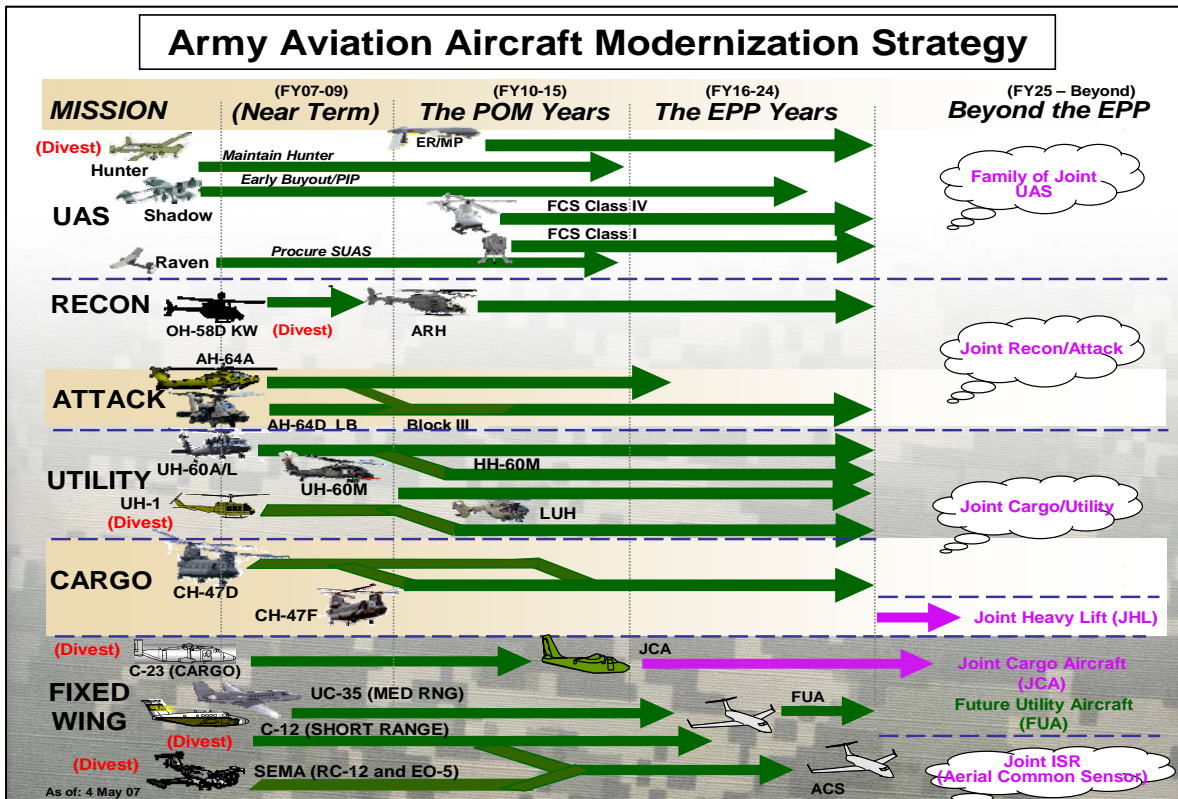


Figure 4-2. Aviation Aircraft Modernization Strategy

d. Given the overall objective for joint and Army forces to have expeditionary capabilities, there may be a new demand for a larger number of militarized light utility systems to augment the UH-60 lift capabilities due to a potentially high demand for vertical lift for small support units. The division commander and the multifunctional brigades have many defined responsibilities in the gray areas where there may well be a priority need for small unit operations by engineers, fires, military police, civil affairs units, and BFSB reconnaissance teams. This could create a larger demand that cannot be handled by the existing utility aircraft fleet.

**4-2. Assessment of Move Related Aviation Enablers**

a. With manned and unmanned air maneuver assets, future Modular Forces will possess the capability to conduct vertical maneuver (mounted or dismounted) in support of full spectrum joint combat operations. When executed rapidly, vertical maneuver gains positional advantage, exposes enemy capabilities to destruction across the JOA, and dislocates and or isolates enemy forces. Mounted vertical maneuver also enhances the element of tactical and operational surprise and reduces the risk of threat forces interdicting high payoff ground or vertical assaults against key enemy centers of gravity. The inability to conduct vertical maneuver with FCS-sized loads and current heavy lift fixed wing transport aircraft’s reliance on prepared landing surfaces reduces the flexibility and responsiveness of the infantry BCTs, Stryker BCTs, and the future BCTs.

b. Aviation advanced lift aircraft must be capable of vertically lifting, maneuvering and transporting FCS-sized vehicles, personnel, and other future force materiel, within tactical striking distance (within 1 to 2 terrain features, no more than 25 kilometers) of the enemy and using unprepared landing zones. Aviation will perform missions over an extended operational environment (potentially up to 600 kilometers in a joint area of operations).

c. Table 4-1 depicts the current, mid term and far term assessment of the move aviation enablers required by the future Modular Force. The alpha numeric rows on the chart correspond to the paragraphs below the chart.

**Table 4-1  
Aviation Move Capability Migration Plan**

<b>Move Aviation Enablers</b>			
<b>Enabling Capability Needs</b>	<b>Current Enablers FY 07-09</b>	<b>Mid Term Enablers Migration 10–15</b>	<b>Far Term Enablers Migration 16–24</b>
d. Capability to tactically transport (mounted vertical maneuver) fully combat-configured future platforms (FCS sized vehicles) and crews from land or sea bases out to operational depths, utilizing austere or unprepared LZs.			- HLVTOL - High performance rotary wing design - Reconfigurable vehicle technology
e. Capability of advanced lift aircraft to rapidly self deploy from strategic and operational distances. Self deployment capability for standard deployment routes.	- UH-60M (1056 nautical miles (nm)) - AH-64D (1089 nm) - CH-47F (1056 nm) - special electronic mission aircraft -Guardrail	- JCA (2400 nm)	- FUA (2400 nm) - HLVTOL (2100 nm) - Air refueling (automated and aided)
f. Capability to conduct shipboard operations to include vertical maneuver (mounted or dismounted) from or through the joint seabase in up to Sea State 4.	- Only requirement for the current and upgraded rotary wing fleet is shipboard capable	- Joint Precision Approach and Landing System (JPALS) Shipboard Relative (SRGPS)	- Shipboard compatible (marinized-folding blades, rotor brake, fit on elevators, folding tail boom) - Routine extended flight over water
g. Capability to transport		- Automated center of	- Robotic material handler



<p>cargo internally/externally with rapid loading and unloading of preconfigured pallets, automatic hookup, and external load stabilization that require minimum manpower or no off-board MHE.</p>		<p>gravity load and restraint management including cargo UAS operations from austere areas                      - Precision hover control with advanced crew displays and controls for rapid and low workload hookups and delivery on land or on ship</p>	<p>- Integrated/advanced cargo handling system</p>
<p>h. Capability to meet mission requirements through enhanced aircraft performance (for example, range, speed, payload) at terrain flight altitudes and higher, in worldwide geological and climatological conditions (high+/hot — 6000 feet pressure altitude at 95°F). Includes:</p>		<p>- JCA (6,000/+95)                      - AH-64D BKIII with 3,400 pound payload.                      - Vertical take off and landing (VTOL) small unit unmanned aerial vehicle                      - Fire Scout</p>	<p>- HLVTOL (6,000/+95)                      - High efficiency and performance rotary wing design.                      - Reconfigurable vehicle technology.                      - Lightweight active rotor concept (LARC)                      - Fire Scout II Follow-On                      - ERMP Follow-On                      - Light weight utility lift System                      - Hybrid Rotorcraft Configurations</p>
<p>i. - Highly efficient and more powerful engines</p>	<p>- Small heavy fuel engine (SHFE)</p>	<p>- Advanced affordable turbine engine (AATE)</p>	<p>- Future aircraft turbine engine (FATE)                      - Joint high efficiency and low noise propulsion for small UAS</p>
<p>j. - Improved powertrain, lift generation, and control system.</p>	<p>CH-47F upgrades                      - Digital advanced flight control system                      - Improved rotor heads, rotor blades, landing gear and electronics                      - New hydraulic systems</p>	<p>UH-60M upgrades                      - Fly by wire flight control system                      - Full authority digital electronic control                      - Composite tail cone and drive shafts                      - Common avionics architecture system cockpit                      - Fully coupled flight director system integrated with the fly by wire flight control system                      - Improved stabilator actuator and sensor                      AH-64D BKIII upgrade                      - AH-64D BKIII improved transmission, improved flight control laws and composite rotor blades</p>	<p>CH-47F upgrades                      - Improved electronic control unit for engines                      - Improved engine tailcone.                      - Intelligent active controls.                      - LARC                      - Enhanced rotorcraft drive system                      - High efficiency rotors and lift devices including small UAS applications</p>
<p>k. - Lighter weight subsystems, components and weapons.</p>	<p>- Lightweight rocket launchers (AH-64D, Observation helicopter (OH)-58D, ARH-70)                      - New machined monolithic airframe (CH-47F)                      - Composite tail cone and drive shafts (UH-60M)</p>	<p>- Lightweight radar electronic unit (AH-64D BKIII)</p>	<p>- LARC                      - Light weight composite or nanotechnology structures and ballistic protection subsystems                      - Solar powered/advanced energy sources for 24/7 extended operations and self protection / active camouflage</p>
<p>l. Capability for navigation systems that will provide precise location accuracy for intelligence information, reporting accuracy, quick response to changes in mission, precise target handovers for engagement of targets, and use of civilian</p>	<p>- AH-64D (embedded GPS inertial navigation system (EGI))                      - CH-47F (EGI)                      - UH-72A                      - ARH-70 (EGI, inertial navigation unit, digital map)                      - UH-60M (EGI)</p>	<p>- AH-64D BKIII (EGI, global air traffic management (GATM))                      - CH-47F (EGI, GATM)                      - ARH-70 (EGI, GATM)                      - UH-60M (EGI, GATM)                      - JCA (dual inertia navigation with dual GPS, GATM compliant)</p>	<p>- FUA (dual inertia navigation with dual GPS, GATM compliant)                      - HLVTOL (EGI, GATM)                      - Enhanced Vision System GPS III</p>

and military airway and precision approach structures.		- JPALS SRGPS	
m. Capability of advanced lift, high efficiency VTOL and fixed wing aircraft to rapidly move high priority (time sensitive) cargo across the non-linear, noncontiguous battlefield, bypassing unsecured lines of communications, and delivering sustainment supplies directly to the deployed unit.		- JCA - Precision delivery UAS	- HLVTOL - Integrated Air Mobile FARP for ground and air unit support /sustainment - Integrated propulsion and power generation systems or fuel cells for extended ground operations

d. Capability to tactically transport (mounted vertical maneuver) fully combat-configured future platforms (FCS sized vehicles) and crews from land or sea bases out to operational depths, utilizing austere or unprepared LZs.

(1) Current. No programmed capability.

(2) Mid Term. No programmed capability.

(3) Far Term. HLVTOL will provide the capability to tactically transport a combat-configured FCS or Stryker vehicle and crew out to operational distances and inserting them within 1-2 terrain features (greater than 25 kilometers) of the objective, utilizing unprepared LZs. There are three potential solution sets or speed bands being explored under the concept design analysis effort. The three speed bands for the HLVTOL are 160-200 knots, 200-250 knots, and 250-300 knots. High performance rotary wing design effort is to integrate and demonstrate high payoff component technologies, evaluate entrepreneurial vehicle configurations/systems for high performance and high payoff applications and demonstrate technology features that enable the achievement of extreme range, payload, and endurance performance. Reconfigurable vehicle technology is a concept for rotary aircraft to reconfigure based on mission (for example, attack, reconnaissance, and lift). As the joint and Army force becomes more expeditionary, and the battlefield dimensions expand out to 600 kilometers for the JOA, future rotorcraft must provide much greater cruise efficiency and reductions in fuel consumptions than current helicopters. Greater cruise speeds and rapid load and unload and mission turn-around times will be needed to increase sortie rates and optimize productivity, and enable higher OPTEMPO that is not possible with today's aircraft.

e. Capability of advanced lift aircraft to rapidly self deploy from strategic and operational distances. Self-deployment for standard deployment routes.

(1) Current. The CH-47F and UH-60M are capable of self-deployment up to 1056 nm using the southern and northern Atlantic routes. The AH-64A and AH-64D have a self-deployment range of 1089 nm. The longest leg required in the southern route is 1,056 nm using integral and auxiliary fuel with at least a 30-minute fuel reserve. The southern deployment route via the Azores to Europe and onward in support of a Southwest Asia scenario provides the greatest potential for year round self-deployment capability. Due to weight restrictions imposed

by fuel requirements for extended ferry operations, during these self-deployments only essential crew and equipment will deploy on the aircraft. All other mission, maintenance and support equipment and personnel must meet the aircraft in theater. The AH-64D BKIII has no self-deployment requirement.

(2) Mid Term. The JCA will be capable of flying a distance of 2,400 nm without refueling, with a 45-minute fuel reserve while carrying the full aircraft crew and 2,000 pounds of cargo.

(3) Far Term

(a) The FUA will be a fixed wing jet aircraft capable of self-deploying over strategic distances to meet Army future Modular Force requirements. The primary mission of the FUA will be to transport senior DOD executives, senior service chiefs, and their staffs over strategic distances. While the current U.S. Army priority air transport aircraft meet future Modular Force requirements, they are expensive to acquire and operate. Although a limited number of these aircraft will always be needed to support senior executives, a more cost-effective, commercial off the shelf (COTS) aircraft should be considered to meet future Modular Force requirements. The FUA will be capable of transporting 9 passengers with their baggage for a total of 2700 pounds (1800 pounds total for the passengers and 900 pounds for 122 cubic feet of baggage). To self-deploy worldwide, the FUA will be capable of flying 2400 nm without refueling, while maintaining a 45-minute fuel reserve and capable of flying in instrument flight rules weather conditions. Some additional advantages of pure jet aircraft include higher speed, less fuel burned, shorter en route times for commanders and aircrews, more mission availability and less maintenance.

(b) HLVTOL will have the capability to self-deploy from CONUS or home station to an intermediate staging base (ISB), FOB or directly into the objective area, a distance of 2,100 nm. It should also be a viable air-to-air refueler to aid other aviation systems to rapidly self deploy globally.

(c) The future multirole aircraft variants must be able to self deploy worldwide or at least to 2100 nm to allow efficient expeditionary operations and rapid deployments within a theater or to an adjacent theater.

(d) Eventually all manned and unmanned UAS with a gross weight above 15, 000 pounds should be capable of global self deployability with or without automated or aided air-to-air refueling.

f. Capability to conduct shipboard operations to include vertical maneuver (mounted or dismounted) from or through the joint sea base in up to sea state 4.

(1) Current. The current fleet of rotary wing aircraft is shipboard capable, which allows the system to operate to and from and aboard ships certified for aviation landing operations. They can operate throughout the worldwide electromagnetic environment, including shipboard, without affect or disturbance to flight critical functions. Momentary interruption (not more than

60 seconds) is allowed in mission essential functions as long as the crew can continue to safely and effectively perform the mission. Shipboard compatible is the capability of a system to routinely deploy, employ, berth, conduct scheduled and non-scheduled maintenance, interoperate with on-board material handling equipment, compatible with elevator and below deck sizing constraints, and operate to/from and aboard ships certified for aviation landing operations without waivers.

(2) Mid Term. JPALS SRGPS will be a shipboard system for aircraft navigation and landing. JPALS increments for land-based use are dependent on and will be introduced in conjunction with Federal Aviation Administration (FAA) decisions on a space-based navigation strategy. This will most likely move to the far term.

(3) Far Term. No programmed improvements. However, a capability is required for shipboard compatible aircraft to meet the Army's seabasing concepts (marinized-folding blades, rotor brake, fit on elevators, folding tail boom). HLVTOL will be marinized and equipped for routine shipboard operations. It will be shipboard capable but likely not fully shipboard compatible with today's ships due to size and weight constraints. Should the joint force acquire an afloat forward staging base or sea base capability, shipboard compatibility would be a desired option for the HLVTOL.

g. Capability to transport cargo internally and externally with rapid loading and unloading of preconfigured pallets, automatic hookup, and external load stabilization that require minimum manpower or no off-board MHE.

(1) Current. No programmed capability.

(2) Mid Term. Future operational environments that include highly dispersed small units conducting missions in complex or urban terrain without assured security of LOCs will likely create a need for precise aerial delivery and retrograde of high value items. An example might include a precision aerial delivery system hardware retrograde from areas where manned lift aircraft may not be available or the risks may be too high to justify the mission. A cargo or lift UAS asset could provide responsive and precise transport of small, high value payloads. However, it will be essential to have proven and mature means to assure that retrograde loads that may be placed on the UAS by non-aviation personnel is properly placed such that the center of gravity of the UAS is within proper limits and that the cargo is properly restrained for safe flight conditions. Turbulence is more likely to affect a UAS due to lack of a positive see and avoid capability. This technology should be within the state of the art but needs to be matured and qualified for safe operations before this capability is incorporated into a fielded UAS.

(3) Far Term. No programmed capability. An integrated cargo handling system is desired for rapid on and off loading of CH-47F. Currently weight is a major issue with the advanced cargo handling system. An autonomous and or semi- autonomous loading and unloading of internal cargo capability is desired for HLVTOL, but not programmed. This capability should include the ability to quickly load and unload heavy vehicles and cargo off/onto the ramp at maximum aircraft slope angles onto soft or uneven terrain to enable robust assault/mounted vertical maneuver operations. These operations should be accomplished

efficiently in austere or unprepared areas during adverse weather conditions and in complex terrain without the need for MHE.

h. Capability to meet mission requirements through aircraft performance (for example, range, speed, payload) and systems (highly efficient and more powerful engines, improved powertrain, lift and control systems and lighter weight subsystems, components and weapons) at terrain flight altitudes and higher, in worldwide geological and climate conditions (high+/hot-6000 feet pressure altitude- 95°F) with low infrastructure support footprint, high fuel efficiency and high daily sortie rate. The additional range, endurance, and fuel efficiency needed to responsively accomplish aviation missions on a greatly expanded battlefield described in the capstone and integrating concepts will likely drive a need for a future generation of manned and unmanned aerial systems that have substantially increased performance over conventional legacy rotary wing and UAS systems. Future expeditionary operational environments; especially in complex terrain or in the early phases of a campaign where the theater is not well developed and the enemy has chosen to pursue anti-access means, will likely require increased aviation support. Examples of missions that may be in greater demand in the future includes persistent ISR (manned and unmanned VTOL and fixed wings capabilities) for urban and complex terrain, widely dispersed sustainment and delivery operations, remote strike, recon, escort and convoy protection and attack sorties and assured communication relay support. As the area of operations expands, there becomes a greater need for increased platform performance and efficiency to allow responsive support with high OPTEMPO and low support infrastructure. Improved fuel efficiency may be a major advantage in highly dynamic and support constrained operations.

(1) Current. 4,000 feet pressures altitude +95°F for all aircraft. No programmed improvements.

(2) Mid Term. AH-64D BKIII with 3,400 pound payload at 6,000 kilometers and +95°F. No further programmed improvements.

(3) Far Term. Objective requirement for all aircraft (except FUA) is the 6,000 ft pressure altitude +95°F. Lightweight active rotor concept (LARC) is improved rotorcraft performance using advanced technology, active on-blade control, and innovative passive design. New rotorcraft configurations (from tiny UAS systems to advanced VTOL manned systems) will need to be explored and considered for improved expeditionary support. These could include a variety of new propulsion and lift and thrust concepts, advanced compound VTOL designs, slowed, or stowed rotor concepts, advanced tilt rotor configuration and hybrid fixed wing with lift fans or other novel VTOL lift and thrust devices.

(a) The FCS ORD calls for highly ambitious capabilities for super quiet UAS capabilities with very challenging payload and endurance goals. Legacy platform concepts may not be ideal for meeting these approved requirements. The future trend toward highly dispersed forces often operating at high OPTEMPO in complex terrain with numerous small units or teams will generate demand for responsive and effective aerial delivery or retrograde of high value payloads or items. Some portions of these missions are best handled with lift UAS systems. Other missions that involve transporting teams of one or two personnel may well be best supported by an advanced light utility system that has the tactical survivability and crashworthiness for future

combat operations. Systems should have low operating costs (small fraction of the FH costs of a UH-60) and potentially have the option for manned and unmanned capabilities. If this demand is validated and the current UH-60 fleet size is not increased or it is determined that it is not a cost effective solution, then some small aerial lift systems may need to be considered for the future combat force.

(b) There has also been a long standing desire by infantry Soldiers and other to have the option for an individual lift device to allow soldiers to seize quickly the high ground with a vertical lift system. The classic capability is to get a few soldiers and special equipment on top of a building so it can be cleared from the top down. These systems have been performance limited and involved high operational risks. Eventually, propulsion and flight control technologies may advance to a point where this becomes practical. Until then, using a UAS to get some of the equipment or ground robotic systems on top of the building may be a useful adjunct until an objective capability is available.

i. Capability for highly efficient and more powerful engines (includes UAS heavy fuel engines).

(1) Current. Develop SHFE technology to enable required range and payload for future Modular Force aviation systems. Develop 700 horsepower heavy fuel propulsion capability for current and future aircraft with improved performance, durability, reliability and reduced cost. Develop scalable technology and design tools to support future engine development efforts. Develop advanced engine component technologies to support rotorcraft engine upgrades. These developments will provide future Modular Force ARH-70, A160, and other UAS manned rotorcraft with SHFE capability that enables affordable range and payload. Also, this technology reduces sustainment footprint due to improved engine fuel efficiency, increased durability and reduced maintenance; 35 percent reduction in production and maintenance cost through parts count reduction and advanced materials; and improved aircraft performance due to higher fuel efficiency and power to weight ratio engines. Partial technology can be incorporated into future force rotorcraft during the current and mid term, with full engine development in the far term.

(2) Mid Term. Develop affordable 3000 shaft horsepower engine technology providing enhanced operational capabilities for current and future Modular Force rotorcraft. The AATE is intended to provide advanced turbo-shaft technology that will affordably enable significant improvements in rotorcraft range/payload operational capability, and achieve reliability and durability requirements while operating in erosive/corrosive environments. AATE technology can also provide the propulsion technology to support persistent engagement for attack helicopters or allow these vehicles to engage targets at a larger radius of action. Improved fuel efficiency of the AATE technology allows a 40 percent increase in mission radius. The lighter engines allow additional payload to be carried at a fixed takeoff gross weight. In addition, the fuel efficient technology can be leveraged and applied to extend the endurance (time-on-station) of UAS that have reconnaissance and homeland defense protection responsibilities. In summary, AATE will develop technology that enables effective operation in the contemporary environment and help to reduce the logistics footprint/sustainment cost associated with aviation platforms.

(3) Far Term

(a) FATE is intended to develop advanced turboshaft technology that will affordably enable significant improvements in rotorcraft range and payload operational capability for primary application to existing rotorcraft such as CH-47 or future platform concepts such as joint heavy lift. It extends the turboshaft technology development beyond AATE with less cost. In addition, the fuel-efficient technology under FATE can be leveraged and applied to extend the endurance (time-on-station) of UAS that have reconnaissance and surveillance and homeland defense protection responsibilities. FATE will develop technology that enables effective operation in the contemporary environment and help to reduce the logistics footprint and sustainment cost associated with aviation platforms.

(b) Most small UAS systems suffer from performance (endurance, lift payload and fuel efficiency) to meet approved objective requirements. Most options that do have operationally useful lift performance also have major limitations in tactical acoustical signatures and generally are too large to meet visual signatures objectives. Major new advancements in innovative UAS propulsion systems are needed to meet operational needs. This includes the need for high reliability, low cost of operation and an ability to operate in urban canyons (high wind gradients) and extreme climatic conditions including tactically stable operations on mountains top conditions – low-density altitude and high winds conditions.

(c) In the far term, it would be useful to have the option for highly controllable visual, acoustical and IR signatures (from very low to very high) to provide masking of manned (dismounted and air assault operations) tactical signatures and provide decoys or distractions to threat forces. This includes inducing them to engage the unmanned system to then determine their precise location, and cuing follow-on engagements or options to use reach back assets to mitigate the target or avoid a high risk threat by bypassing a given location.

j. Capability for improved power train, lift generation, and control systems.

(1) Current. CH-47D to CH-47F upgrades include: digital advanced flight control system, improved rotor heads, rotor blades, landing gear and electronics and new hydraulic systems.

(2) Mid Term. UH-60L to UH-60M upgrades include fly by wire flight control system; full authority digital electronic control; composite tail cone and drive shafts; the common avionics architecture system cockpit; a fully coupled flight director system integrated with the fly by wire flight control system; and an improved stabilator actuator and sensor. AH-64D BKIII will have improved transmission, improved flight control systems, and composite rotor blades

(3) Far Term

(a) Desired upgrades for the CH-47F are improved electronic control unit for engines and an improved engine tailcone. Intelligent active control is the seamless operation across many modes, with increased platform integration; analysis considering integrated control architectures; autonomous control algorithms adapted for larger piloted configurations. Flight control and aero analysis is needed for dynamically-complex, multipurpose configurations. LARC is improved rotorcraft performance using advanced technology, active on-blade control,

and innovative passive design. Enhanced rotorcraft drive system will incorporate advanced materials and processing methods and the latest design methods to significantly improve the durability of the basic drive systems components. Examples include advanced corrosion resistant housing materials, advanced lubrication and high performance corrosion resistant gears and bearings. These will combine to increase times between parts replacement (4,000 hours to 6,000 hours) and reduce maintenance requirements.

(b) In addition, the advanced torque splitting configuration results in reduced parts counts and lower acquisition cost. Current manned and unmanned VTOL systems are largely based on rotor and lift system technologies developed during the 1960–1980s. There is a need for much greater efficiency to increase the endurance and payload for a given size VTOL platform – of any class size and especially for the smaller aerial vehicles. Much progress has been made in proving the viability of advanced rotor and on-blade control concepts. Smart materials also offer many new options to enhance performance and operational agility that have not been exploited in full scale flight demonstrator aerial systems. The need for greater range, endurance, and efficiency will likely intensify as we move toward the future Modular Force.

k. Capability for lighter weight subsystems, components and weapons.

(1) Current. The M240H system being fielded offers lighter weight and improved capability and reliability over M60D machine gun on UH-60 and CH-47. Lightweight rocket launchers are also being fielded for attack and reconnaissance aircraft.

(2) Mid Term. Lightweight radar electronic unit (AH-64D BKIII).

(3) Far Term. No programmed improvements or requirements.

l. Capability for navigation systems that will provide precise location accuracy for intelligence information, reporting accuracy, quick response to changes in mission, precise target handovers for engagement of targets, and use of civilian and military airway and precision approach structures.

(1) Current. The H-764G EGI program is a tri-Service, U.S. Air Force led effort to provide an integrated navigation solution for aircraft equipped with a military standard 1553 digital data bus. The EGI embeds a 5-channel GPS receiver into a ring laser gyro inertial navigation system. The EGI will provide extremely precise location to the aircraft fire control computer or integrated system processor for processing targeting information and sensor pre-pointing. The EGI is the objective, fully digitized GPS solution for the scout attack helicopters. The ARH-70, UH-60M, CH-47F and AH-64D BKIII will all have EGI systems. The AN/ARN-128D (Army-Navy Airborne Radio Navigation) also provides the UH-60A/L and CH-47D instrument flight rules certified GPS for civil area navigation.

(2) Mid Term. JCA will have dual inertia navigation with dual GPS, and be GATM compliant. GATM is a concept for satellite-based communication, navigation, surveillance, and air traffic management. JPALS is integrated on aircraft and starts to replace the instrument landing system for Army precision approach and landing. JPALS increments for land-based use



are dependent upon, and will be introduced in conjunction with FAA decisions on a space-based navigation strategy. JPALS will most likely move to the far term.

(3) Far Term. FUA and HLVTOL will have same navigation improvements as the JCA. The Enhanced Vision System GPS III changes existing operational paradigms. Improved operator capabilities are enabled by a new high-speed uplink, downlink, and crosslink communication architecture. Continuous connectivity allows operators a "contact one satellite - contact all satellites" concept enabling near real time navigation updates and telemetry monitoring. GPS III provide improvements for the following operations: constellation monitoring, command and control, navigation upload monitoring, global service monitoring, global service prediction, civilian navigation messaging, and anomaly detection and resolution.

m. There needs to be a capability for advanced lift, high efficiency VTOL and fixed wing aircraft to rapidly move high priority (time sensitive) cargo across the non-linear, noncontiguous battlefield, bypassing unsecured lines of communications, and delivering sustainment supplies directly to the deployed unit.

(1) Current. No programmed improvements from current rotary wing lift aircraft.

(2) Mid Term. JCA. The primary mission of the JCA is to move rapidly time sensitive, mission critical supplies to forward deployed units.

(3) Far Term

(a) Supporting a highly dispersed, high OPTEMPO force composed of a diverse array of small units operating independently or at remote locations and often in complex terrain will pose a major transport challenge. The exploitation of precision guided munitions and reach back fires should increase the stowed kill potential for small units and help reduce the overall transport needs of the force by close to an order of magnitude from cold war levels. This will enable the ability to move this type of resupply by air (total tonnage now more compatible with airlift) but will also increase the probability of emergency sustainment in high priority situations; especially for urban and mountainous environments. Although future technologies may allow small units to scavenge fresh drinkable water, their reliance on aerial resupply of fuel to remote locations may increase. Future aviation systems may be able to provide FARP support for small units operating in high risk areas and avoid the need for frequent movement of convoys with the associated need for robust protection and overwatch.

(b) HLVTOL and smaller VTOL systems may be able to revolutionize responsive sustainment of highly dynamic units. As the battlefield distances expand, this capability may become essential. Deliveries from high altitude platforms may help this problem but will likely increase the demand for aerial retrograde of the hardware, compromising the overall benefit of this delivery concept. Air mobile FARPs may also be required for sustained aviation operations in the far corners of the battlefield to maximize the on station time for organic attack, reconnaissance, and lift assets. Some of these FARPs may need to be automated with modern robotic capabilities to support rapid refuel, rearming, and mission planning software updates for

UAS to minimize their on-the-ground time and minimize the number of personnel exposed to forward area threats.

**4-3. Assessment of See Related Aviation Enablers**

a. Responsive focused reconnaissance, surveillance, and target engagement is required worldwide in day, night, adverse weather, obscured visibility, high levels of background clutter, complex terrain environments, and in the presence of C3D2 countermeasures. Targets may have low or indistinct signatures or emissions (personnel, small UAS, unmanned ground vehicles, IEDs, mines, CBNRE agents, and others). Targets may be highly mobile with short exposure times and may be intermingled with noncombatant civilian populations and infrastructure in urban environments so collateral damage and fratricide must be minimized. Standoff must be maximized to enhance survivability.

b. Aviation systems must be able to search areas of operations within times and at ranges consistent with survivable operations. Systems must overcome enemy use of countermeasures. Systems must enable detection, classification, recognition, identification, affiliation, and determination of target location with the accuracy needed for tracking, precision targeting, reporting, and handover. Data must be processed, confirmed, integrated into COP-compatible reports, and disseminated in a time consistent with planning, responsive and survivable engagements or reporting, and OPTEMPO requirements.

c. Table 4-2 depicts the current, mid term and far term assessment of aviation enablers that support the see functional concept.

**Table 4-2  
Aviation See Capability Migration Plan**

<b>See Aviation Enablers</b>			
<b>Enabling Capability Needs</b>	<b>Current Enablers FY 07-09</b>	<b>Mid Term Enablers Migration 10-15</b>	<b>Far Term Enablers Migration 16-24</b>
d. Capability of multi-spectrum sensors with sufficient resolution to detect, recognize, track, and identify targets and perform reconnaissance at survivable standoff ranges during day, night and obscured conditions with both active and passive capabilities.	- AH-64A Target acquisition designation sight (TADS) pilot night vision sensor (PNVS) - OH-58D mast mounted sight (MMS) - AH-64D fire control radar (FCR) - Shadow UAS electro-optical Infrared (EOIR) payload - Hunter EOIR payload - AH-64D modernized target acquisition designation sight (MTADS) PNVS	- ARH Target acquisition sensor suite (TASS) - ERMP UAS - UAS EOIR payload - AH-64D BKIII Modernized day sensor assembly (MDSA) - AH-64D improved radio frequency interferometer (RFI) - Improved AH-64D BKIII UAS control	AH-64D BKIII: - FCR extended range performance - Automatic aided target recognition, detection, classification - Maritime target mode - Multi-mode laser - RFI frequency expansion - Image fusion - Cognitive decision aiding system - Third generation forward looking infrared (FLIR) - Distributed aperture sensor system
e. Capability of sensors with sufficient search speed, area coverage, and automation to enable responsive, survivable operations and accurate	- AH-64A TADS - OH-58D MMS - Shadow UAS EOIR - Hunter UAS - AH-64D MTADS	- ARH-70 TASS - ERMP UAS EOIR payload - AH-64D MDSA	- Automatic, aided target recognition, detection, classification - AH-64D BKIII cognitive decision aiding

reporting.	- AH-64D FCR		- Coherent change detection (IR, RF and other means) and pattern and movement detection and discrimination between routine commercial and civilian operations and conventional military or counterinsurgency operations.
f. Capability of ISR sensors that can penetrate foliage and C3D2.	- AH-64D FCR	- ERMP UAS foliage penetration (FOPEN) payload - ERMP UAS light detection and ranging (LIDAR) payload - AH-64D Improved FCR - ERMP UAS synthetic aperture radar (SAR)	- High-range-resolution radar Systems - Hyper spectral imagery systems - LIDAR laser ranging, laser radar (LADAR) systems - FOPEN Systems with MTI functionality that can detect both moving and stationary military system and dismounted maneuver operations in complex terrain
g. Capability of sensors that can detect changes in a 360° spherical area and provide MTI alerts.	- AH-64D FCR capability in air targeting mode only - Airborne Reconnaissance Multi-Sensor System (ARMS) - Highlighter	- ERMP UAS SAR ground moving target indicator (GMTI) - AH-64D improved FCR MTI maritime mode and air targeting mode only	
h. Capability of mine and IED detection sensors for UAS capable of detection at survivable standoff distances.		- ERMP UAS with IED and mine detection sensor	
i. Capability for reduced sensor size, weight, power, and cost reduction (particularly for UAS).	- AH-64A TADS PNVS - OH-58D MMS - AH-64D FCR - Shadow UAS EOIR payload - AH-64D MTADS	- ERMP UAS SAR GMTI - ERMP UAS EOIR - AH-64D Improved FCR - AH-64D BKIII tactical common data link (TCDL)	- Third generation FLIR
j. Capability of sensors which allow ops in day/night/adv weather or in the presence of countermeasures.	- AH-64A TADS PNVS - OH-58D MMS - AH-64D FCR - Shadow UAS EOIR payload - AN/AVS-6 - AH-64D MTADS	- AH-64D MTADS PNVS (with fused imagery) - AH-64D FCR counter-countermeasures - ARH-70 TASS - ERMP UAS EOIR, SAR GMTI payloads - AH-64D improved FCR	
k. Capability to conduct aerial armed reconnaissance to produce actionable combat information.	- AH-64A/D - OH-58D	- ARH-70 - OH-58D - AH-64A/D - AH-64D BKIII - ERMP UAS	
l. Capability for LOI 3 and 4 control of unmanned aircraft (manned-unmanned teaming) from manned platforms.	- Hunter strike killer team (HSKT) advanced concept technology demonstration (ACTD)	- AH-64D BKIII LOI 4 control of UAS - ARH-70 LOI 2 control of UAS - Aerial common sensor	- ARH-70 LOI 4 control of UAS
m. Capability to systematically observe geographic areas, facilities, and mobile forces with the ability to observe specific NAI/TAs continuously or with persistent stare. (continued) Range to reach any point in division AO;	- Shadow UAS - Hunter UAS - Constant Hawk	- ERMP UAS - Aerial common sensor	- Extended duration, wide area surveillance

provide a minimum of 24 hour continuous observation; perform wide area search to cue other sensors, conduct emitter mapping, electronic attack, meteorological survey, long endurance wide area surveillance, and network extension.			
n. Capability for persistent wide area surveillance for extended periods.		- ERMP UAS	- Extended duration, wide area surveillance
o. Capability to efficiently utilizes the COP in performing reconnaissance/surveillance operations and to quickly report information in COP-compatible formats.	- Future battle command, brigade and below (FBCB2) (thru BFT) - Variable message format messaging	- System of systems common operating environment (SOSCOE) - Joint Tactical Radio System (JTRS) -Wideband network waveform (WNW) -LINK 16 -Mobile users objective system (MOUS)	- FCS interoperability - Airborne networking waveform)

d. Capability of multi-spectrum Sensors with sufficient resolution to detect, recognize, track, and ID targets and perform reconnaissance at survivable standoff ranges during day, night and obscured conditions with both active and passive capabilities.

(1) Current. AH-64A TADS is an EOIR target acquisition system with first generation FLIR imaging, laser range finder/designator (LRF/D) and laser spot tracker. OH-58D MMS is an EOIR target acquisition system with first generation FLIR imaging and LRF/D. The AH-64D FCR is a millimeter wave radar-targeting sensor providing automatic detection, classification, and prioritization of multiple ground and air targets in adverse weather and under battlefield obscurants. The Shadow UAS EOIR payload is an electro-optical target acquisition system with a second generation FLIR thermal imager. The Hunter UAS EOIR payload is an electro-optical target acquisition system with a second generation FLIR thermal imager. The AH-64D MTADS PNVS is an upgrade to the current system providing a second generation FLIR thermal imager, an image intensification pilotage sensor, and a multiple target tracker with reliability and maintainability improvements.

(2) Mid Term. The ARH-70 TASS is an electro-optical target acquisition system with a second generation FLIR thermal imager; low light color television, LRF/D, laser pointer, and laser spot tracker. The ERMP UAS EOIR payload contains an electro-optical target acquisition system with second generation FLIR thermal imager, and LRF/D. A planned improvement to the AH-64D MDSA will improve target acquisition and laser designation performance. RFI frequency expansion and passive ranging is programmed for AH-64D BKIII to improve passive location and identification of radar-emitting threats. AH-64D BKIII will integrate LOI 3 and 4 control with a compatible UAS permitting increased standoff when operating in a teaming arrangement.

(3) Far Term. AH-64D BKIII FCR improvements provide extended range and maritime capability. RFI frequency expanded to include the millimeter wave notch and the higher frequencies while maintaining precise angular direction finding to provide cueing to threats not

covered in the Block I and Block II systems. The AH-64D BKIII Cognitive Decision Aiding System (CDAS) will reduce crew workload and improve performance by providing continuous recommended flight path information to avoid threat systems, terrain, and synthetic obstacles. Third generation FLIR detectors for targeting systems provide enhanced capabilities like larger number of pixels, higher frame rates, better thermal resolution, as well as multicolor functionality and other on-chip functions. Distributed aperture sensor systems employ multiple sensors to obtain high resolution, wide-angle video coverage of their local environment in order to enhance the SA of manned and unmanned platforms.

e. Capability of sensors with sufficient search speed, area coverage, and automation to enable responsive, survivable operations and accurate reporting.

(1) Current. AH-64A and OH-58D have EO target acquisition systems with manual search and automatic tracking. The AH-64D fire control radar has automatic scanning and target detection, classification and prioritization. The AH-64D MTADS PNVIS upgrade includes a multiple target tracker that increases automation and target tracking and servicing rate.

(2) Mid Term. The ARH-70 TASS has an objective requirement for multiple target tracking. AH-64D BKIII and ARH-70 open system architectures will facilitate integration of Automatic/Aided Target Algorithms. The ERMP UAS will provide auto-search/track algorithms and onboard sensor cross cueing and provides extended range and long endurance for long dwell surveillance of expanded operational environment. AH-64D BKIII MDSA will improve day sensor targeting performance.

(3) Far Term. AH-64D BKIII provides programmable aided target detection and classification system to automatically display targets in an order of priority established by the crew.

f. Sensors that have FOPEN Capability and C3D2

(1) Current. AH-64A and OH-58D sensors do not have a FOPEN capability. Current EOIR targeting sensors on rotary wing and UAS have limitations due to susceptibility to C3D2 countermeasures. AH-64D FCR and improved FCR have limited FOPEN capability.

(2) Mid Term. ERMP UAS capability production document lists FOPEN and LIDAR as candidate payloads for integration after initial operational capability, but before Increment II based on technology development and operational requirements. AH-64D MTADS, ARH-70 TASS and the ERMP UAS EOIR payload have greater range and resolution with second generation FLIR detectors that provide improved performance against targets in a C3D2 environment. ERMP SAR payload (with a 4" resolution) has the capability to penetrate foliage and defeat some D3C2 to detect and display suspected targets.

(3) Far Term. High-range-resolution radar systems with the ability to track and accurately classify moving targets, FOPEN radar systems that can reliably find and track combat vehicles under trees or other vegetation; hyper spectral imagery systems that can not only detect the presence of specific materials on the battlefield (such as, Kevlar), but also reduce the

effectiveness of traditional C3D2 measures and, LIDAR laser ranging, laser radar systems that can form high-resolution, three-dimensional images of suspected targets.

g. Capability of sensors that can detect changes in a 360° spherical area and provide MTI alerts.

(1) Current. AH-64A and OH-58D sensors do not have this capability. The AH-64D FCR has limited capability in the air-targeting mode only. The Airborne Reconnaissance Multisensor System (ARMS is a C-12 aircraft equipped with the enhanced FLIR, laser illuminator/laser designator and near real time full motion video downlink to the multimedia analysis and archive system and the one system remote video terminal (OSRVT). ARMS has a digital pan camera capable of high resolution mapping, change detection, and spatial and spectral filtering that is downloaded post- mission. The system will download still photographs for storage onto the multimedia analysis and archive system work station. Highlighter is a C-12 aircraft equipped with a real time automated, daylight only, change detection system.

(2) Mid Term. ERMP UAS GMTI has a requirement for a 345 degree revisit capability every 30 seconds. ERMP UAS will also have an aided target detection capability to provide an automatic cue to the operator indicating the presence of potential targets within a scene. The aided target detection function will post process near real time SAR imagery. The AH-64D BKIII improved FCR has limited capability in the air targeting mode only.

(3) Far Term. ERMP UAS has an objective requirement for the GMTI to revisit 360 degrees every 10 seconds. The ERMP UAS aided target detection capability will be extended to the EOIR sensor. Aided target recognition and aided target identification will be added to the ERMP system capability providing an automatic aid to the operator to support the recognition and identification of target-like objects detected by the EOIR Laser Designator or SAR GMTI payload.

h. Capability of mine and IED detection sensors for UAS, capable of detection at survivable standoff distances.

(1) Current. No programmed capability.

(2) Mid Term. ERMP UAS capability production document lists the requirement for mine and IED detection as a payload for integration after initial operational capability but before Increment II based on technology development and operational requirements.

(3) Far Term. No programmed improvements.

i. Capability for sensor reduced size, weight, power, and cost reduction (particularly for UAS).

(1) Current. Shadow UAS is equipped with the plug-in optronic 200 and 300 EOIR payload with high resolution thermal imaging, a charge coupled device and color television.

Hunter is equipped with the multipurpose optical stabilized payload with second generation FLIR, color CCD and LRF/D.

(2) Mid Term. Shadow UAS will be upgraded to the plug-in optronic 300 EOIR payload with an improved IR detector providing greater resolution and range. Size and weight (60 pounds) remain the same. ERMP UAS will be fielded with threshold EOIR and SAR GMTI payloads. Maximum allowable weight for the EOIR payload with LRF/D is 155 pounds. Maximum allowable weight for the SAR GMTI payload is 100 pounds. AH-64D BKIII improved FCR and TCDL reduces the weight of the system.

(3) Far Term. Third generation FLIR.

j. Capability of sensors which allow operations in day/night/adverse weather or in the presence of counter measures.

(1) Current. AH-64A TADS and OH-58D MMS allow operations in day, night and limited adverse weather conditions. These are first generation FLIR systems with limitations in terms of range and resolution and performance against countermeasures. The upgrade to the modernized TADS and PNVIS has begun and will be completed by 2012. The AH-64D FCR provides an improved adverse weather targeting capability. The Shadow UAS EOIR payload is an electro-optical target acquisition system with a second generation FLIR thermal imager. The Hunter UAS EOIR payload is an electro-optical target acquisition system with a second generation FLIR thermal imager. The AN/AVS-6 night vision goggle (NVG) provides an image intensification pilotage capability for operations in low light levels. The AH-64D MTADS PNVIS upgrade includes features to allow improved operations day or night.

(2) Mid Term. AH-64A target acquisition designation sight and PNVIS upgraded to MTADS and PNVIS with fused imagery (thermal and image intensification images fused for pilotage) to increase capability to operate at night or in limited adverse weather. ARH-70 fielding (initial operational capability in 2009) continues. ARH-70 TASS second generation FLIR provides improved capability in night and limited adverse weather. ERMP UAS fielding begins during this timeframe. ERMP UAS EOIR payload provides greater range and resolution. The ERMP UAS SAR GMTI provides increased capability to image at night and through weather.

(3) Far Term. No programmed improvements.

k. Capability to conduct aerial armed reconnaissance to produce actionable combat information.

(1) Current. OH-58D performs this role in the current force but has limitations in terms of performance, lethality, interoperability, and survivability. The AH-64, while optimized for attack can also provide this capability.

(2) Mid Term. ARH-70 performance, lethality, interoperability, and survivability requirements provide improved capabilities to address shortcomings and limitations of OH-58D

and provide the threshold capability required. ERMP UAS equipped with an EOIR sensor and armed with Hellfire missiles will perform armed reconnaissance as one of its primary missions.

(3) Far Term. AH-64D BKIII provides improved sensor, interoperability, and performance which contribute to this capability.

l. Capability for LOI 3 and 4 control of unmanned aircraft (MUM teaming).

(1) Current. The HSKT ACTD demonstrated LOI 4 control of a Hunter (RQ-5A) tactical UAS from an AH-64D using aircraft displays, TCDL, and UAS control software hosted in a separate processor.

(2) Mid Term. AH-64D BKIII will have integrated capability for LOI 4 (control of the unmanned aircraft, less takeoffs and landings) control of Standardization Agreement of North Atlantic Treaty Organization-4586 compliant UAS through TCDL. ARH-70 will have integrated capability for LOI 2 (receipt of imagery or data directly from the unmanned aircraft) control of Standardization Agreement of North Atlantic Treaty Organization-4586 compliant UAS through TCDL. ACS will automatically cross-cue its sensors, team with unmanned aerial reconnaissance, surveillance, and target acquisition, and ISR systems to task and cue their sensors, and receive, integrate and correlate data from other joint intelligence systems.

(3) Far Term. ARH-70 will have integrated capability for LOI 4 control of Standardization Agreement of North Atlantic Treaty Organization-4586 compliant UAS through TCDL.

m. Capability to systematically observe geographic areas, facilities, and mobile forces with the ability to observe specific NAI/TAIs continuously or with persistent stare, range to reach any point in division AO; provide a minimum of 24 hour continuous observation; perform wide area search to cue other sensors, conduct emitter mapping, electronic attack, meteorological survey, long endurance wide area surveillance, and network extension.

(1) Current. Shadow UAS has a threshold endurance requirement of four hours on station at 50 kilometers. Constant Hawk is a Sherpa Shorts 360 aircraft equipped with forensic EO daylight-only capability. Constant Hawk employs a very high resolution EO camera set (6 cameras) that images ~6X6 kilometer area. It has tactically employable, wide field of view airborne persistent surveillance capability for interdiction.

(2) Mid Term. ERMP UAS requirement is 24 hours at 300 kilometers with 250 pound payload. ERMP UAS will have a communications package for network extension and is designed to support the warfighter information network-tactical (WIN-T) communications payload when available. ERMP UAS will have a meteorological sensor. ACS will provide day and night all-weather multi-intelligence, airborne collection and analysis capability that will provide assured, timely, accurate, and responsive actionable intelligence support and targetable information to tactical commanders across the full spectrum of military operations.



(3) Far Term. ERMP UAS objective requirement is 24 hours at 500 kilometers with 250 pound payload. The persistent aerial presence (PAP) concept provides an extended duration, wide area surveillance capability for longer periods than traditional aviation assets - weeks to months vs. hours at a time.

n. Capability for a persistent wide area surveillance at altitude for extended (longer than traditional aviation assets) periods of time, to conduct missions such as but not limited by; ISR, network extension, C-RAM, force and convoy protection, base security, meteorological monitoring, and CBRN monitoring.

(1) Current. No programmed capability.

(2) Mid Term. ERMP UAS ‘dwell’ (24 hours at 300 kilometers) exceeds traditional aviation assets but does not achieve the persistence (weeks to months) of the PAP concept.

(3) Far Term. ERMP UAS objective requirement is 24 hours at 500 kilometers with 250 pound payload. The PAP concept provides an aerial presence for longer periods than traditional aviation assets - weeks to months at a time vs. hours.

o. Capability to efficiently utilize the COP in performing reconnaissance and surveillance operations and to quickly report information in COP-compatible formats.

(1) Current. AH-64D and OH-58D receive FBCB2 SA via BFT over SATCOM radio through the L-band frequency range.

(2) Mid Term. Aircraft will have a direct network exchange of C2 and SA with FCS battle command system allowing them to ‘see and be seen’ without requiring a BFT gateway.

(3) Far Term. Aircraft will have a direct network exchange of C2 and SA with FCS battle command system allowing them to ‘see and be seen’ without requiring a BFT gateway.

#### **4-4. Assessment of Strike Related Aviation Enablers**

a. Weapons effects must achieve first round destruction and neutralization of targets with minimal collateral damage and no fratricide. Capability should include nonlethal options and scalability up to lethal level. Damage to target should be sufficiently detectable and assessable to enable accurate and reliable BDA. The effectiveness of aviation reconnaissance, surveillance, and attack operations is limited by our inability to detect and identify targets with low or indistinct signatures or emissions and by the excessive timelines to report information and acquire targets. Aviation weapon systems require sufficient range, lethality, accuracy, and or flexibility to engage diverse target sets in the future operational environment at survivable ranges. Lethal Army forces can combine the elements of combat power to provide overwhelming and decisive force at the right time, at the right place, and for the right purpose.

b. Table 4-3 depicts the current, mid term and far term assessment of aviation enablers that support the strike functional concept.

**Table 4-3  
Aviation Strike Capability Migration Plan**

<b>Strike Aviation Enablers</b>			
<b>Enabling Capability Needs</b>	<b>Current Enablers FY 07-09</b>	<b>Mid Term Enablers Migration 10-15</b>	<b>Far Term Enablers Migration 16-24</b>
c. Capability of air-to-ground weapons to provide lethal overmatch against the anticipated target set.	- Cannon machine gun - Unguided rocket - Hellfire II - Longbow Hellfire - Viper Strike	- Guided rocket - joint air to ground missile (JAGM)	- 30millimeter airburst ammunition - Directed energy - Scalable effects (lethal to nonlethal)
d. Capability to defeat anticipated target set in C3D2 environment.	- AH-64A TADS - AH-64D FCR - OH-58D MMS - Shadow UAS EOIR Payload - Hunter EOIR payload - AH-64D MTADS	- ARH-70 TASS - ERMP UAS EOIR payload - AH-64D MTADS - ERMP UAS SAR payload	- AH-64D FCR extended range performance - Automatic aided target recognition, detection, classification - Maritime target mode - Multimode laser - RFI Frequency Extension - Image fusion - Cognitive decision aiding System - Third generation FLIR
e. Capability of air-to-ground weapons that defeat countermeasure resistant seekers/warheads.	- Hellfire II - Longbow Hellfire with home on jam and counter active protection systems upgrades	- JAGM	- Home on jam seekers and capability to regain target track after break-lock.
f. Capability to provide increased precision for guided and unguided munitions. Improved (reduced) target location error to enable successful weapon delivery, designation or target handover.	- TAD MMS and laser designator EGI - FCR - Shadow UAS	- ERMP UAS - AH-64D MDSA	- Covert lower probability of intercept and detection laser designation and target illuminations and cueing - Lightweight directed energy systems outside the visible or NVG wave band.
g. Capability for extended range weapon systems to enable survivable standoff from threat.	- Cannon machine gun - Unguided rocket - Hellfire II - Longbow Hellfire - Viper Strike	- JAGM - Advanced precision kill weapon system (APKWS)	- DEW
h. Capability of air-to-ground weapons to provide scaleable effects (lethal to nonlethal).			- DEW
i. Capability of air-to-ground weapons to provide flexibility (additional weapon types and mixes).	- Cannon machine gun - Unguided rocket - Hellfire II - Longbow Hellfire - Viper Strike	- Guided rocket (such as, APKWS) - JAGM - ERMP UAS Hellfire - Means for counter sensors and target acquisition systems	- DEW - Expanded wing store configurations - Increased weapon attach points and weight limits - Counter sniper detection, jamming and suppression or engagements
j. Capability of air-to-ground weapons to provide both LOS and BLOS engagement capabilities.	- Hellfire II - Longbow Hellfire	- JAGM	- Weaponized UAS including flight agile wing store attack UAS. - Loitering precision guided munitions (PGM) and arsenal UAS (large payload UAS

			with array of highly agile and responsive munitions)
k. Capability of air-to-ground weapons to provide passive targeting and engagement to minimize munition and launch platform detection and countermeasure.		- JAGM - AH-64D RFI	- FCR counter-countermeasures - Miniature PGMs with multifunction and scalable effects Low cost munitions
l. Capability for man-in-the-loop, BLOS weapon control.			- JAGM (Increment II)
m. Capability for single variant, precision air-to-ground munition, interoperable between both rotary wing and UAS platforms, providing both MITL precision terminal control after launch as well as through the weather fire and forget capability, with multi-mode weapon effects scaleable for defeat of all targets in the anticipated target set.		- JAGM	- Air-to-air weapons including Counter UAS PGMs - Team protection and lethality including automated, team based avenge kill once targeted or engaged (includes engagement detection, threat locator, fire control coordination and cooperative suppression and engagement BDA
n. Capability for direct access to Army and joint fire delivery systems from external sources to provide extended range, networked, responsive precision or volume fires on demand in support of tactical maneuver. Be able to provide and/or integrate CAS on demand.	- Voice only private net	- Tier 3 FCS battle command Interoperability for Attack and Reconnaissance - AH-64D BKIII Joint Tactical Radio System (Link 16)	- Tier 3 FCS battle command Interoperability for all aviation platforms (adds cargo and utility)
o. Capability for smaller, lighter and cheaper PGMs and munitions	- Viper Strike	- JAGM - APKWS	- SAGE (small, aimable guided explosive) concept munition
p. Capability for target acquisition and identification at or beyond the range of the tactically preferred weapon.	- AH-64A TADS - OH-58D MMS - AH-64A FCR - Hunter EOIR payload - Shadow UAS EOIR Payload - AH-64D MTADS - AH-64D FCR	- AH-64D MTADS - AH-64D FCR extended range performance - ARH-70 TASS - ERMP UAS EOIR payload - Radio based combat identification - AH-64D MDSA	- Third generation FLIR - Advanced focal plane array technology - Gated laser illumination for long range targeting, identification, and BDA. - Gated illumination for precise target identification and engagement in limited obscured conditions
q. Capability for LOI 3 and 4 control of unmanned aircraft for manned and unmanned teaming.	-HSKT ACTD	- AH-64D BKIII LOI 4 control of UAS - ARH-70 LOI 2 control of UAS	- ARH-70 LOI 4 control of UAS - Unmanned autonomous collaborative operations
r. Capability for reduced acquisition and engagement timelines.	- AH-64A TADS - MMS - Shadow UAS EOIR - Hunter UAS - AH-64D FCR - AH-64D MTADS	- TASS - ERMP UAS EOIR payload - Shadow UAS EOIR with Laser Designator - AH-64D BKIII Improved FCR	- Automatic aided target recognition detection, classification - AH-64D BKIII cognitive decision aiding - FLIR based MTI for military like targets, foliage penetration sensors
s. Capability for ASE to	- AN/ALQ-136	- AN/ALQ-136	- SIIRCM

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allow weapon delivery from higher altitudes.	- AN/ALQ-144 - AN/APR-39 <sup>8</sup> - CMWS - AH-64D RFI	- AN/APR-39 - Suite of Integrated Infrared Countermeasures (SIIRCM) - AH-64D Improved RFI	- 4 <sup>th</sup> generation SAM countermeasures (concept)
t. Capability for weapons system reliability/maintainability	- Hellfire II - Longbow Hellfire - Unguided rocket	- JAGM - APKWS	
u. Capability for modularity and reprogrammability	- Hellfire II - Longbow Hellfire	- JAGM	
v. Capability to improve BDA to prevent unneeded re-attack and conserve weapons.	- AH-64D Shot at files	- AH-64D auto BDA formatting	- JAGM (Increment II) MITL BLOS guidance - AH-64D BKIII cognitive decision aiding - MUM teaming collaborative BDA with multi-spectral sensors
w. Capability of reconnaissance and attack aircraft to receive air threat warning, alerting and cueing information and detect, correctly identify and defeat low, slow flying UAS and rotary wing threats as a secondary mission.	- Caliber.50 machine gun - M230 cannon - Air-to-air Stinger - Hellfire II - Longbow Hellfire	- FCR air targeting mode - JAGM	
x. Capability for reduced cost, multipurpose weapons, and launchers.		- JAGM - APKWS - Lightweight missile and rocket launcher	
y. Capability to correctly identify (95% probability) of detected friendly objects/entities.	- AH-64A TADS - OH-58D MMS - Hunter EOIR payload - Shadow UAS EOIR payload - AH-64D MTADS	- Radio based combat identification - Soldier radio waveform (SRW) position location information	
z. Capability for networked links to other joint and Army fires and ISR assets.	- AN/ARC 201D Single Channel Ground and Airborne Radio System (SINCGARS) - AN/ARC 162 HAVEQUICK (Not networked)	- JTRS with WNW or SRW - Link 16	- FCS battle command

c. Capability of air-to-ground weapons to provide lethal overmatch against the anticipated target set.

(1) Current. OH-58D is armed with the M296 caliber .50 machine gun effective against personnel and light vehicles. The AH-64 M230 30-millimeter cannon is effective against personnel and lightly armored vehicles. Viper Strike provides a relatively lightweight air dropped munition for smaller UAS that is effective against soft and armored targets. The Hellfire missile with tandem (precursor and main charge) shaped charge warhead is effective against the traditional target set (armored vehicles to include those with explosive reactive appliqué). Hellfire with blast and fragmentation warhead is effective against targets in the non-traditional target set. Unguided rocket warheads include high explosive, antipersonnel (Flechette), and antiarmor (multipurpose submunition).

<sup>8</sup> A is piloted aircraft, p is radar, and r is receiver. It is the nomenclature of the radar.

(2) Mid Term. ARH-70 will be equipped with the GAU-19-caliber .50 machine gun that provides an increased rate of fire and improved reliability over the M296. Army aviation has documented a requirement for a semi-active laser (SAL) guided rocket. Increment I capabilities include improved insensitive munitions compliance. Increment II includes improved warhead performance. The APKWS guided rocket concept would provide improved insensitive munition compliance and improved high explosive warhead performance. JAGM has a multipurpose warhead effective against the range of targets in the anticipated target set eliminating need for missile warhead variant mix and reducing the logistics and operational planning burden.

(3) Far Term. AH-64D BKIII has objective requirement to accommodate the 30 millimeter airburst round. Aviation has a capability gap for non lethal weapon options and for scalable effects (lethal to nonlethal). Directed energy weapons such as tactical lasers might be made suitable for aircraft application in this time frame.

d. Capability to defeat anticipated target set in C3D2 environment.

(1) Current. Current EOIR targeting sensors on rotary wing and UAS have limitations due to susceptibility to C3D2 countermeasures.

(2) Mid Term. AH-64D MTADS, ARH-70 TASS and the ERMP UAS EOIR payload have greater range and resolution with second generation FLIR detectors that provide improved performance against targets in a C3D2 environment. ERMP UAS SAR has the ability to see through some C3D2 and can display images of suspected targets.

(3) Far Term. No programmed improvements.

e. Capability of air-to-ground weapons that defeat countermeasure resistant seekers and warheads.

(1) Current. The air to ground missile (AGM)-114K Hellfire II provides increased counter measure resistance over basic Hellfire. It has a tandem (precursor and main charge) warhead for defeat of explosive reactive appliqué and reprogrammability features that permit varying attack profiles. The AGM-114L Longbow Hellfire home on jam software revision changes guidance logic to improve effectiveness against self-screening and standoff jammers. Longbow Hellfire counter active protection system upgrade includes hardware and software to provide active counter-countermeasures for the missile.

(2) Mid Term. The JAGM multi-sensor seeker provides both active and passive engagement capability and greatly improved performance against threat active protection systems and defensive aids suites. JAGM employs a tandem (precursor and multipurpose main charge) warhead to defeat threat third generation explosive reactive appliqué.

(3) Far Term. No programmed improvements.

f. Capability to provide increased precision for guided and unguided munitions. Reduced target location error to enable successful weapon delivery, designation or target handover.

(1) Current. AH-64A and OH-58D have on board EGI systems that are used in combination with the EO targeting system and LRF/D to locate targets with sufficient accuracy for target handover and transfer alignment of inertial coordinates. The AH-64D FCR locate targets with sufficient accuracy for target handover and transfer alignment of inertial coordinates. Shadow UAS EOIR payload target location accuracy requirement is better than 80 meters.

(2) Mid Term. ERMP UAS target location accuracy will be 25 meters circular error probable. The Shadow SAR payload (objective requirement) is also target accuracy better than 80 meter. MDSA is planned for AH-64D and BKIII.

(3) Far Term. ERMP target location accuracy will be 5-meter circular error probable or less from a slant range of 10 kilometers from 8,000 feet above ground level up to 20,000 feet above ground level. No other required or programmed improvements in target location error.

g. Capability for extended range weapon systems to enable survivable standoff from threat.

(1) Current. AH-64 armament includes a turreted 30mm cannon, 2.75 inch unguided rockets with a mix of warheads and both semi-active laser (SAL) and RF guided Longbow Hellfire AGM. There are two warhead variants for SAL guided Hellfire, an antiarmor shaped charge warhead and a delayed fuze, blast and fragmentation warhead for non traditional targets. OH-58D armament includes a fixed caliber .50 machine gun, unguided rockets, and SAL Hellfire missiles. OH-58D is also capable of employing the air-to-air Stinger (ATAS) system against aerial targets. The Hunter UAS has demonstrated employment of the Viper Strike, a SAL guided brilliant antiarmor technology submunition.

(2) Mid Term. The JAGM is intended as an eventual replacement for Hellfire, tube-launched optically-tracked wire-guided, and Maverick missiles for use on helicopters, UAS, and fixed wing fighters. It will have advanced seeker and guidance technologies combining multiple sensors to improve targeting and resistance to enemy countermeasures, and a multipurpose warhead to defeat both heavy armored vehicles and non traditional targets. JAGM will provide extended range to improve platform standoff, survivability, and lethality. The APKWS is an upgraded 2.75 inch rocket with a SAL guidance package to provide a point engagement capability at greater range than is possible with the unguided rocket.

(3) Far Term. DEWs, such as tactical lasers, might be made suitable for aircraft application in this time frame.

h. Capability of air to ground weapons to provide scalable effects (lethal to nonlethal).

(1) Current. No programmed capability.

(2) Mid Term. No programmed capability.

(3) Far Term. Aviation has a capability gap for nonlethal weapon options and for scalable effects (lethal to nonlethal). DEWs, such as tactical lasers, might be made suitable for aircraft application in this time frame.

i. Capability of air to ground weapons to provide flexibility (additional weapon types and mixes).

(1) Current. AH-64 armament includes a turreted 30mm cannon, 2.75 inch unguided rockets with a mix of warheads and both SAL and RF guided Longbow Hellfire AGM. OH-58D armament includes a fixed caliber .50 machine gun, unguided rockets and SAL Hellfire missiles. OH-58D is capable of employing the ATAS system against aerial targets. The Hunter UAS has demonstrated employment of the Viper Strike, a SAL guided brilliant antiarmor technology submunition.

(2) Mid Term. ARH-70 armament will include fixed caliber .50 machine gun, unguided and guided (such as the APKWS) rockets and SAL Hellfire missiles. ERMP UAS will be capable of employing SAL Hellfire P+ AGM. The JAGM reaches initial operational capability in 2015 and is backward compatible with all Hellfire platforms.

(3) Far Term. Directed energy weapons such as tactical lasers might be made suitable for aircraft application in this time frame. Aviation has identified expanded wing store configurations and increased weapon attach points and weight limits as a capability need for attack helicopters to facilitate additional weapon types and quantities.

j. Capability of air-to-ground weapons to provide both LOS and BLOS engagement capabilities.

(1) Current. Hellfire provides precision point LOS engagement capability. Longbow Hellfire provides an autonomous fire and forget LOS and BLOS engagement capability.

(2) Mid Term. JAGM will provide both precision point and fire and forget LOS and autonomous fire and forget BLOS capability.

(3) Far Term. JAGM increment II has a requirement for MITL BLOS targeting capability.

k. Capability of air to ground weapons to provide passive targeting and engagement to minimize munition and launch platform detection and countermeasure.

(1) Current. Current EO targeting sensors are passive but Hellfire missile uses active (emitting) guidance.

(2) Mid Term. JAGM has a passive targeting capability – neither launching aircraft, cooperating platform nor missile seeker emit search, acquisition or homing signals that could be detected by threat warning receivers. AH-64D BKIII will have improved RFI.

(3) Far Term. AH-64D BKIII has an objective requirement for counter-countermeasure capability for FCR.

l. Capability for MITL, BLOS weapon control. MITL BLOS targeting provides a capability for the operator to guide the weapon in BLOS engagements to the maximum range of the weapon using missile seeker images for target acquisition, target strike confirmation, and battle damage assessment.

(1) Current. Current suite of weapons does not provide this capability.

(2) Mid Term. JAGM increment I does not provide this capability.

(3) Far Term. MITL BLOS capability is defined in the joint common missile (JCM) capability development document as a capability to be provided in a follow on increment. The capabilities defined for the JCM have been renamed JAGM in the wake of JCM program termination. The JAGM program increment I will be fielded in approximately 2015, so an increment II MITL BLOS might be fielded late in the far term.

m. Capability for a single variant, precision air to ground munition, interoperable between both rotary wing and UAS platforms, providing both MITL precision terminal control after launch as well as through the weather fire and forget capability, with multi-mode weapon effects scaleable for defeat of all targets in the anticipated target set.

(1) Current. Hellfire provides a portion of the capability with number of single mode variants optimized for specific environmental and target conditions; four SAL variants of Hellfire (AGM-114F, 114K, 114M, and 114N) and the RF guided AGM-114L Longbow Hellfire are employed to provide the required MITL precision terminal control after launch and through the weather fire and forget targeting capabilities and the traditional (armored vehicles) and non traditional<sup>9</sup> target effects. Hellfire is not interoperable or employable from UAS without software and hardware modifications.

(2) Mid Term. JAGM provides a common, multi-mode weapon capable of providing required targeting and weapons effects in a single variant interoperable with all joint and Army platforms. ERMP UAS will utilize a modified 114K Hellfire missile which will permit a greater engagement area than a standard Hellfire.

(3) Far Term. JAGM increment II has a requirement for MITL, beyond line of sight guidance that capability for the operator to guide the weapon in BLOS engagements to the maximum range of the weapon using missile seeker images for target acquisition, target strike confirmation and BDA.

n. Capability for direct access to joint and Army fire delivery systems from external sources to provide extended range, networked, responsive precision or volume fires on demand in support of tactical maneuver. Be able to provide and or integrate CAS on demand.

(1) Current. Exchanges with Army fire delivery systems are via voice-only private indirect fire nets.

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<sup>9</sup> USMC Urgent Need Statements (Jun/Jul 00); Change 4 to HELLFIRE Materiel Need



(2) Mid Term. Integration of FCS battle command on attack and reconnaissance aircraft will permit direct digital exchange with Army fire delivery systems. JTRS with Link 16 permits direct exchange with joint CAS platforms.

(3) Far Term. Integration of FCS battle command on cargo and utility aircraft will permit direct digital exchange with Army fire delivery systems.

o. Capability for smaller, lighter and cheaper munitions that provide improved aircraft performance margin, range and endurance, increased stowed kills, and allow employment of precision munitions in a greater percentage of engagements, reducing the potential for fratricide and collateral damage.

(1) Current. Viper Strike provides a relatively lightweight and low cost air dropped munition for smaller UAS that is effective against soft and armored targets.

(2) Mid Term. JAGM will result in cost efficiencies by replacing a number of Hellfire variants with a single weapon providing all required capabilities.

(3) Far Term. Small, lightweight precision munitions – example is the SAGE small missile concept for Shadow class UAS. SAGE concept describes notional attributes such as a 1.5 inch diameter, 18 inch length, 5 pound total weight missile with 1 pound blast and fragmentation warhead, and SAL seeker.

p. Capability for target acquisition and identification at or beyond the range of the tactically preferred weapon.

(1) Current. Targets can be acquired at or beyond the range of the tactically preferred weapon (gun, rocket, or AGM). However, AH-64 TADS or OH-58D MMS first generation FLIR targeting systems cannot perform target identification beyond the employment range of the gun (for example, caliber .50 machine gun or 30 millimeter cannon). The AH-64D has MTADS.

(2) Mid Term. MTADS can perform target identification from beyond twice the range of the first generation TADS and supports targeting at the minimum of typical Hellfire engagement ranges. AH-64 FCR extended range performance upgrade will provide the capability to engage autonomously targets at extended ranges. The ARH-70 TASS can perform target identification at the minimum of typical Hellfire engagement ranges. ERMP UAS will identify a standard military target from its operational altitude at maximum typical Hellfire engagement ranges.

(3) Far Term. The AH-64 FCR extended range performance upgrade will provide the capability to engage autonomously targets at extended ranges but the FCR does not perform target identification (classification only). The gap is the lack of target identification and classification capability to engage autonomously targets at extended ranges. Third generation FLIR advanced focal plane array technology will provide a more advanced generation of IR imaging sensors, which take advantage of advanced large staring focal plane arrays.

q. Capability for LOI 3 and 4 control of unmanned aircraft for MUM teaming.

(1) Current. The HSKT ACTD demonstrated LOI 3 and LOI 4 control of a RQ-5A Hunter Tactical UAS from an AH-64D using TCDL and aircraft displays and UAS control software hosted in a separate processor.

(2) Mid Term. AH-64D BKIII will have integrated capability for LOI 4 (control of the unmanned aircraft, less takeoffs and landings) control of Standardization Agreement North American Treaty Organization 4586 compliant UAS through TCDL. ARH-70 will have integrated capability for LOI 2 (receipt of imagery or data directly from the unmanned aircraft) control of Standardization Agreement North American Treaty Organization 4586 compliant UAS through TCDL.

(3) Far Term. ARH-70 will have integrated capability for LOI 3 and 4 control of UAS.

r. Capability for reduced acquisition and engagement timelines.

(1) Current. AH-64A TADS and OH-58D Warrior MMS provide capability for manual search and manual and automatic target tracking. AH-64D has a FCR and MTADS.

(2) Mid Term. AH-64D BKIII has a requirement for electro-optical aided target detection and classification that is programmable by the crew to display targets in an order of priority established by the crew and improved FCR. ARH-70 has requirement for open system architecture in order to facilitate integration of emerging technologies such as automatic and aided target algorithms.

(3) Far Term. AH-64D BKIII cognitive decision aiding.

s. Capability for ASE to allow weapon delivery from higher altitudes.

(1) Current. The current suite of ASE includes:

(a) AN/ALQ-136<sup>10</sup>: automatic, electronic radar jammer designed to defeat and degrade the tracking capability of hostile threat pulse radar.

(b) AN/ALQ-144: is an omni-directional active IR countermeasures set which protects the aircraft from air-to-air and ground-to-air IR missiles.

(c) AN/APR-39: radar-warning device that detects, characterizes, and identifies pulsed radar signals and provides alert to the existence of emitters to the crew.

(d) AN/AAR-57: common missile warning system is the detection component of the SIIRCM. It detects incoming missiles, provides warning to the crew, and dispenses countermeasures.

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<sup>10</sup> Army/Navy (AN) A is piloted aircraft, L is countermeasures, Q is combination.

(e) AH-64D RFI.

(2) Mid Term. SIIRCM will provide a next generation lamp and laser jammer, coupled with the CMWS, advanced flare dispenser, and flare munition. AH-64D BKIII improved RFI.

(3) Far Term. Forth generation surface to air missile countermeasures (concept).

t. Capability for weapons system reliability and maintainability.

(1) Current. Hellfire has a threshold in flight reliability requirement of 92 percent with an objective of 95 percent. Unguided rocket reliability has historically been 99 percent.

(2) Mid Term. JAGM reliability (based upon JCM requirement) is 94 percent at system maturity, with an objective of 96 percent. APKWS guided reliability requirement is 94 percent.

(3) Far Term. No programmed improvement.

u. Capability for modularity and reprogrammability.

(1) Current. Hellfire II and Longbow Hellfire have limited modularity in design making replacement of shelf life limiting components or technology insertion difficult. Hellfire II does have reprogrammability features to permit varying attack profiles and trajectories.

(2) Mid Term. The JAGM (based upon JCM requirement) will utilize modularity in software and subsystem design such as, but not limited to, the warhead, guidance, control, and propulsion sections, and any shelf life limited components to provide for shelf life extension and to enable technology insertion for future required capabilities, and will be reprogrammable in theater to provide a capability to upgrade software to improve performance and react to changes in threats without returning the missile to depot.

(3) Far Term. No programmed improvement.

v. Capability for accurate and timely BDA to prevent unneeded re-attack and conserve weapons.

(1) Current. AH-64 creates a 'shot at file' storing the location of targets that have been previously engaged with Hellfire.

(2) Mid Term. AH-64D BKIII will have automatic BDA formatting to format automatically all targets identified as shot at by the crew for BDA reporting from the BDA file.

(3) Far Term. AH-64D BKIII cognitive decision aiding.

w. Capability of reconnaissance and attack aircraft to defeat low, slow flying UAS and rotary wing threats as a secondary mission.

(1) Current. OH-58D is capable of employing the ATAS system against aerial targets. The AH-64A/D (or OH-58D) has a limited capability against slow flying UAS or rotary wing threats with Hellfire.

(2) Mid Term. AH-64D FCR air targeting mode improvements will provide an improved targeting capability against aerial targets. The JAGM has improved capabilities against aerial targets.

(3) Far Term. No programmed improvement.

x. Capability for reduced cost, multipurpose weapons and launchers.

(1) Current. The current AGM inventory is comprised of a number of single mode missiles optimized for specific environmental and target conditions.

(2) Mid Term. The JAGM will provide a common, multi-mode weapon capable of providing both current and future aviation platforms with reactive targeting capabilities exceeding that of HELLFIRE and eliminating the need to address upgrades to each of the existing individual missile variants separately. The APKWS requirement places a SAL guidance system on a 2.75” rocket to provide greater precision than unguided rockets at lower cost than an air-to-ground missile. The lightweight missile and rocket launcher is a direct replacement for the M299 Hellfire Launcher that would provide weight savings across all the MIL-STD-1760 compliant DOD rotary wing and UAS platforms, which currently employ Hellfire M299 launchers in 4 rail (holds four missiles), 2 rail (holds two missiles), and UAS variants. The lightweight missile and rocket launcher is modular so that the electronics could include rocket specific software and the structure could carry missile rail or rocket pod (for example, the lightweight missile and rocket launcher).

(3) Far Term. No programmed improvement.

y. Capability to correctly identify detected friendly objects and entities with a 95 percent probability.

(1) Current. The Joint Air-to-Ground Combat Identification Study found that only a few platforms ever meet this threshold capability. AH-64A TADS, OH-58D MMS, Hunter EOIR payload, Shadow UAS EOIR payload all have limitations in achieving the prescribed probability for correct identification. Apache MTADS provides significantly improved target identification capability over TADS.

(2) Mid Term. Radio based combat identification is a software upgrade to SINCGARS radios providing a GPS based cooperative target identification capability integrated with on board processors and targeting systems to provide 95 percent probability of identification in approximately two seconds.

(3) Far Term. No programmed improvement.

z. Capability for networked links to other Army and joint fires and ISR assets

(1) Current. Voice only nets using AN/ARC 201D SINCGARS for indirect fires or AN/ARC 162 and ARC231 HAVEQUICK for coordination of CAS and other joint fires – these nets are not networked.

(2) Mid Term. The JTRS with WNW or SRW may be able to provide networked links to Army and joint fires. Link 16 is capable of networked links to joint fires.

(3) Far Term. In the far term, aviation will integrate Tier III FCS battle command interoperability providing fully networked links to Army and joint fires and ISR assets.

#### **4-5. Assessment of Battle Command Related Aviation Enablers**

a. Information superiority is the advantage derived from the ability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same. The CAB is equipped with the ABCS providing significant advantages in sharing technical information and intelligence rapidly. The ABCS satisfies two critical battle command requirements: interoperability and SA. ABCS employs networks that are interoperable with theater, joint, and combined C2 systems. Effective communications are required during all aviation activities and in the presence of jamming and other countermeasures. Manned aircraft, UAS, and ATS systems must have joint, combined arms, and multinational force interoperable communications (voice, data, and imagery) during all flight modes and aviation operations. On-board, on-system LOS, NLOS communications must be multi-mode, multi-band, reliable, possess a low probability of intercept, provide a jam-resistant capability, be hardened against virtually any source of electronic countermeasures, and operate in both secure and non-secure modes.

b. Use of the communications system must not significantly increase aircrew, ATC and UAS operator workloads nor degrade/interfere with their ability to maintain SA, fly the aircraft or service the airspace and execute the mission. Communication systems must be compatible with future modular force battle command system requirements, to include an on-the-move C2 capability. Communication systems (to include antennas and mounts) must be high efficiency, lightweight, and multi-spectral, to enable over the horizon control and information transfer for UAS, ATS, and reconnaissance and surveillance missions through satellite links. Communications must provide sufficient bandwidth and speed to maintain up to LOI 4 control of UAS, video sharing and a real time air picture. ATS operations must be accomplished in day, night, and adverse weather and obscured visibility conditions. The airspace environment will include friendly, threat, and noncombatant aerial systems as well as airborne munitions (artillery, rockets, missiles, and others).

c. ATS system must be capable of providing effective and responsive airspace management and ATC in a complex, rapidly changing, evolving, and crowded airspace. ATS systems must maintain shared SA and SU by integrating with other Army and joint sensors. The systems must be integrated with capabilities that reduce the logistics burden during deployment and sustained operations. All JIM users of airspace must be accounted for, managed, and synchronized. Army

Aviation has a complex challenge in acquiring automated battle command capabilities not only for the command post and ground platforms but also the air platforms; both manned and unmanned.

d. Table 4-4 depicts the current, mid term and far term assessment of aviation enablers that support the *Battle Command* functional concept.

**Table 4-4  
Battle Command Capability Migration Plan**

<b>Battle Command Aviation Enablers</b>			
<b>Enabling Capability Needs</b>	<b>Current Enablers FY 07-09</b>	<b>Mid Term Enablers Migration 10-15</b>	<b>Far Term Enablers Migration 16-24</b>
<p><b><u>TRANSPORT</u></b>                      e. Capability to access a pervasive, extended range, intertheater and intratheater global NLOS network extension capability and communicate between noncontiguous forces at the halt, at the quick halt, and on the move. Communications include data, voice, imagery, video.</p> <p>- Manned and unmanned aircraft, need to be to be self reporting and have joint, combined arms, and multinational force interoperable communications (voice, data, and imagery) during all flight modes and at extended ranges to include NLOS.</p> <p>- Access space links and processors enabling joint BFT and SA awareness worldwide.</p>	<ul style="list-style-type: none"> <li>- FBCB2</li> <li>- Joint network node (JNN) and CP node at brigade CP</li> <li>- Battalion CP node at battalion CP</li> <li>- BFT L-band SATCOM, multi-band voice radios (include ultra-high frequency (UHF) SATCOM, high frequency)</li> <li>- Mode 5/S identification friend or foe (IFF) (lethal Interrogation)</li> </ul>	<ul style="list-style-type: none"> <li>- JTRS, service orientated architecture</li> <li>- BFT L-band SATCOM, multi-band voice radios, TCDL</li> <li>- Link 16 airborne networking waveform</li> <li>- SRW</li> <li>- WNW</li> <li>- MOUS</li> </ul>	<ul style="list-style-type: none"> <li>- FCS-battle command</li> <li>- Net enabled command capability (NECC)</li> <li>- WIN-T</li> </ul>
<p><b><u>APPLICATIONS</u></b>                      f. Capability to access a single integrated ABCS, joint capable to the lowest levels that is backward and forward compatible with JIM and coalition forces.</p> <p>- Network that provides decision making tools to accelerate the MDMP and mission execution.</p> <p>- Access to a single integrated ABCS joint capable to the lowest levels that is backward</p>	<ul style="list-style-type: none"> <li>- Global Command and Control System Army (GCCS-A) ABCS, Command post of the future , FBCB2</li> <li>- FBCB2-air</li> <li>- Aviation Mission Planning System (AMPS)</li> </ul>	<ul style="list-style-type: none"> <li>- SOSCOE</li> <li>- JTRS</li> </ul>	<ul style="list-style-type: none"> <li>- FCS battle command</li> <li>- NECC</li> <li>- WIN-T</li> </ul>

<p>and forward compatible with JIM and coalition forces.</p> <p>- Multiple sensor and information fusion, multi-spectral sensor cross cuing to, share, push, pull and update the tactical knowledge base from a wide variety of sensors and access to that information simultaneously from multiple noncontiguous locations. Requires the capability to make information available down to small, highly dispersed units and teams, and dynamically retask units and platforms (near real time) with improved SA, SU and a COP.</p>			
<p><b>SERVICES</b></p> <p>g. Capability to access sufficient bandwidth/bit rate capacity to meet all network needs for example, tactical internet, fire support net, private net (targeting) and reconnaissance/surveillance reporting requirements to maintain up to LOI 4 control of UAS.</p>	<p>- Tactical Internet (such as, BFT), private net (targeting), fire support net                      - Joint network management system program.                      - Coalition joint spectrum management planning tool</p>	<p>- Tactical Internet (such as, BFT), private net (targeting) fire support net, UAS imagery exchange                      - SOSCOE                      - WIN-T spectrum management tool</p>	<p>- Tactical Internet (such as, BFT), FCS network, UAS imagery exchange                      - Global Electromagnetic Spectrum Information System (GEMSIS)                      - WIN-T network management</p>
<p>h. Capability to conduct en route mission planning and rehearsals both intertheater and intratheater utilizing the network-enabled battle command system and collaborative capable network.</p>	<p>- Aviation combined arms tactical trainer - aviation (AVCATT-A) reconfigurable manned simulator                      - AH-64D Longbow crew trainer)                      - The secure en route communications Package-Improved (SECOMP-I)</p>		
<p>i. Capable efficient network services and communication systems-compatible protocols to ensure high priority messages are received with minimum latency for all participating systems.</p>	<p>- Border gateway protocol                      - BFT network control, information system control</p>		<p>- SOSCOE)                      - WIN-T network management.</p>
<p>j. Capable protocols for controlling UAS from any C2-like terminal.</p> <p>-Capability to conduct over the horizon control and information transfer for UAS and aviation reconnaissance/surveillance missions through satellite links (LOI 3 and 4 control)</p>		<p>- TCDL                      - Ku wideband SATCOM                      - MOUS</p>	<p>- FCS networking data link (such as, SRW)</p>
<p>k. Capability for UAS common and standardized</p>		<p>- One system remote video transceiver</p>	<p>- FCS launch control unit                      - Interoperable ground control</p>

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control architectures and interfaces for ground control stations.			stations capable of controlling multiple platforms of various types through in a system network
l. Capability for 4-dimensional visual airspace planning and real time airspace deconfliction.	- Tactical Airspace Integrations System (TAIS) with air picture		- Multifunctional air traffic service (ATS) platform - FCS - NECC - Space or high altitude sensor to enable NLOS AC2 and ATS
m. Capability for network interoperable communications of airborne platforms with ATS.	- Tactical Terminal Control System (TTCS) - TAIS - Air Traffic Navigation, Integration, and Coordination System (ATNAVICs) - Traffic Alert and Collision Avoidance System (TCAS)	- Mobile Tower System (MOTS) with JTRS - TAIS with JTRS - TTCS with JTRS - ATNAVICs with JTRS	- Multifunctional ATS Platform with JTRS - Space or airborne capability to enable NLOS communications
n. Capability for lighter more deployable ATS systems.	- TTCS - TAIS - ATNAVICs	- MOTS	- Multifunctional ATS Platform on joint light tactical vehicle with man-pack JPALS
o. Capability for tailorable ATS displays and more efficient controls and interfaces.	- TTCS - TAIS - ATNAVICs	- MOTS	- Multifunctional ATS platform - FCS - NECC - Joint battle command platform
p. Capability for ATS controller workload reduction and automation features.	- TTCS - TAIS - ATNAVICs	- MOTS	- Multifunctional ATS platform
q. Capability for seamless, passive non-cooperative ATS interrogation of air platforms.	- Mode 5 IFF (lethal interrogation)		- Multi-functional ATS Platform - Future Integrated Air Picture - Space or high altitude sensor to enable NLOS AC2 and ATS
r. Capability for ATS ability to maintain controller visual cues in limited visibility and adverse weather conditions.			- Multifunctional ATS platform
s. Capability to generate ATS self-surveying and TERPs generating capability.			- Multifunctional ATS platform
t. Capability for ATS accident/incident voice and data recording.	- TAIS - ATNAVICs	- MOTS - TTCS	- Multifunctional ATS platform
<i>* Note for Space battle command enabler see TRADOC Pamphlet 525-7-4</i>	<i>* Note for Space battle command enablers see TRADOC Pamphlet 525-7-4</i>	<i>* Note for Space battle command enablers see TRADOC Pamphlet 525-7-4</i>	<i>* Note for Space battle command enablers see TRADOC Pamphlet 525-7-4</i>

e. Capability to access a pervasive, extended range, intertheater and intratheater global NLOS communications relay capability and communicate between noncontiguous forces at the halt, at the quick halt and on the move. Communications include data, voice, imagery, and video.

(1) Current



(a) FBCB2 is the mobile information system (INFOSYS) that provides a battle command capability for units operating at the tactical level. FBCB2 integrates with the ABCS subsystems, and can transmit SA and provide C2 messaging. All Army brigades have FBCB2. The aviation brigade uses combat net radios primarily for voice C2 and secondarily for data transmission providing private nets for targeting that cannot be accommodated on the tactical internet. The most prevalent frequency modulation radio for the brigade, battalions, companies, and platforms is the SINCGARS family of radios. SINCGARS is used for short-range, secure voice communications. Based upon LOS it has a planning range of 35 to 40 kilometers. FBCB2 BFT uses SATCOM. Network software enables both terrestrial and BFT nets to share SA. The fielding of encryption software will enable the exchange of C2 messaging between terrestrial and BFT units and platforms. AH-64 and OH-58D receive FBCB2 SA via BFT over L-band SATCOM radio.

(b) The JNN suite of equipment is the network enabler fielded to provide timely, network enabled support to tactical modular formations. The JNN provides Aviation Brigade and Battalion connectivity to the GIG. The major components of the JNN are the network service centers (fixed, mobile, and tactical) and the JNN versions (V) 1 to 3. The network service center and JNN (V3) are found only at corps level. Primarily, the JNN (V1) is fielded to the battalion level headquarters; but it can be used to augment CPs at other echelons. The JNN (V1) operates in the time demand multiple access (TDMA) satellite architecture providing secret data and voice over internet protocol phone services. This architecture enables the battalion data network to connect to the JNN (V2) and network service centers. JNN (V1) uses Ku band SATCOM and a commercial very small aperture terminal technology, which is man portable. The JNN (V2) is the communications package deployed at the BCT and division levels. The JNN (V2) enables independent operations and direct communication into the GIG. The JNN (V2) has voice and data switching equipment allowing independent operations and enabling both circuit switching and Internet Protocol-based networking. The JNN(V2) works with existing terrestrial transport (high capacity line-of-sight and LOS), ground mobile forces, troposphere scatter, secure mobile anti-jam reliable tactical terminal, and when available, commercial Ku-band satellite or Ka-band satellite frequency ranges.

(c) The battalion CP node provides enhanced voice and data capabilities at support battalions, secret internet protocol router network devices and access capability to interface directly to Ku satellite or LOS radio transmission resources.

(d) Experiences in Operation Enduring Freedom and Operation Iraqi Freedom demonstrate that the CAB must maintain communications from at least three different locations in order to execute its missions. During transformation to the modular force, the CAB received new organizations that have expanded the brigade's span of control requirements beyond that which can be supported by the traditional Main CP and TAC CP model. The addition of an UAS company and an ATS company significantly expanded the mission sets of the CAB. This increased operational scope created a significantly more complex communications and data-transfer challenge than can be supported by a single JNN and CP node at brigade level. A typical CAB command post configuration now includes a Main CP location and TAC CP location. This configuration does not include the added requirement for the CAB to locate aviation units at the division airfield with responsibility for flight operations and air traffic

services. The proposed signal company does not have the assets to support the CAB requirements at this critical node.

(e) The CAB includes a 12-aircraft UAS company that will support the division headquarters and units across the entire division area of operations. Due to unique take-off and landing requirements, the UAS company will likely be employed from a fixed facility or division airfield from which it must maintain communications with a wide variety of locations, including the division headquarters, CAB command posts, ATS facilities and all supported organizations. Supported organizations may include BCTs, fires units, BFSB, aviation battalions, sustainment brigades, and other support units. To properly support so many potential customers, the UAS company requires dedicated support from a communications node at its location, most likely the division airfield.

(f) The ATS company will also be headquartered at the division airfield to support the CAB mission in the JOA. It will have significant communications and data-transfer requirements that cannot be met without access to a dedicated communications node. The ATS company's airspace information center (AIC), control tower, ground controlled approach and tactical aviation control team (TACT) systems will maintain voice communications and exchange airfield, airspace and battle command data between systems, and with many organizations, to include supported aviation units, cooperative fixed-based and tactical ATS facilities, and joint, multinational and host nation airspace regulation authorities. The AIC's TAIS communications, digitized airspace management tools, and correlated feeds from ground, airborne, and space sensors will provide airspace information and SA to en route aircraft and collocated and distant AC2 and ATS facilities. To support these numerous communication and data requirements, the UAS and ATS companies must have access to the CAB's third communications node. A two-node communications template for the CAB will not support this capability if the UAS and ATS companies are to accomplish their missions. At the theater level, the airfield operations battalions (AOBs), assigned to the theater airfield operations groups of the TACs, have a mission identical to the ATS company but with added airfield management, airfield operations, and flight dispatch service responsibilities.

(g) The AOB serves the theater airfield, like the ATS company serves the division airfield, and will also have significant communications and data-transfer requirements that require a dedicated communications node. The AOB's management, operations, and service units will communicate and exchange data between AOB elements and with supported Army and JIM aviation units; cooperative fixed-base and tactical ATS facilities; and joint, multinational, and host nation airspace organizations. The communication and data exchange requirements unique to the AOB include capabilities, such as AMPS, to plan, submit, exchange, share, and track flight plan information from mission initiation to termination with distant flight operations and collocated ATS facilities in the Army, joint, multinational, or national airspace system. The AOB must have access to a communication node on the theater airfield to perform and accomplish its mission within a networked, theater or national airspace system.

(h) Exchange of voice, data, imagery, and video currently requires a suite of radios. The gap is the number of radios necessary to conduct successful operations as well as assured connectivity at beyond line-of-sight range. The primary voice radio for air-to-air and air-to-

ground exchange is the SINCGARS. Multiple SINCGARS radios are required to support command, operations, and intelligence nets for higher echelon coordination as well as internal and supported ground unit synchronization. This will remain the standard for the near future. Aviation platforms also require very high frequency amplitude modulated and UHF amplitude modulated radios to communicate with ATS agencies and joint Service and coalition force aviation. High frequency radio and data for high frequency is currently the only capability for BLOS voice communication. Aviation is starting the transition to UHF SATCOM as the primary BLOS communications means, however, this will take a number of years to complete. BLOS very high frequency amplitude modulated and UHF-amplitude modulated voice capabilities will be required for ATS because high frequency and SATCOM communications are not conducive to the immediate exchange of instructions and information between ATS systems and low level and terrain-masked aircraft platforms in terminal and en route environments.

(i) Data exchange is accomplished by employing several nets. The primary means of data exchange is the BFT network. BFT uses a commercial L-Band SATCOM radio. BFT is the single aviation solution for tactical internet operation. The value of BFT is its situation awareness display. It is particularly important to aviation as a high mobility platform that frequently operates at great ranges from supported ground forces. BFT does not perform as well at data message exchange due to limited capacity and the unclassified network. Tactical internet limitations contribute to the need for additional data nets. These are fire support and air-to-air targeting. Attack and reconnaissance helicopters are also aerial observers. Fire support operates its own network, placing additional data requirements on aviation. Aviation has to also perform remote weapons engagement, with one helicopter observing the target while another engages by direct fire. This requires a dedicated, near real time network.

(j) Imagery is data but because of its unique format and large file size, it is considered separately. Both AH-64D and ARH-70 have a requirement to perform LOI 3 and 4 control of UAS. The capability is in development but will not be fielded until the mid term period.

(k) Mode 5 IFF improves the current ATS IFF system for aircraft identification and positive control by migrating toward common digital technology and implementing growth capabilities that incorporate new waveforms and cryptology (Mode S).

## (2) Mid Term

(a) Voice radio capabilities will continue in their current configuration during the mid term. Aviation will build its UHF SATCOM capability by fielding additional quantities of the AN/ARC-231 and AN/PRC-117F multi-band radios.

(b) BFT tactical internet will continue, however, JTRS will be introduced in 2014. Aviation will participate with other forces using the new networks operating on WNW and SRW. Aviation expects the new network waveforms to consolidate network needs such as tactical internet, fires, and air-to-air targeting. The transition to the new waveforms will take many years. Until this is complete, effective backward compatibility will be necessary.

(c) Aviation will adopt data link capable radios in the mid-term. This will become the primary command and control link to allow attack and reconnaissance helicopters to share sensor video and to control UAS. JTRS compliments AN/ARC-231 and AN/PRC-117 radios by providing SRW, WNW, and TCDL waveforms while maintaining backwards compatibility. If the highband networking waveform (HNW) is selected for the UAS, then aviation will need to adopt a means of using that waveform, either by developing an HNW capable card for the JTRS or installing a joint C4ISR radio system in the aircraft. Presently the HNW data link uses frequencies above the JTRS capability.

(d) AH-64D BKIII is scheduled to upgrade to a Link 16 radio in the 2012 timeframe. Link 16 is a military inter-computer data exchange format of the North America Treaty Organization. With Link 16, military aircraft, as well as ships, Army and Marine Corps units may exchange their tactical picture in near real time. Link 16 also supports the exchange of free text messages, imagery data and provides 2 channels of digital voice (2.4 and or 16 kilobits per second in any combination). It is a TDMA-based secure, jam-resistant high-speed digital data link, which operates over the air in the L-band portion (969 - 1206 Megahertz) of the UHF spectrum.

### (3) Far Term

(a) JTRS will provide multi-band and multi-mode radios for voice and data, and will replace AN/PRC-117F and AN/ARC-231. This reduces the number of radios needed and associated space, weight, and power. Improved network waveforms reduce the number of data nets needed.

(b) Attack and reconnaissance helicopters will continue to support the selected data link architecture and TCDL for backward compatibility but this period will begin the transition to network supported video.

(c) FCS battle command may become Army battle command. NECC is a network-centric initiative that will replace the current family of GCCS. WIN-T is the Army's on the move, high speed, high capacity backbone communications network, linking warfighters with commanders and the GIG, the DOD worldwide network-centric information system.

f. Capability to access a single integrated ABCS, joint capable to the lowest levels that is backward and forward compatible with JIM and coalition forces.

### (1) Current

(a) The GCCS-A is the U.S. Army's strategic and theater C2 system. It provides readiness, planning, mobilization and deployment capability information for the strategic commanders. For theater commanders, GCCS-A provides COP and associated friendly and enemy status information, force employment planning and execution tools (receipt of forces, staging, intratheater planning, readiness, force tracking, onward movement, and execution status), and overall interoperability with joint, coalition and the tactical ABCS. GCCS-A's stated

mission is to provide automated C2 tools for Army strategic and theater commanders to enhance warfighter capabilities throughout the spectrum of conflict during joint and combined operations.

(b) The ABCS are the body of digital C2, communications, computers, and intelligence systems that will automate the emerging digital force. The ABCS provides a net-centric data management capability on a dedicated server. The ABCS enables a digital battlefield that frames architecture of every stationary and moving platform in the operational environment. It employs a mix of fixed/semi-fixed installations and mobile networks and will be interoperable with theater, joint, and combined C2 systems. The TAIS is aviation's component of ABCS.

(c) Army battle command is a layered application by echelon. Aviation will use the same battle command software used by other Army organizations at brigade and battalion echelons. Aviation presently uses a system called AMPS to fulfill its mission planning requirement. The planning software receives input from several battle command systems on friendly and enemy positions, airspace use, battle graphics, communications data, weather, and maps. The output from AMPS is a data cartridge that transfers the mission plan to aircraft systems. Planning also includes rehearsal. Rehearsal is the combined sum of portable flight planning software and a 'top scene' simulation capability. It provides the staff and flight crew the ability to visualize the route and actions on the objective with a high fidelity, photo-realistic, and geospatial environment. Aviation also produces a platform layer of battle command software called FBCB2-air. This is tailored FBCB2 software that interfaces with aircraft navigation, fire control, and communications systems.

## (2) Mid Term

(a) SOSCOE provides a common infrastructure of software components and services that allow FCS battlefield systems to effectively interoperate and exchange information. SOSCOE provides consistent information management within the FCS equipped elements. In order for Army aviation to maintain interoperability with FCS elements, platforms and operations centers must have a direct network exchange capability as a participant in SOSCOE. Aircraft must have the direct processing capability with SOSCOE to allow them to 'see and be seen' in real time without the interface with a gateway system unless transparent to the user.

(b) Aviation command post, battle command software will migrate with other Army brigade and battalion organizations. The major challenge during this period will be backward compatibility. battle command aviation software will continue fielding while incorporating software blocking directed enhancements for the mid term period. Aviation battle command software enhancements will incorporate some level of SOSCOE interoperability while maintaining backwards compatibility with the rest of the force. It must support the entire force until everybody is on a single Army battle command network.

(c) Aviation requires a mission planning and rehearsal system. Historically, AMPS has performed the mission planning in a semi-isolated environment without direct connectivity to any manned and unmanned aircraft. Aircrews, operations personnel, and ATS must be able to interoperate and collaborate for mission planning and rehearsal, in a static environment and on the move or en route. The mission planning system must be part of the network and interface

with any GIG entity for the collection of any required mission data, such as, weather, terrain, intelligence, COP, manifest, etc. Once the planning is finalized, the mission profile must be loaded into the airframes and provided to both operations and ATS electronically with minimal human interface.

(3) Far Term

(a) WIN-T is the Army's program that provides a tactical communications network for the warfighter. It encompasses three tiers: ground, airborne and space. All three tiers are scaleable and dynamically adaptive to meet the Army's tactical network requirements. WIN-T utilizes a single integrated framework to include all tactical communications systems from the dismounted Soldier to the strategic interface connected to the global information grid. WIN-T will enable BCOTM and will allow the Army to migrate to battle command vehicles and away from traditional command posts. WIN-T has three internal transceivers: the HNW, the network-centric waveform, and the Global Broadcast Service. JTRS has three aviation required waveforms: WNW, the SRW, and Link 16. JTRS is the radio that establishes the migration path for aviation support to the future Modular Force as well as maintaining backwards compatibility with the current force. JTRS will also have legacy waveforms and MOUS.

(b) Aviation will continue to evolve battle command software and the requirement is full FCS interoperability. Mission planning (for example, the AMPS) software will also continue to change incorporating the planning and rehearsal features of FCS.

g. Capability to achieve sufficient bandwidth and bit rate capacity to meet all network needs such as, tactical internet, fire support net, private net (targeting) and reconnaissance and surveillance reporting requirements to maintain LOI 3 and 4 control of UAS.

(1) Current

(a) Aviation has requirements to participate in three data nets: tactical internet, targeting (private net), and fire support. UAS video and control net is in development. Data nets induce radio quantity, space, weight, power, multifunction display and pilot workload problems. Aviation operates on the tactical internet using BFT L-band SATCOM. The fire support and targeting nets are implemented using SINCGARS. This will not improve until the Army builds higher capacity and more efficient tactical networks.

(b) The joint network management system program provides joint and service component commanders a common, automated planning and management tool that will plan, monitor, and control the joint communications and data backbone associated with a joint TF or joint special operations task force. Its capabilities include high level planning, to include creating, editing and or loading of data bases; defining network sites and units; assigning responsibilities and schedules; and generating and distributing planning data. It also includes the Joint Communications-Electronics Operating Instruction; Communications Service Requests; detailed planning and engineering, activation and modification, to include planning and engineering for circuit switches; asynchronous transfer mode; Defense Message System; commercial and military satellite communications systems; data networks; message switches;

transmission systems; and single channel networks. The joint network management system indirectly supports spectrum management within the network.

(c) The coalition joint spectrum management planning tool is an ongoing joint urgent operational needs effort funded by the joint improvised explosive devices-defeat organization to address current and near term urgent capability gaps. This joint program is meant to specifically address the issue of spectrum interference between counter-remote control improvised explosive device electronic warfare and BFT, and assist in providing access to the future spectrum management database for tactical units.

(2) Mid Term

(a) Aviation will continue to operate in the BFT tactical internet in the mid term. The Army will begin to migrate toward the FCS battle command network, destined to become the Army battle command network. The new software and transport radios will allow consolidation of data nets. This will support the consolidation of the tactical internet, fire support nets, intelligence, C2, and SA nets. Introduction of the data link will permit aviation to share UAS video. The capability of the tactical internet to incorporate all data services is not known at this time.

(b) The WIN-T spectrum management tool will provide integrated dynamic electromagnetic spectrum operations capability to request, allocate, plan, and assign the efficient use of electromagnetic spectrum for all communications and noncommunications emitters employed within the AO.

(3) Far Term

(a) Aviation will reduce reliance on BFT and depend more on the FCS battle command network. TCDL will migrate toward FCS data link for UAS video sharing and control.

(b) The GEMISIS is a joint program. The Signal Center endorsed GEMISIS as the program of record that the Army will be supporting to fix the capability gap in electromagnetic spectrum operations.

(c) WIN-T will combine GEMISIS and the coalition joint spectrum management planning tool to become the integrated dynamic electromagnetic spectrum operations (such as, requesting, allocating, assignment, deconfliction, protection, and revocation) tool to plan and efficiently use electromagnetic spectrum for all communications and noncommunications emitters employed within the AO. WIN-T will be able to access dynamically available RF spectrums. WIN-T frequency assignment process will allow reuse of available spectrum to minimize harmful interference. WIN-T will provide the capability to exchange positive control information with SATCOM Operation Centers to coordinate and de-conflict WIN-T's usage of satellite resources.

h. Conduct en route mission planning and rehearsals both inter-theater and intratheater utilizing the network-enabled battle command system and collaborative capable network. Aviation battle command systems and platforms must access en route mission planning, support

collaboration and mission rehearsal, battle command, and have the ability to integrate into gaining battle command architectures during movement by air, land and sea.

(1) Current

(a) EMPRS is an enabled battle command and planning capability that enables joint forces en route on any strategic lift platform to receive updates on the developing situation in the JOA; interoperate with organic battle command systems; conduct mission planning and rehearsal; and maintain a common operating picture with forces already in theater. The capability will help abbreviate RSOI and the time required for arriving forces to plug into in-theater C4ISR structures.

(b) An EMPRS capability provides the aviation staff and individual warfighter the ability to render the commander's intent within a high fidelity, photorealistic, and geo-specific environment relative to terrain and threat without any redundancy of planning effort. It is able to depict friendly, enemy, and neutral position status in real time, and allows commanders to conduct remotely rehearsals with either classified or unclassified databases. Whether at home station, en route or deployed it would also allow aircrews to perform such tasks as mission planning and rehearsal, course of action (COA) analysis, NLOS analysis of terrain, TTP validation and refinement just to name a few. This would be accomplished by taking battle command entities translated and displayed on a screen of the terrain to allow 3-dimensional SA and COA analysis. A properly modeled semi automated force (SAF) for electronic warfare emissions and surface-to-air range fans, which are currently exclusive in an exercise environment, and are important in establishing an EMPRS capability. Whether integrated into the platform or as a transportable laptop, the intent would be to make these simulation capabilities operational enablers in the live realm in order for aviators to better understand the environment they are about to engage in as well as better understand the commanders intent with regard to graphics, such as, the capability to change graphics from the commander or AMC while en route.

(c) One of the products the space operations officer at division headquarters can develop is a 3D fly through using its space operations tool kit software. These fly-throughs are excellent for mission planning and rehearsals; although no en route mission planning and rehearsal or collective rehearsal capability exists with this system.

(d) The AVCATT-A reconfigurable manned simulator is a mobile, transportable, trailorized virtual simulation training system designed to provide aviation the capability to conduct realistic, high intensity, task-loaded collective (they can be networked) and combined arms training exercises and mission rehearsals. Currently these systems do not have en route mission planning and rehearsal capabilities.

(e) The Longbow crew trainer is a full-mission, deployable simulator that replicates, with high fidelity, aircraft operations and the aircraft system functions. The entire trainer can be packed in two ISO-type containers, making it deployable via rail, ground, ship, or C-5 heavy-lift cargo aircraft. The system includes pilot and co-pilot compartments, an instructor station, two Pentium computers, three image generators and an external power generator. Again, these



systems are located at each AH-64D battalion but do not have an en route mission planning capability or a collective training/rehearsal capability.

(f) The SECOMP-I is an integrated voice and data communications system providing robust, collaborative, En route Mission Planning and Rehearsal (EMPR) capabilities through high-quality voice and data communications for forces en route aboard C-130 and C-17 aircraft to the area of deployment. SECOMP-I enables joint tactical forces to arrive at their deployment destinations fully briefed on the most current SA, intelligence reports and plan updates available. This system eliminates the information blackout experienced by forces while en route to an area of operation improving their ability to *see first, understand first, act first and finish decisively*. Identified by the System of Systems Program Executive Officer as a FCS complementary system, SECOMP-I's modular design allows for expandability, supporting additional requirements and ensuring investment protection. Planned upgrades include the insertion of JTRS and wideband SATCOM, as well as a variant of the SECOMP-I capability for the theater support vessel. With SECOMP-I, the warfighters immediate and future mission needs for en route voice and data communications will be met. SECOMP-I is not a program of record

(2) Mid Term.

(a) Aviation has the requirement for a fully integrated, collaborative, and networked mission planning and rehearsal system capable of planning and rehearsing missions from any location, home station, deployed site, or en route via self deployment, and or land, sea, or air transport. The system will have real time connectivity to the GIG to permit mission planning and collaborative rehearsal.

(b) The system should be capable of every operation or function presently performed in AMPS and EMPR plus the following:

- Real time interactive rehearsal among all participants with multiple and variable speed settings for quick action.
- Digital recording of rehearsal for full playback and analysis.
- Ability to insert and deviate from multiple COAs on the fly.
- Ability for real time insertion of intelligence, weather, COP environment, and others, to influence planning and rehearsal.
- Ability to position participants at any selected location to observe actions. For example,, in cockpit, outside aircraft, in battle position, in target area looking back at mission entities, and others.
- Ability to insert what if scenarios to mission planning and rehearsal.
- Ability to insert SOP and TTP to tailor mission planning and rehearsal to unit requirements and actions.
- Ability to electronically load aircraft and set radios and secure codes from mission planning station(s).
- Ability to broadcast mission and flight plans to all required entities and receive acknowledgement of receipt.
- Ability for system to interface with aircraft, aircraft maintenance, and air crew records to establish aircraft and air crew readiness state and risk factor.

(3) Far Term. No programmed capability.

i. Capable efficient network services and communication systems-compatible protocols to ensure high priority messages are received with minimum latency for all participating systems.

(1) Current. Aviation command posts will use the same network management and services as other Army brigades and battalions. There are additional challenges involved in tactical internet participation. Helicopters do not have the same memory storage as laptop systems. Aviation Mission Planning System must tailor the address database for data cartridge transfer to aircraft. This is currently done using a translation tool from FBCB2 tactical internet manager. All helicopters participate in the BFT tactical internet. The SATCOM based BFT network provides necessary connectivity for the speed and range of helicopter battlefield operations. This will be an issue as the Army migrates to line-of-sight transport radios and new tactical internet designs.

(2) Mid Term. The Army and aviation will begin to implement elements of FCS battle command and network design. Aviation command posts will use the same network designs and management as ground maneuver brigades and battalions. The new JTRS network waveforms are LOS (WNW, SRW, Link 16). Network designs must accommodate helicopter speeds and range of operations across the battlefield. Mission planning, using for example, AMPS, and network management software must be synchronized to tailor network products for helicopter interoperability. Aviation must remain backward compatible with BFT and other unique data links such as UAS TCDL, during the transition period.

(3) Far Term. Aviation brigade and battalion command posts will continue to employ the same network design and management as ground maneuver units. Mission planning (AMPS, for example) software must be updated to remain interoperable with network management changes. Helicopter software must be upgraded to implement network management and service features.

j. Capable protocols for controlling UAS from any C2-like terminal.

(1) Current. Ground control stations will control air vehicles via line-of-sight, air vehicle-to-air vehicle data link relays, or SATCOM relay data link. Ku wideband SATCOM communications links for UAS are used for NLOS C2 of the air vehicle and as a downlink for collected sensor products such as motion imagery, still imagery, and GMTI data. There are no current enablers for controlling UAS from any C2-like terminal.

(2) Mid Term. TCDL or equivalent data link system will be used for UAS data links. This provides interoperability between UAS by requiring a common set of operating parameters. All UAS will have at least one common mode of operation among them. Small UAS will have a digital data link but it may not be TCDL because of size, weight, and power. Standardization of the data link allows the functionality up to LOI 4 control to be imbedded into BFT, FBCB2, or other C2-like terminals. The AH-64 block III and ARH-70 will have up to LOI 4 over UAS.

(3) Far Term. In FCS battle command, all C2-like terminals have the functionality up to LOI 4. Access to the UAS is restricted by roles. Anyone on the network with the appropriate role can control a UAS. The SRW is the communications path used for UAS command and control. The same functionality will have to be migrated to the rest of the Army as it transitions to FCS battle command.

k. Capability for UAS common/standardized control architectures and interfaces ground control stations.

(1) Current. The One System Ground Control Station (OSGCS) is an interoperable ground control station capable of controlling various types of UAS platforms (Shadow, Hunter, ERMP UAS). Switching from one type of UAS to another is not dynamic and requires a system reboot and the appropriate avionics (C-band, TC DL, and others).

(2) Mid Term. The OSGCS is capable of controlling multiple platforms of the same type. The OSGCS is also capable of controlling up to eight unmanned aircraft of different types simultaneously. The OSRVT is now capable of LOI 2, 3 and 4.

(3) Far Term. The OSGCS and OSRVT continue to exist in the CAB. FCS has a launch control unit for up to LOI 5 C2 of FCS UAS. In addition, all manned ground vehicles have the capability to C2 FCS UAS up to LOI 4. Data links, control units and TTPs will have to be revised to migrate from future and modular units into one.

l. Capability for 4-dimensional visual airspace planning and real time airspace deconfliction during mission execution.

(1) Current. The TAIS serves as the aviation component of ABCS for airspace management planning and execution and has 4-dimensional functionality. The TAIS possesses a deconfliction capability when provided with a real time air picture.

(2) Mid Term. No change to TAIS.

(3) Far Term. A Multifunctional ATS platform will provide all airspace control and management functions in an integrated system capability on a single platform. NECC is a network-centric initiative that will replace the current family of GCCS. The multi-mission sensor will provide the potential to share a common sensor picture between systems. Aircraft will have a direct network exchange of C2 and SA with FCS battle command system allowing them to 'see and be seen' without requiring a BFT gateway or ATS. NECC is a network-centric initiative that will replace the current family of GCCS.

m. Capability for interoperable communications of airborne platforms with ATS.

(1) Current. The TTCS, TAIS, and ATNAVICS possess multi-band radios that provide interoperable communications with current airborne platforms. The TCAS is an airborne system developed by the FAA that operates independently from the ground-based ATC system. TCAS

was designed to increase cockpit awareness of proximate aircraft and to serve as a last line of defense for the prevention of mid-air collisions.

(2) Mid Term. The MOTS will possess multi-band radios that will provide interoperable communications with airborne platforms. JTRS will be incorporated in the TTCS, TAIS, ATNAVICS, and MOTS as the common multi-waveform radio for the DOD.

(3) Far Term. A Multifunctional ATS platform will provide all airspace control and management functions in an integrated system capability on a single platform with JTRS.

n. Capability for lighter more deployable ATS systems.

(1) Current. The TTCS, TAIS, and ATNAVICS are mounted on the high mobility multipurpose wheeled vehicle and are deployable with minimal preparation on C-130 and CH-47 and larger aircraft. The TAIS and ATNAVICS will migrate to up armored vehicles as part of the DOD's force protection efforts. The systems will require MHE for C-130 deployability after armoring.

(2) Mid Term. The MOTS will be mounted on an armored light medium tactical vehicle () and will require MHE for deployability on a C-130 aircraft. The MOTS armored light medium tactical vehicle will not be deployable by CH-47 aircraft.

(3) Far Term. A Multifunctional ATS platform will provide all airspace control and management functions in an integrated system capability on a single platform using the joint light tactical vehicle with a man-pack JPALS.

o. Capability for tailorable ATS displays and more efficient controls/interfaces.

(1) Current. The TTCS, TAIS, and ATNAVICS possess a digital display and soft-touch or keyboard control for operating the subsystems from one or more central locations.

(2) Mid Term. The MOTS will possess digital displays and soft-touch control for operating the subsystems from one or more central locations.

(3) Far Term. A multifunctional ATS platform will provide all airspace control and management functions in an integrated system capability on a single platform. Aircraft will have a direct network exchange of C2 and SA with FCS battle command system allowing them to see and be seen without requiring a BFT gateway or ATS. NECC is a network-centric initiative that will replace the current family of GCCS.

p. Capability for ATS controller workload reduction and automation features.

(1) Current. The TTCS, TAIS, and ATNAVICS possess a digital display and soft-touch or keyboard control for operating the subsystems and are all capable of being operated from one or more central locations.

(2) Mid Term. The MOTS can control any or all three of its positions from any one position within the tower or remotely from a collaborated system.

(3) Far Term. The Multifunctional ATS platform will be capable of monitoring and controlling all aspects of the airspace system from a single location, either on location or anywhere via the network and GIG. From the multifunctional ATS platform a single controller can assume the responsibility of any other controller within the network and provide air traffic control, advisories, and all other functions expected or required from a local ATS facility without derogation of functions and transparent to the traffic and users. The multifunctional ATS platform will provide state-of-the-art displays. The displays will be high definition, multifunction, multi-input, tailorable displays, which can be, controlled via coded and un-coded laser pointer and or proximity sensor(s) without requiring contact touch. These displays will be thin, light weight, weatherproof, flexible, and capable of selective and variable lumination with full color array.

q. Capability for seamless, passive non-cooperative ATS interrogation of air platforms.

(1) Current. Mode 5 IFF improves the current ATS IFF system for aircraft identification and positive control by migrating toward common digital technology and implementing growth capabilities that incorporate new waveforms and cryptology.

(2) Mid Term. Mode 5 IFF.

(3) Far Term. No further programmed capability.

r. Capability for ATS ability to maintain controller visual cues in limited visibility and adverse weather conditions.

(1) Current. No programmed capability.

(2) Mid Term. No programmed capability.

(3) Far Term. A Multifunctional ATS platform will provide all airspace control and management functions in an integrated system capability on a single platform. A Multifunctional ATS platform will provide an automated capability to survey and collect data on the landing area and terminal airspace, and generate a TERP for the safe instrument recovery of an aircraft in a tactical environment.

s. Capability to generate ATS self-surveying and TERPs generating capability.

(1) Current. No programmed capability.

(2) Mid Term. No programmed capability.

(3) Far Term. A Multifunctional ATS platform will provide an automated capability to survey and collect data on the landing area and terminal airspace, and generate a TERP for the safe instrument recovery of an aircraft in a tactical environment.

t. Capability for ATS accident and incident voice, and data recording.

(1) Current. The TAIS and ATNAVICS possess an accident and incident voice recording capability.

(2) Mid Term. The MOTS will provide an accident and incident voice recording capability.

(3) Far Term. A Multifunctional ATS platform will provide all airspace control and management functions in an integrated system capability on a single platform. This platform's system will maintain a fifteen day accident and incident voice and data recording capability for all traffic handled by or through the facility.

u. \*SATCOM Enablers. The cornerstone of current space-based intertheater and intratheater communication enablers are the satellite communications systems available to the joint force. They are generally organized into five system groupings: Milstar, UHF fleet satellite, or UHF follow-on, Defense Satellite Communications System, Global Broadcast Service, commercial SATCOM, and MOUS. The Space Operations CCP offers numerous enablers, current, mid, and far term to provide capabilities discussed below.

(1) The ability for pervasive, extended range, intertheater and intratheater global NLOS communications relay capability and broadcast services between noncontiguous forces at the halt, at the quick halt and on the move in all operational environments and conditions. Communications include data, voice, imagery, and video.

(2) Ability to provide the space and high altitude long-loiter platforms, links and processors to enable the fusion, sharing, push, pull and update information from a wide variety of sensors and sources in all domains, access that information simultaneously from multiple noncontiguous locations in order to provide timely, actionable, and relevant information in support of the planning, execution and assessment operations of the joint force and component commanders.

(3) Ability to position, cue, cross-cue, task and dynamically retask netted layers of redundant space, air, and surface sensors and relays.

(4) Ability to provide high-resolution geospatial data and comprehensive environmental information, including real time collection, in order to visualize and describe the operational environment and assess the impact of terrain, atmosphere, weather, and space variables in all operational environments and conditions.

(5) Ability to provide an enhanced, fully networked, space-based theater and global missile warning, detection, processing and dissemination system in all operational environments and conditions.

**4-6. Assessment of Protect Related Aviation Enablers**

a. Current aircraft systems do not enable optimally safe operations across the range of expected mission conditions. Aviation must be able to conduct manned and unmanned worldwide operations in day, night, and reduced visibility conditions due to adverse weather and environmental obscurants (blowing dust, snow, and debris) at wartime flying hour mission usage rates consistent with future Modular Force operations. Aviation will perform missions in complex terrain and harsh environments (to include high/hot) over an extended operational environment (potentially up to 600 kilometers in a joint area of operations). Manned and unmanned aviation systems operate against unpredictable threats and within the effective range of small arms fire, RPGs, MANPADS, directed energy weapons, anti-helicopter mines, and natural and emplaced flight path obstacles. Workload intensive operations degrade crewmember and operators' ability to focus on the most mission-critical tasks and reduce safety.

b. Effective aviation operations are also limited by high crew workload, ability to manage and control UAS, conducting operations in CBRNE or other adverse environmental conditions, and extended duration missions. Workload intensive operations degrade crewmember, and operator ability to focus on the most mission-critical tasks, reduce safety, and increase risk of errors. Anticipated mission complexity is driven by requirements to safely operate the aircraft, manage multiple inputs, control on-board and off-board sensors, communicate, manage, and control UAS, and react to threat systems. This imposes high cognitive and physiological loads on crewmembers. Aviation survivability and reaction time are insufficient against unpredictable and hard to detect threats. Manned and unmanned aviation systems often operate against unpredictable threats and within the range of small arms fire, RPGs, MANPADs, anti-helicopter mines, and natural or emplaced flight path obstacles. Ground and air platforms that employ the best combinations of low observability, ballistic protection, long-range acquisition and targeting, early attack, and high probability of first-round hit-and-kill technologies will be required to ensure the desired degrees of survivability.

c. Table 4-5 depicts the current, mid term and far term assessment of the protect related aviation enablers required by the future Modular Force.

**Table 4-5.  
Aviation Protect Capability Migration Plan**

<b>Protect Aviation Enablers</b>			
<b>Enabling Capability Needs</b>	<b>Current Enablers</b>	<b>Mid Term Enablers Migration 10–15</b>	<b>Far Term Enablers Migration 16–24</b>
d. Capability for detection and reaction time against threats to positively identify ground and air threats beyond their engagement range and at the extended ranges of our	- Detect RF emitters - Detect IR missile launch - Detect laser energy - CMWS - APR 39 - AVR-2B	- SIIRCM Software upgrades - AH-64D improved RFI	- Hostile fire indicator - Networked SA - AN/AVR-2 laser warning receiver (LWR) - APR 39X - Detect all RF emitters

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future weapons systems with sufficient time to avoid or target.	- AH-64D RFI (AN/APR-48A)		- Detect all IR missile launches - Detect all laser energy - Detection before launch – - Multifunction electro-optical defense of U.S. aircraft (MEDUSA) - Defense Advanced Research Projects Agency (DARPA)
e. Capability to minimize aural, visual, IR and RF signatures to reduce detectability and enhance the effectiveness of active ASE.	- IR Suppressors - AH-64 Aircraft Survivability Program Improvement	- IR suppressors - Partial active passive aircraft survivability (APAS) fielding	- IR reduction - Rotor noise reduction - Reconfigurable rotors - APAS adaptive IR suppressor system
f. Capability to defeat or suppress enemy air defense systems both radar and IR guided (such as, MANPADS) with active and passive countermeasures, and to defeat or suppress enemy small arms.	- CMWS - Omni directional IR - Jammers directional - Spherical coverage - ALQ-144 - Flares	- ASE to allow for higher altitudes - Networked SA - Software upgrades - Hostile fire indicator - Spherical coverage - Partial APAS fielding	- ASE to allow for higher altitudes - Networked SA - Software upgrades - Hostile fire indicator - Spherical coverage - High-brightness strobe lamp - Steered agile beams - Distributed aperture fiber optics - Hard kill lasers - Team based aircraft survivability effects
g. Capability to provide maximum protection to Soldiers (crew and passengers) and critical aircraft flight components from ballistic, flame, thermal, overpressure, and electromagnetic DEW effects. Damage-limiting hardened and redundant systems.	- Current generation aircraft/body armor	- Lighter durable ballistic protection systems	- Shielding, add on armor - Aircrew Occupant Ballistic Protection System (AOBPS) - Survivable Affordable Repairable Airframe Program (SARAP) - Improved rotor durability
h. Capability to detect and avoid anti-helicopter mines and IED.	- UAS sensors capable of detection at survivable standoff distances. (such as, BUSTER)		- UAS sensors capable of detection at survivable standoff distances - Jamming, premature detonation - Signature reduction, jamming, premature detonation - DARPA-helicopter quieting research and development
i. Capability to provide, embedded standoff sensor/detector capability for real time warning and dissemination to protect the force against CBRNE hazards, anti-helicopter mines and improvised explosive devices.	- Chemical agent resistant coatings - M17 decontamination apparatus	- UAS based chemical agent detector	- Decontamination using non-corrosive non-toxic solvents
j. Capability to provide realistic virtual training and networked mission rehearsal against threat systems.	- ASE Trainer IV - AVCATT-A - AMPS - Tactical Terrain Visualization System (TTVS) - Combat mission simulator	- AVCATT-A - AMPS - TTVS	- JMPS



	(CMS)		
k. Capability to provide accurate damage assessment if hit.	- Post flight inspection system failure	- Prognostic and diagnostic algorithms	- Prognostic and diagnostic algorithms - Composite airframe - Impact energy detecting
l. Capability for pilotage/navigation systems which enable safe aircraft control when visual cues to the surrounding terrain and aircraft attitude are degraded or lost. Safe operations in DVE and complex terrain.	- "hover mode" "go around mode" on glass cockpit aircraft	- Accurate terrain and obstacle data base. - Drivers vision enhancer	- Leverage current multimode radar technology - Terrain avoidance/terrain following radar - Objective pilotage for utility and lift (OPUL) - Advanced Tactical Flight Control System (ATFCS) Automated flight controls. - Display and sensor technologies which provide field of view, field of regard, and resolution consistent with safe operations (to include heads-up ops for manned aircraft and unmanned air vehicle operators) - Low cost, low weight 360 degree pilotage system - Helmet mounted UH-60, CH-47 - Degraded-brownout conditions - Intelligent control concepts
m. Capability to detect obstacles around the aircraft to enhance crew SA and maintain safe spherical standoff distance. (Hover, low speed flight)	- Radar altimeter - FLIR - LLTV - Hover page symbology - AH-64D FCR, Radar map and terrain profile mode - Hazard map - Visual	- Driver vision enhancer - Airborne surveillance target acquisition and minefield detection system (ASTAMIDS) - Multi spectral imager - Fog and haze penetration	- OPUL - Millimeter wave - Advanced tactical flight control system - Detect obstacle early enough to react
n. Capability to predetermine suitability of landing environments.	- Maps - Mission planning - TTVS - Aerial ISR assets	- Software and database upgrades	- Software and database upgrades - Update imagery and data while in flight
o. Capability to provide CDAS.	- RFI - FCR - Thermal sights	- Software and database upgrades - CDAS	- Software and database upgrades - Intelligent decision aiding for aircraft survivability (IDAS) threat lethality locator - Manned and unmanned rotorcraft enhanced survivability
p. Capability to improve cockpit displays, flight control systems, and man-machine interfaces. (manned aircraft)	- Head-up displays - Glass cockpits - Second generation FLIR	- CDAS - Cockpit menu system software upgrades - Air Soldier System	- Third generation FLIR - Image fusion (IR and low light television) - Cockpit menu system software upgrades - Air Soldier System upgrades - 3-dimensional audio - Voice commands - Wide field of view NVGs - Low cost, low weight 360 degree pilotage system
q. Capability to reduce head-	- Helmet Gentex Unit 56/P		- Joint Design

borne weight for manned system crews.	(pilot helmet)		
r. Capability to protect the network from intercepts, jamming, viruses, through integrated and centralized network management.	- Implement information assurance policies in aircraft		
s. Capability to safeguard weapons from most common electronic interference, spoofers or false target generators.	- Hazardous electromagnetic radiation to ordnance (HERO) testing to safeguard against stray RF energy activating fuses		- Shielding - Safeguard firing circuit

d. Capability for detection and reaction time against threats to positively identify ground and air threats beyond their engagement range and at the extended ranges of our future weapons systems with sufficient time to avoid or target.

(1) Current. The current generation of aviation survivability equipment can be broken down into three areas: detect RF emitters, detect IR missile launch and detect laser energy. To counter IR threats the Army accelerated the fielding of the CMWS including the improved countermeasures dispenser. The APR 39A(V)1 radar warning receiver (RWR), APR-44 (OH-58D) and ALQ-136 provide current RF detection. The AN/AVR-2B LWR provides detection of laser energy although it is not mounted on all aircraft. Mid term enablers will include the combination of CMWS, the improved countermeasures dispenser, and IR jammer to complete the SIIRCM package, APR-39X, and AVR-2B.

(2) Mid Term. The mid term will complete the fielding of SIIRCM and software upgrades to CMWS. The AN/AVR-2B LWR will provide the capability for laser detection, and the Army will continue development of the APR 39X RWR.

(3) Far Term. Far term enablers include, networked SA, hostile fire indicator, SIIRCM, APR39X advanced RWR, AN/AVR-2B LWR and RF countermeasures. There is no existing RWR system that meets Army digital weight and size requirements. All systems in development currently require new wiring harness kits. Software upgrades to existing ASE systems will provide upgraded capability. Detection and defeat of all RF, laser energy, and IR missile launches is the ultimate goal for improving detection and reaction against threats. One current science and technology project is the MEDUSA. This is a DARPA funded project to give aircrews detection before launch capability.

e. Capability to minimize aural, visual, IR and RF signatures to reduce detectability and enhance the effectiveness of active ASE.

(1) Current. Current signature reduction technology is already operational or being fielded. IR suppressors, windshields, and paint offer limited IR and radar absorption. AH-64D Aircraft Survivability Program Improvement.

(2) Mid Term. Partial fielding of the APAS system is attainable in the mid term. The objective of APAS is to develop a light weight, low cost aircraft self-protection suite that is effective in defeating current MANPAD threats and detecting and cueing to small arms and RPG

threats. APAS is a suite of capabilities including: low back pressure engine IR suppressors, multi-spectral aircraft coatings, IR based hostile fire indicator, aircrew visual cueing system for hostile fire, and a visual disruptor to reduce small arms and RPG threat effectiveness.

(3) Far Term. Far term capabilities include full fielding of APAS technology. Research and development continues into super lightweight thermal insulation, and reconfigurable rotors. Reconfigurable rotors would minimize the effectiveness of threat systems that rely on rotor noise for cueing.

f. Capability to defeat or suppress enemy air defense systems both radar and IR guided (such as, MANPADS) with active and passive countermeasures, and to defeat or suppress enemy small arms.

(1) Current. As discussed in the section on improved detection reaction time against threats, current IR countermeasures capabilities are based on CMWS, M206, 211, 212 flares, omni-directional IR jammers, and directional IR jammers. The APR 39A, APR-44, ALQ-136 and the M130 chaff dispenser provide RF countermeasures.

(2) Mid Term. ASE improvements will allow flight at higher altitudes in the mid term. Enablers to allow this include networked SA, hostile fire indicator, software upgrades, spherical coverage and partial APAS fielding. These improvements will carry over into the far term.

(3) Far Term. No further programmed improvements. Research and development efforts include the high brightness strobe lamp and the DARPA project-steered agile beams, which replaces mechanical gimbals with lightweight laser beam control modules to facilitate faster, more accurate positioning of laser beam. Another program called Next-Generation Electronic Warfare Technologies for Survivability uses fiber optics to distribute laser energy to multiple sensors along the outside of the fuselage. DEW programs include hard kill lasers, such as the joint high-power solid state laser, a joint Army, Navy, and Air Force program. A concept being developed for the Army is team based ASE. The team based system distributes countermeasures to a manned-unmanned team instead of each airframe. By distributing these components, the aircraft cost and weight burden is significantly less than current ASE systems.

g. Capability to provide maximum protection to Soldiers (crew and passengers) and critical aircraft flight components from ballistic, flame, thermal, overpressure, and electromagnetic DEW effects. Damage limiting hardened and redundant systems.

(1) Current. Redundant systems are engineered into the current inventory of Army rotary wing aircraft. Currently aircraft have armor added to key component locations. Adding additional armor results in a reduction in range, power or weapons.

(2) Mid Term. The Army will still operate current designed and operational aircraft in the mid term. Lighter durable ballistic protection systems will probably not be integrated into Army aircraft until the far term.

(3) Far Term. A far term enabler would be ballistic protection for the airframe and transparent surfaces (chin bubble, windows). One document being developed is the AOBPS Initial Capabilities Document (ICD). The AOBPS would provide lightweight armor protection for both the cockpit and passenger compartments and the windshield or chin bubble. One research and development effort is the SARAP, which will demonstrate crashworthy and ballistic tolerant airframe concepts with the added benefit of reduced weight. Another research effort is the improved rotor durability study, which plans to demonstrate improved main/tail rotor durability, reparability, availability, and performance.

h. Capability to detect and avoid anti-helicopter mines and improved explosive devices.

(1) Current. Survivability is currently focused on TTPs for threat avoidance. Aerial reconnaissance platforms exist today to detect or jam IEDs. The Buster UAS is an example of the capability. The Buster UAS could provide high resolution day imagery minutes before a convoy passes a suspected IED location.

(2) Mid Term. Upgrades of UAS will continue through the mid term.

(3) Far Term. No programmed improvements. Research and development in signature reduction, jamming, and premature detonation needs to continue in the area of helicopter quieting. One payoff of the reconfigurable rotors concept is a decrease in acoustic signature resulting in a reduced detection range.

i. Capability to provide embedded standoff sensor and detector capability for real time warning and dissemination to protect the force against CBRNE hazards, anti-helicopter mines and improvised explosive devices. Capability requires multiple multifunctional networked sensors for appropriate situation awareness. Aviation must be able to safely operate in contaminated areas, and be able to quickly and safely decontaminate equipment.

(1) Current. Aviation units will use current chemical agent resistant coatings and decontamination apparatus, such as the M17, through the mid term. The M17 high-pressure hot water cleaner apparatus (lightweight) consists of a water pump, heater, and an air cooled gasoline engine. The M17 can use water from any natural source up to 30 feet away. The M17 provides a pressurized, hot water capability to facilitate the removal of contaminated mud and grease prior to the application of decontaminants to equipment. The apparatus will also be used to rinse the decontaminant from the equipment. Current generation solutions, such as DS-2, Decontamination Solution No. 2 (mixture, 2 percent solution sodium hydroxide, 5 percent solution monoethanolamine, 20 percent solution ammonia) and super tropical bleach are corrosive to aircraft.

(2) Mid Term. In the mid term aviation will have the capability to use UAS based mobile chemical agent detectors. UAS based systems will increase warning times and decrease survey times. Staging areas, assembly areas, and FARPs can be occupied faster through the use of air based sensors.

(3) Far Term. No programmed improvements. Research and development efforts should focus on decontamination using non-corrosive and non-toxic solvents.

j. Capability to conduct realistic training and mission rehearsal against threat systems.

(1) Current. Current systems include AVCATT-A, which provides collective virtual simulation training. AVCATT-A also allows the cockpits to be reconfigured to support current rotary wing aircraft. Aircrews and staff can rehearse missions against threat systems both air and ground. The ASE Trainer IV allows aircraft to maneuver against a suite of RF threats. The ASE Trainer IV systems are limited to the combat training centers located at Ft Bliss and Ft. Hood, Texas. The TTVS as part of the AMPS provides the aviation staff, and individual warfighter the ability to visualize the commander's intent and actions on the objective within a high fidelity, photo-realistic, and geo-specific environment. The cockpit mission simulator gives AH-64 crewmembers a capability similar to the AVCATT-A.

(2) Mid Term. No programmed improvements.

(3) Far Term. The eventual goal is to replace all mission planning systems with a Joint Mission Planning System. This system will enhance mission accomplishment and aircrew survivability through more successful planning of the departure, ingress, attack and cargo delivery, egress, and recovery phases of a mission, as part of a continual evolution of mission planning systems. The current Joint Mission Planning System program is led by the Navy and does not meet all of the Army's requirements.

k. Capability to provide accurate damage assessment if hit.

(1) Current. Current indications of battle damage are usually discovered by system failure while in flight or through a post flight inspection. These procedures will continue through the mid term.

(2) Mid Term. Additionally the Army should be able to leverage advancements in prognostics, diagnostics, and algorithms gleaned from the ADEC and MFOQA programs.

(3) Far Term. Advancements in prognostic and diagnostic algorithms should continue into the far term. Composite airframes with embedded impact energy detecting sensors need to be considered.

l. Capability for pilotage and navigation systems which enable safe aircraft control when visual cues to the surrounding terrain and aircraft attitude are degraded or lost. Aviation will have the ability to conduct safe operations in DVE and complex terrain. Aircrews will be able to fly multi-ship missions at night to unimproved staging bases or other points in the area of operations and complete the operation safely with no damage to aircraft and no injury to personnel. Assault aircraft will plan and execute vertical maneuver missions to tactical LZs at night that provide the greatest maneuver support to the JFC. These formations will be unhindered in their LZ selection as they will be able to safely land as a flight in totally obscured conditions. Attack and reconnaissance aircraft crews will have enhanced SA and survivability

capabilities that will allow them to operate over complex and urban terrain engaging the enemy at will without fear of collision with wires, towers, or other obstructions.

(1) Current. Two modes of flight available to the UH-60M and CH-47F are the go around mode and hover mode, to be utilized in limited visibility environments. These designed operational aircraft improvements are programmed through the mid term.

(2) Mid Term. No programmed improvements. Aviation can leverage driver's vision enhancer technology, utilizing accurate terrain and obstacle data bases.

(3) Far Term. One enabler to consider for the far term is leveraging current multi-mode radar technology with aircraft programmed for the conventional force. Current mechanical flight controls are separate from multi-mode radar and other terrain avoidance systems. One concept being developed is the ATFCS which will combine flight control inputs with multi-mode radar and terrain following, terrain avoidance radars.

(4) Another research and development effort is OPUL concept. OPUL is a light weight, cost effective pilotage system designed specifically for UH-60 and CH-47 pilots and crew. OPUL will give both pilots and crew chiefs improved imagery in degraded and brownout conditions. One design feature of the OPUL system is the spherical coverage of the aircraft and helmet mounted displays. The helmet mounted displays will allow crew chiefs and flight engineers to "see" through the fuselage to clear the aircraft. The capability for the far term is to utilize display and sensor technologies, which provide field of view, field of regard, and resolution consistent with safe operations (to include heads-up ops for manned aircraft and unmanned air vehicle operators). Another concept in development is the intelligent controls concept. One of the goals of the intelligent controls concepts is to develop guidance algorithms for 3-dimensional obstacle field navigation and landing.

m. Capability to detect obstacles around the aircraft to enhance crew SA and maintain safe spherical standoff distance.

(1) Current. Current designed operational aircraft rely on pilot training and technique while engaged in hovering or slow flight. LZ dust control techniques and technologies vary by aircraft. Current pilotage aids include radar altimeter, FLIR, low light television, symbology derived from the hover page, and moving map displays. Pilot workload increases when flying in degraded flight conditions. The AH-64D has a FCR, radar map and terrain profile mode.

(2) Mid Term. One mid term enabler is driver's vision enhancer technology. This provides the operators of combat and tactical wheeled vehicles with the ability to operate their vehicle effectively 24 hours a day and in foggy, dusty and smoky conditions. It also improves situation awareness and silent watch capabilities. The vision enhancer technology is currently being developed for the Stryker program. One possible source of data is the ASTAMIDS study. ASTAMIDS uses a multi-spectral imager to penetrate fog and haze.

(3) Far Term. No programmed improvements. As mentioned two additional concepts being developed are the ATFCS and OPUL.

n. Capability to predetermine suitability of landing environments.

(1) Current. Pilots are heavily reliant today on pre-mission planning using maps, mission planning systems and aerial ISR assets. The TTVS mentioned in section g is a valuable tool for both the staff and individual aviator.

(2) Mid Term. Software upgrades to current mission planning systems and updates to geo-spatial databases.

(3) Far Term. Software upgrades to current mission planning systems and updates to geo spatial databases and the capability to update imagery and data while in flight.

o. Capability to provide cognitive decision aiding.

(1) Current. Current cognitive decision aids include the RFI, fire control radar, thermal sights and the MTADS. Autonomous RFI passive ranging allows single aircraft to determine the location of radar threat emitters and increase the ranging cues to the FCR for greater accuracy. This capability significantly enhances the efficiency and effectiveness of the AH-64D target acquisition system and enhances the AH-64D survivability

(2) Mid Term. The addition of a CDAS for the AH-64D BKIII will reduce crew workload via rapid computer generated calculations and analysis during combat operations. These computerized analysis and recommendations can be accepted or rejected by the aircrew.

(3) Far Term. The manned and unmanned rotorcraft enhanced survivability concept includes a threat lethality predictor. The predictor generates near real time threat lethality data to the CDAS for IR, RF, and acoustic threats. The predictor also provides geo-referenced lethality footprints for display by the host aircraft mission management system. Manned and unmanned rotor craft enhanced survivability concept eventually transitions to IDAS. IDAS is a cognitive decision-aiding tool that allows for rapid and accurate courses of action. IDAS includes a near real time threat lethality predictor. Potential software and database upgrades could be available in the far term.

p. Capability for digital cockpit displays and advanced man-machine interfaces.

(1) Current. Digitally based aircraft allow pilots to process information from a central location and improve cockpit management. More detailed information is available to the pilot in real time with a reduced reliance on kneeboard information. Second generation FLIR improves upon first generation technology by doubling the range and resolution. Heads up displays allow crewmembers to keep their attention focused outside of the aircraft.

(2) Mid Term. In the mid term, CDAS, mentioned in the previous section, is programmed for the AH-64D aircraft. Software upgrades and an improved cockpit menu system will improve the pilots' ability to focus outside of the aircraft. The improved Air Soldier system will include wireless intercom for the aircrew and improved heads up display and day heads up display capability.

(3) Far Term. Improved cockpit menu system, software upgrades, improved Air Soldier system will all carry over into the far term. Three current science and technology efforts include, voice commands, 3-D audio and wide field of view NVGs. Voice commands will help shorten task timelines by allowing crewmembers to interact quickly with the aircraft. Voice commands will help replace manual data entry (keypad) and allow crewmembers to keep their attention focused on the external environment. The 3-dimensional audio will enhance SA and reduce task times by allowing crewmembers to spatially locate battlefield elements (such as, threat and friendly vehicles). It could also help crewmembers quickly react to safety problems. For example, if the left engine became inoperable, the crewmembers would instinctively know that the left engine was inoperable because they would hear the warning annunciation in their left ear. Wide field of view NVGs will enhance crewmember performance and reduce the probability of accidents by improving the capability of crewmembers to visually detect targets, avoid obstacles, and identify cultural features.

q. Capability for lighter weight head-borne systems for manned crews.

(1) Current. The basic Helmet Gentex Unit 56/P flight helmet. AN/AVS-6 NVG and AN-AVS 7 heads up display unit. The AN/AVS-6, required battery pack and counterweights and AN/AVS-7 heads up display also add to the amount of stress on the aviators. Further, the elector-optical cable on the heads up display is stiff, heavy, and bulky. Transition to a pliable fiber-optic cable is beneficial and necessary.

(2) Mid Term. No programmed improvements.

(3) Far Term. The far term goal is a joint design. One solution for the far term is the modular aircrew common helmet.

r. Capability to protect the network/information assurance from intercepts, jamming, viruses, through integrated and centralized network management.

(1) Current

(a) Aviation will implement information assurance policies in aircraft and data processing subsystems in accordance with Army Regulation 25-2, *The Army Information Assurance Program* (AIAP). AIAP is a unified approach to protect unclassified, sensitive, or classified information stored, processed, accessed, or transmitted by Army information systems, and is established to consolidate and focus Army efforts in securing that information, including its associated systems and resources, to increase the level of trust of this information and the originating source. The AIAP is not a stand-alone program, but incorporates related functions from other standards or policies such as operations security, communications security, transmission security, information security, and physical security to achieve information assurance requirements.

(b) Network protection extends beyond basic radio encryption. It keeps the network safe from intercept, jamming, viruses, worms and other external exploitation. Protection includes intrusion detection, prevention, firewalls, vulnerability assessment, integrated security, net filtering, and a centralized management system to maximize network operating time and



minimize the need for active administrator involvement. Aircraft, ground platforms, and operations centers integrate and enforce the security measures. Operators have a role managing and employing the two-part encryption codes. These encryption keys secure transmissions and decrypt incoming packets dynamically and transparently. Aviation mission planning and aircraft processors must incorporate these features to protect aviation networks.

(2) Mid Term. No programmed improvements.

(3) Far Term. No programmed improvements.

s. Capability to safeguard weapons from most common electronic interference, spoofers or false target generators.

(1) Current. HERO. Current ammunition with electric primers is HERO susceptible under handling, loading, and presence conditions. The presence defines a condition where there are live rounds exposed directly to RF energy. Ammunition is HERO susceptible to RF radiation from fire control and surface and air search radar and from high frequency communication transmitter equipment. Close proximity to RF emitters is primarily a concern when conducting shipboard operations. TTPs have been developed for arming aircraft on both land and sea. FARPs conduct stray voltage and static voltage checks during rearming procedures. Initiatives to meet dual safe Army fuse board requirements will continue through the mid term. Improvements to the M151 high explosive warhead will apply to both guided and unguided rockets.

(2) Mid Term. No programmed improvements.

(3) Far Term. No programmed improvements. Current efforts are under way to improve the safety of fuzes. As DEWs begin to proliferate, material solutions will have to be developed to improve shielding and protection of the firing circuit.

#### **4-7. Assessment of Sustain Related Aviation Enablers**

a. Responsive sustainment is measured in terms of time, distance, and sustained momentum. This responsiveness is achieved with rapid and sustained strategic lift, forward-deployed supplies, and seabasing. It requires close, continuous coordination between Army Service component commanders and joint, Service, and interagency personnel to achieve deployability levels and responsive sustainment through multiple unimproved entry points without relying on fixed ports and staging bases. Operations will take place in complex terrain, at high wartime flying hour mission usage rates, over long periods and an extended discontinuous environment. BCTs are required to sustain high-intensity operations for 3 days without external resupply or support. This will require enhanced aviation systems and capabilities. Systems must be transportable, logistics must be focused and flexible, and a culture must reside within the Army that accepts deployment readiness as a way of life.

b. Future operations emphasize maximum mission utilization of deployed systems and minimization of the logistics footprint. Aviation must significantly reduce the maintenance

work-hours per flight hour, minimize the launch-recover-launch cycle time, and be able to rapidly reconfigure systems to meet changing mission needs. Aviation units must achieve and maintain a 90percent operationally ready rate at wartime flying hour rate usage generated by mission demand. Aviation will need anticipatory maintenance systems based on component condition established by embedded diagnostics/prognostics with data logging and remote data transmission rather than current systems based on operating hours. Aviation needs an “on condition” based, two level maintenance process and to automate the maintenance process to work with a resupply parts delivery concept. Platform operating costs must be reduced. Systems must achieve improved reliability and exhibit graceful degradation of function during mission execution to minimize mission aborts. To maintain OPTEMPO, flight and ground crews need the ability to rearm and refuel aircraft up to a basic combat load in less than 15 minutes, and achieve a mean time to repair of less than 2 hours for field level maintenance. Sustainability requirements reflect the continuous, uninterrupted provision of sustainment replenishment to Army forces.

c. Table 4-6 depicts the current, mid term and far term assessment of the sustain related aviation enablers required by the future Modular Force.

**Table 4-6.**  
**Sustain Capability Migration Plan**

<b>Sustain Aviation Enablers</b>			
<b>Enabling Capability Needs</b>	<b>Current Enablers FY 07-09</b>	<b>Mid Term Enablers Migration 10-15</b>	<b>Far Term Enablers Migration 16-24</b>
d. Capability to establish a condition based two level maintenance process. Automate the maintenance process to work with a sense and respond parts delivery concept.	- Transitioning from three level maintenance system to two level maintenance for aircraft, enhanced by placing ASBs within CABs and AMCs in the battalions. Tactical ATS system maintenance transitions to two level maintenance with general support and special repair activity support from an ATS maintenance company and area maintenance support facilities (AMSFs)	- System maintenance compatible with two level maintenance. ATS continues relationship with ATS maintenance company and AMSFs.	- ADEC (MFOQA,CBM)
e. Capability to AGSE with designed-in deployability, reliability, maintainability, availability, sustainability and interoperability to increase readiness and reduce logistics requirements and costs.	- Aviation ground power unit - Shop equipment contact maintenance - Generic aircraft nitrogen generators - BDAR - Standard Army towing system - Shop sets - Aviation vibration analyzer - Nondestructive test equipment - Digital aircraft weight scale - Unit maintenance aerial recovery kit	- Self-propelled crane aircraft maintenance and positioning - Air ground radio service - Aviation light utility mobile maintenance capability	

<p>f. Capability to provide a fully deployable aviation sustainment maintenance organization, which can be either land based or seabased.</p>	<ul style="list-style-type: none"> <li>- Limited sustainment maintenance (depot level) in support of the National Maintenance Program. (AVCRAD)</li> </ul>	<ul style="list-style-type: none"> <li>- Limited TASMC fielded towards end of mid term. Land and seabased.</li> </ul>	<ul style="list-style-type: none"> <li>- Full TASMC fielded to include airframe repair on vessel and hangar facilities.</li> </ul>
<p>g. Capability to sustain a high operational readiness rate, with minimal demands on quality and quantity of logistics manpower and compatible with the CLOE.</p>	<ul style="list-style-type: none"> <li>- Unit Level Logistics System-Aviation (enhanced) (ULLS-A(E)), Standard Army Maintenance System (enhanced) (SAMS(E)), SAR</li> <li>- interactive electronic technical manuals (IETM)</li> </ul>		<ul style="list-style-type: none"> <li>- ADEC (MFOQA,CBM)</li> <li>- GCSS-A</li> <li>- Capability-based operations and sustainment technologies</li> </ul>
<p>h. Capability of systems, which provide graceful degradation. Aircraft to reconfigure systems in response to component degradation or failure during missions.</p>			<ul style="list-style-type: none"> <li>- Intelligent active controls.</li> <li>- LARC.</li> <li>- Reconfigurable vehicle technology.</li> <li>- Adaptive vehicle management system.</li> </ul>
<p>i. Capability to provide affordable, lightweight, durable, survivable, and repairable airframe and auxiliary fuel systems.</p>	<ul style="list-style-type: none"> <li>- Cargo Compartment Expanded Range Fuel System (CH-47)</li> <li>- Internal auxiliary tank (UH-60)</li> <li>- Internal auxiliary tank (AH-64)</li> <li>- CEFS (AH-64,UH-60)</li> </ul>		<ul style="list-style-type: none"> <li>- SARAP</li> <li>- Platform durability and damage tolerance.</li> <li>- LARC</li> </ul>
<p>j. Capability to provide enhancements that enable aviation Soldiers and crewmembers stamina through prevention of disease and enhance endurance in hot, cold, dry and wet weather. Integrated Soldier systems allowing crews to operate over extended mission durations.</p>	<ul style="list-style-type: none"> <li>- Air Warrior-(AW) Block 1 complete - AW Block 2 begins fielding</li> </ul>	<ul style="list-style-type: none"> <li>- AW Block 2 complete</li> <li>- AW Block 3 begins fielding</li> </ul>	<ul style="list-style-type: none"> <li>- AW Block 3 complete</li> <li>- Transition to Air Soldier System</li> </ul>
<p>k. Capability for more realistic TADSS. Embedded training and mission rehearsal capability.</p>	<ul style="list-style-type: none"> <li>- Lift Simulator Modernization Program (UH60A/L CH47D)</li> <li>- Transportable Blackhawk Operational Simulator) (UH60M)</li> <li>- Transportable Flight Proficiency Simulator (CH47D)</li> <li>- Longbow crew trainer (AH64D)</li> <li>- CMS (AH64A)</li> <li>- AVCATT-A</li> <li>-Multiple Unified Simulation Environment-MUSE (UAS)</li> <li>-Enhanced Tower Operator Simulator (ATS)</li> <li>- Army Aviation Radar Training Simulator</li> <li>- Commercial-off-the-shelf, stand-alone, and non-tactical ATC tower and radar simulators purchased by</li> </ul>	<ul style="list-style-type: none"> <li>- ASE threat simulation</li> <li>- One SAF and SE core integration into flight simulators and AVCATT-A</li> <li>- Non-rated crewmember trainer</li> <li>- Manned and unmanned</li> <li>- ARH-70 (CMS)</li> <li>- Tactical ATS systems embedded with ATC simulators</li> </ul>	<ul style="list-style-type: none"> <li>- Operationalized simulation capabilities integrated within platforms</li> <li>- Combined individual and collective flight and ATC simulators</li> <li>- Interoperability between aviation simulation and FCS ground system embedded training</li> <li>- FCS interdependency links replicated in aviation simulation</li> <li>- Embedded (laptop) virtual and constructive training capability.</li> <li>- Interoperable live instrumentation with virtual and constructive environments.</li> <li>- Timely simulation concurrency with aircraft block improvements</li> </ul>

	some ATS units. - Armed Reconnaissance Mission Simulator)		- Full deployability
l. Capability to perform audio and video communications between MEDEVAC aircraft and medical treatment facilities.	- Battle command network over BFT-Army, free text only, FBCB2 - UH-60M baseline operational testing	- UH-60M upgrade operational testing	- HH-60M operational testing - MEDEVAC request icon for SA. MEDEVAC response message to task desired system and update the requesting station. The ability to video link a Flight Medic helmet camera to the receiving medical treatment facility or a specialty doctor from a remote location to an Army medical center in real time.
m. Capability to minimize aircraft turn-around time for refueling and rearming through a flexible system of planned logistics support.	- Advanced Aviation Forward Area Refueling System (AAFARS)		-Smart launchers -Robotic systems
n. Capability for rapid movement of medium weight, modular payloads utilizing UAS. (precise delivery of supplies to forward locations).		- UAS (for example, the broad-area unmanned responsive resupply operation (BURRO))	
o. Capability to have embedded joint ITV and tactical asset visibility of aviation air and ground systems for movement planning and tracking.	- RF tags		- GCSS-A

d. Capability to establish a condition based two-level maintenance process. Automate the maintenance process to work with a sense and respond parts delivery concept.

(1) Current. Army aviation is currently transforming to two level maintenance, field and sustainment, which has replaced the previous three levels of aviation unit maintenance (battalion), aviation intermediate maintenance (division, corps, theater), and depot (national) for aircraft, and the four levels of unit and organizational, direct support, general support, and depot maintenance for ATS systems. Field maintenance level tasks are divided between two organizations for aircraft: the ASC in the ASB; and the AMC in the flight battalions. Field maintenance for ATS units is provided by the communication - navigational maintenance section of each ATS company and airfield operations battalion. ARNG TASMG, AMC Depots at the National Level, and the original equipment manufacturers form the sustainment level of maintenance. An ATS maintenance company (ordnance) and AMSFs provide general support and special repair activity support for legacy tactical ATS systems not covered by an original manufacturer's warranty.

(2) Mid Term. Army aviation continues to conduct two level maintenance procedures. The maintenance company and the AMSFs continue their special general support and special repair activity relationship with tactical ATS systems.

## (3) Far Term

(a) The ADEC encompasses the concepts of MFOQA and CBM. MFOQA will process flight information, achieved through digital data download from the aircraft, and analyze the data. The fully integrated MFOQA capability will provide diagnostics and prognostics to enhance safety, training, maintenance, and operations. CBM replaces scheduled maintenance within the two level maintenance system. CBM will process the capabilities derived, in large part, from real time assessment of the platform and weapon system condition, obtained from embedded sensors and external tests and measurements. These capabilities will increase operational availability and readiness at a reduced cost throughout the platform and weapon system life cycle. CBM will streamline logistical sustainment by performing maintenance only upon evidence of need.

(b) Additionally, standardization of aircraft components and equipment coupled with evolutionary changes in technology will reduce the in-theater logistical footprint as well as operational and support costs. Requisitioned parts will flow through the system in a matter of hours instead of days, and be tracked via embedded electronics so that asset visibility is maintained wherever the unit is deployed. ADEC will support the CLOE protocols and standards as the baseline for moving data from the aircraft to the unit and into the enterprise resource planning environment. It provides the requirement for planned and well-designed embedded data monitoring and collection systems on Army aircraft, and lays the foundation for development of on/at aircraft data analysis tools to exploit fully the information. The ADEC provides a capability to institute improved aircraft maintenance decision making, aircraft accident investigations, risk management, and flight record keeping. CBM is the consistent collection and analysis of the digital data, predicting failures, viewing component wear and will provide insight to the components status, thus resulting in higher reliable more efficient components. Modern tactical ATS systems are fully serviced by a two level maintenance system with CBM.

e. Capability to provide aviation ground support equipment with designed-in deployability, reliability, maintainability, availability, sustainability and interoperability to increase readiness and reduce logistics requirements and costs. A need exists for a reliable and sustainable AGSE capable of operating in the contemporary environment for current and future Modular Force operations. AGSE must support the transformation to two level maintenance and to condition based maintenance. AGSE must be able to support aviation maintenance while based at sea and operate in austere environments to include extreme temperature and weather conditions.

(1) Current. The current systems are being upgraded through service life extension programs that will carry aviation maintenance support through 2025. The aviation ground power unit, shop equipment contact maintenance, generic aircraft nitrogen generators, BDAR, standard Army towing system, shop sets, aviation vibration analyzer, nondestructive test equipment, digital aircraft weight scale, and unit maintenance aerial recovery kit are being upgraded under an on-going improvement program that carries this support equipment through 2009. Standardization of common components of AGSE and diagnostic test equipment will enhance maintenance and contribute to a reduced logistics footprint. Aircraft will be designed with components that are common throughout the Army. This will reduce the amount of repair parts

and associated costs needed to support the aircraft fleet. Common components will allow for standardization of tools, diagnostic test equipment, and ground support equipment required by aviation units. Fewer repair parts, tools, and equipment will further reduce the logistics footprint. These systems address many of the gaps identified in the AGS ICD.

(2) Mid Term. A new program is being worked for a self-propelled crane aircraft maintenance and positioning (7.5 ton) crane replacement that will be fielded during mid-term. The aviation ground power unit, shop equipment contact maintenance, generic aircraft nitrogen generators,, BDAR, standard Army towing system, shop sets, aviation vibration analyzer, nondestructive test equipment, digital aircraft weight scale, and unit maintenance aerial recovery kit are being upgraded under an on going improvement program that carries this equipment through mid term and also into far term. There are two new programs, air ground radio service and aviation light utility mobile maintenance capability, that are to be fielded during mid term and will also be carried through 2025.

(3) Far Term. All of the AGSE programs have been through upgrades and service life extension programs and provide support for aviation maintenance through 2025. Capabilities within CBM will provide the data that will enhance these systems.

f. Capability to provide a fully deployable aviation sustainment maintenance organization which can be either land based or sea based. A capability gap exists in the ability to provide sustainment maintenance (selected depot level component and airframe repair) in support of sustained aviation combat operations in an immature theater and during seabased operations. This logistic sustainment dependence can be reduced by performing depot level maintenance repair in theater. Performing this maintenance in theater will reduce the dependence on the industrial sustainment base supporting aviation operations.

(1) Current. AVCRADs currently provide limited depot level aviation logistics and maintenance functions in support of the NMP as a land based component. The Army's current Total Army Analysis addresses AVCRAD requirements in each of the two major theaters of operation in support of the Army Material Command's Logistics Support Element Theater Aviation Maintenance Program, as well as, to support CONUS-based aviation operations and training. The current AVCRAD (TDA is designed without the tactical vehicles and communications equipment or the personnel to sustain this equipment required of a theater level sustainment organization.) HQ Department of the Army (DA) directed TRADOC to convert existing AVCRAD TDAs to TASMG table of organizations and equipment and develop an ICD to establish the requirement for both a land and sea based sustainment maintenance capability.

(2) Mid Term. The TASMC enables continuous logistics support and improves aircraft operational readiness by conducting sustainment maintenance forward and reducing the logistics tail. Additionally the TASMC vessel provides dedicated deployment prioritization with no impact on other strategic lift assets. The TASMC will provide limited maintenance capability, supply, and ancillary support (AGSE, aviation life support equipment, TMDE, oil analysis) for the repair of components in support of the NMP while sea or land based.

(3) Far Term. TASMC will enable shipboard airframe repair and hangar facilities.

g. Capability to sustain a high operational readiness rate, with minimal demands on quality and quantity of logistics manpower and compatible with the CLOE. This will require computer assisted maintenance procedures, digitized maintenance documentation, anticipatory maintenance, balanced system reliability, redundancy and repair, and aircraft to perform self diagnostic and prognostic tests, compile a report, and then transmit systems health when prompted internally or queried externally.

(1) Current. The CLOE will identify operational sustainability within a transformed, modular aviation brigade in order to reduce the burden on the Soldier, increase operational readiness, and decrease sustainment costs.

(a) The ULLS-A(E) and the SAMS(E) make up the automated portions (forms and records) of The Army Maintenance Management System (TAMMS). These systems provide commanders and aviation support personnel with greatly improved access to readiness and logistics management information, enabling them to make faster and better informed decisions. ULLS-A(E) automates the logistics functions for aviation units to include unit maintenance and materiel readiness management operations. Without ULLS-A(E), aviation units would be unable to support the Army's two levels of maintenance.

(b) Digitization of paper-based products and computer assisted maintenance includes IETMs, logbooks, diagnostic procedures, requisitions, and status reports. Technical manuals, logbooks, aviation status reports, and diagnostic procedures will be in electronic formats. Mechanics and technicians will use maintenance support devices with IETMs as the initial entry point for all maintenance actions into the Army maintenance module. These devices are capable of interfacing with equipment end items via a digital source collector or data bus using a single port low-power RF device. The IETM will be capable of running embedded and off-platform diagnostics programs, interfacing with automatic identification technology (AIT) devices for information, processing work orders, managing, service actions, requesting parts, and reviewing training for maintenance tasks via animation, video clips, or digital pictures. The AIT includes a variety of read and write data storage technologies that are used to process asset identification information. These technologies include bar codes, magnetic strips, integrated circuit or smart cards, optical memory cards (OMC), RF identification tags, and magnetic storage media.

(c) These AIT devices are core requirements to reduce repair cycle time and support costs. The basis of these digitization efforts will be a man-portable computer system in which all aircraft technical manuals, repair procedures, and requisitions will be encompassed in one standardized piece of equipment. This equipment will be light and small enough to be worn while working on aircraft. The man portable computer will communicate with aircraft systems to electronically download maintenance work and required parts into unit production control and quality control computer systems.

(2) Mid Term. ULLS-A(E) will be upgraded with a UAS module to enable utilization by all UAS (except the Raven model). Army ATS units must transition to digitized, interactive formats and processes for technical manuals, maintenance, logistics, and status reporting of tactical ATS systems to continue participation in TAMMS and prepare for conversion to GCSS-A.

(3) Far Term. ULLS-A(E) and SAMS(E) will convert to GCSS-A (Global Combat Support System-Army), which will perform all aviation maintenance and logistic functions currently provided by TAMMS. ADEC and MFOQA will enhance the capability by providing digital data for TAMMS. GCSS-A is the solution for logistics and maintenance modules Army wide. GCSS-A will have the capability of automated TAMMS such as ULLS-A(E), SAMS(E), and SARS. Integrated communications systems will include state-of-the-art connectivity throughout the maneuver sustainment community; facilitating the rapid and assured delivery of repair parts. The integration of state-of-the-art voice and data links throughout the sustainment community will increase the effectiveness of aviation logistics by automating requisitions and reducing shipping times. Instantaneous lateral searches for repair parts will extend well beyond the aviation support unit. The system will transmit automated status reports to appropriate sustainment agencies, as well as higher headquarters. Immediate parts location will make just right logistics availability of repair parts possible. Capability based operations and sustainment technologies include system level, prognostic and diagnostic algorithms covering corrosion, rotor system, aircraft usage, subsystems and engine faults and performance. CBM IETM may be incorporated into GCSS-A and health and usage monitoring system ground stations will assist in maintenance procedures.

h. Capability of systems which provide graceful degradation. Aircraft to reconfigure systems in response to component degradation or failure during missions, so that the mission can be completed rather than aborted.

(1) Current. No programmed capability.

(2) Mid Term. No programmed capability.

(3) Far Term. No programmed capability. Intelligent active controls is the seamless operation across many modes, with increased platform integration; analysis considering integrated control architectures; autonomous control algorithms adapted for larger piloted configurations. Flight control and aero analysis is needed for dynamically-complex, multipurpose configurations. LARC is improved rotorcraft performance using advanced technology, active on-blade control, and innovative passive design.

i. Capability to provide affordable, lightweight, durable, survivable, and repairable airframe and auxiliary fuel systems.

(1) Current

(a) Two internal auxiliary fuel systems are available for the AH-64 helicopter. The 130 system provides approximately 130 gallons of additional fuel. The combo pack system provides approximately 100 gallons of additional fuel and an ammunition storage magazine that permits the AH-64 to carry 300 rounds of 30 millimeter ammunition. Both internal auxiliary fuel tanks are crashworthy, self-sealing, single-point pressure refuelable and nitrogen inerted. Both systems are interchangeable with each other and with the AH-64 standard ammunition storage magazine. Using the AH-64 magazine and auxiliary tank transfer system, either the 130 gallon fuel system, the combo pack or the existing ammunition storage magazine can be installed or



removed in less than 30 minutes. The crashworthy external fuel system includes components that permit an AH-64 or UH-60 equipped with an automatic fuel management system and external stores support system to carry up to four crashworthy tanks on the wing pylons. Each tank holds approximately 200 gallons of fuel and is crashworthy, self-sealing, and single-point pressure refuelable simultaneously with the helicopter's main tanks. Each crashworthy external fuel system tank can be installed or removed by two personnel in approximately 10 minutes using a portable ground-handling device.

(b) UH-60. A single 200 gallon internal auxiliary tank installed against the rear bulkhead of the cargo compartment provides approximately a 50 percent increase in range and endurance. Two 185 gallon tanks installed against the rear bulkhead of the cargo compartment provide approximately a 100 percent increase in range and endurance. The internal auxiliary fuel tanks of both systems are crashworthy, self-sealing and single-point pressure refuelable simultaneously with the helicopter's main tanks. Two personnel can install or remove either system in about 10 minutes per tank.

(c) CH-47. The cargo compartment expanded range fuel system consists of three 800 gallon crashworthy fuel tanks with restraint systems, fixed hardware, and plumbing. One to three tanks can be installed or removed by a crew of four without tools and be operational in approximately 20 minutes. The system provides the CH-47 with up to 2,400 gallons of fuel, effectively extending the range to 1,100 nm. Equipped with the forward area refueling equipment, the CH-47 can deliver fuel to forward area aircraft or ground units over a radius of 150 nm.

(2) Mid Term. No programmed improvements.

(3) Far Term. No programmed improvements. Research efforts include full spectrum crashworthiness which will establish a standardized crashworthy design and improve crash survivability of rotary wing aircraft occupants. Data from SARAP can be leveraged to demonstrate crashworthy and ballistic tolerant airframe concepts. Additionally, aircrew survivability technologies are being studied with the goal of reducing aircraft and crew vulnerability to ballistic and crash events. Platform durability and damage tolerance program will identify failure modes, develop standard test methods, determine damage tolerance criterion, model damage on-set and growth, develop fracture mechanics based life prediction methodologies and certification using probabilistic methods.

j. Capability to provide enhancements that enable aviation Soldiers and crewmembers stamina through prevention of disease and enhance endurance in hot, cold, dry and wet weather. Integrated Soldier systems allowing crews to operate over extended mission durations.

(1) Current. The Air Warrior is a joint Service program that will effectively integrate state-of-the-art aircrew mission equipment with personal protective gear and clothing that is primarily aircrew mounted. A three-block approach is being pursued in the development and manufacture of the Air Warrior system. Block 1 is directed toward currently available technology and Blocks 2 and 3 will focus on the development and insertion of emerging technologies. Air Warrior addresses the operational need for maximum protection of aircrews

from nuclear, biological, and chemical contamination, and from flame, heat, munitions, and small arms. Air Warrior also addresses the requirement for a materiel solution to reduce complexity, eliminate incompatibilities, and minimize fatigue, stress, weight, and bulk associated with previous aviation life support equipment in order to enhance aircrew effectiveness and stamina. Air Warrior is an integrated, modular, mission-tailorable aviation life support equipment and chemical and biological protective ensembles for aircrew Soldiers. The Air Warrior system consists of items worn by aircrew and mounted on aircraft platforms.

(a) Block 1 focuses on improving aircrew survivability and mission endurance through a number of improvements that include:

- Improved over water survivability.
- Improved flame protection for uniform.
- Increased chemical and biological protection through the modified chemical protective undergarment and the modified aviation battle dress uniform combination, and adding a blower to the existing M45 mask.
- Tailorable, modular ballistic protection.
- Improved ergonomics that allow access to most survival equipment with either hand.
- Increased ammunition carrying capacity for the M9.
- Microclimate cooling.
- Reduced logistical footprint.

(b) Block 2 increases aircrew survivability and force effectiveness through these and other improvements:

- Technical insertion of the wide field-of-view advanced night vision goggle and joint Service aircrew mask.
- Addition of an electronic data manager automates many pilotage tasks and publications, reducing paper clutter and increasing pilot efficiency. The data manager can also serve as an interim digital navigation and flight-planning tool.
- Addition of the aircrew wireless intercom system permits crew chiefs, flight engineers, and flight medics to attend to tasks in and around the aircraft cabin with both hands and still maintain communication with the pilots.
- Technical insertion of improved chemical and biological protection in the form of the joint Service aircrew mask and joint protective aircrew ensemble.
- Improved laser eye protection in the form of the joint advanced laser eye protection device.
- Technical insertion of the combat survivor evader locator radio, which provides worldwide automatic position reporting and over-the-horizon communications capability.

(2) Mid Term. Block 3 increases aircrew survivability and force effectiveness through:

- Total transparency between day, night, and mission-oriented protective posture 4 capabilities. This will be achieved through incorporation of the fully compliant multiple integrated helmet display system.

- Nuclear flash protection (even temporary flash blindness can be fatal for aircrews in flight).
- Agile laser eye protection that protects against the full spectrum of hazardous lasers on the battlefield.

(3) Far Term. Air Soldier system replaces Air Warrior and will include any of the improvements not totally achieved in Block 1-3.

k. Capability for more affordable, realistic and sustainable TADSS with embedded training and mission rehearsal capability. Army aviation must have the capability to effectively and affordably train, sustain, and evaluate aviation personnel in individual, leader, and collective warfighting skills. To the extent possible, it is desirable to embed training capabilities into the actual systems, which will allow the system to function as a stand-alone or as part of a collective training system. The training system and TADSS will allow a combination of interoperable, live, constructive, and virtual simulation. Aircraft simulators must be networked with ‘tiered’ full task trainers embedded in future combat platforms and command posts and enable training linkage from home station to National Support Centers, to CTCs, and to other geographic locations. Aviation doctrine and training architecture must also complement joint and Army doctrine development.

(1) Aviation is facing a complex and ever changing environment. As a result of transformation and CAB redesign, aviation commanders must cope with preparing for such diverse and complex missions as reconnaissance, close combat attack, sustainment, MEDEVAC, and convoy escort. Due to the current OPTEMPO, commanders are working within shortened post-deployment and pre-deployment cycles in order to prepare for combat operations. Once deployed, units face near simultaneous deployment and employment against adaptable adversaries.

(2) This creates a sizeable challenge, especially in terms of mitigating risk for pre-deployment and in-theater training and the subsequent post deployment transition to civil airspace and the training required to reacquire lost skills.

(3) Unfortunately, first generation simulation technology is not keeping pace with these needs. The current strategy of high fidelity individual and crew, and low fidelity collective simulators limits the ability to add the needed rigor to training. Compounding the problem is the lag between platform and simulator upgrades. Now more than ever, the conditions exist for a new look at how simulations and simulators can support not only home station training but also training, mission planning and rehearsal while deployed. This is especially true as we transition to the future Modular Force.

(4) Though the COE may change, we can expect even greater training challenges especially when operating in a distributed, noncontiguous operational environment over great distances. The need to operate and train in an air-ground, joint and coalition warfare environment will increase. The interdependencies driven by battle command systems, SA and SU, sensor to shooter linkages will result in increasing complexity in both training and execution. The demand will grow for the ability to plug and train but also for plug and plan.

Whether at home station, en route, or deployed commanders will demand the ability to seamlessly network simulations, simulators, and battle command systems around the corner or around the globe to achieve a seamless collaborative environment that provides the high fidelity to train, plan and win.

(5) Current. Aviation utilizes multiple types (rotary, UAS and ATS) of simulations focused on different echelons of training (individual and crew vice collective) and capabilities with limited or no interoperability. Any effort to conduct Army air-ground training requires workarounds and there is a limited joint capability. Units at home station lack the ability to stimulate ASE and while a system is in development, there is an absence of a virtual trainer for non-rated crewmembers. ATC simulators are not present in our tactical ATS systems. Some ATS units have purchased highly-capable, stand-alone COTS ATC simulators, but they are not tactically deployable or embeddable with our mobile, space-constrained tactical systems.

(6) Mid Term

(a) True interoperability between simulators and simulations will be enhanced through the integration of One SAF and Synthetic Environment Core, providing common SAF and common terrain databases, enabling interoperability for crew coordination fidelity in collective environment, providing a realistic venue for collective Army air-ground and enabling virtual and or constructive battle command training. Tactical ATS systems will start incorporating ATC simulators. The MOTS will be fielded with a capability for training ATC operators using COTS, virtual-based training through the depiction of an electronic, visual control tower scenario that incorporates voice and audio interaction. The capability will also make use of the MOTS voice recorder's record and playback capability for post-simulation evaluation. TAIS, ATNAVICS, and TTCS will integrate simulations that provide qualification and proficiency training for terminal and en route ATC skill tasks. All tactical ATS systems must have the capability for training scenarios to be accessed from pre-configured training applications and operator-developed scenarios of emergency procedures, deployments, mission rehearsals, and other unique unit training requirements.

(b) The full requirement is to integrate aviation functional capabilities for live, virtual, and constructive domains allowing simulated aircraft flight and mission execution, UAS simulation of MUM teaming, and integration of ATC operator, maintainer, and non-rated crewmember trainer simulation in an interoperable collective joint environment.

(c) Address shortcomings in ASE training at home station using a multi-faceted approach, providing an on-board simulation and stimulation capability for individual, collective, and collective training with the potential for interoperability with live ranges such as the Digital Multipurpose Range Complex and Digital Air Ground Integration Range.

(d) Fill an unaddressed need for non-rated crewmembers a virtual simulation capability that provides the crew an immersive environment for missions such as sling load operations, troop insertions or hoist operations as well as gunnery and obstacle observation and avoidance.

(e) Safety and airspace concerns will drive the need to develop a manned-unmanned teaming capability that encompasses the rotary wing, UAS and ATS communities. The capabilities must range from receipt and display of secondary imagery data (LOI 1) to full function and control of the unmanned aircraft, including takeoff and landing (LOI 5) from the cockpit.

(f) Develop links and the long-haul communications capability between aviation, ground, and joint simulation capabilities to create an environment where you can achieve a plug in and train, plan and rehearse.

(7) Far Term

(a) Provide combat aviation commanders a combined procedural and collective trainer and a full complement of training enablers – live, virtual, constructive, and battle command. These enablers would be interoperable with ATC, UAS, non-rated crewmember, and Army ground and joint virtual simulation systems. In addition, these enablers will include all interdependency links for future Modular Force and will be mandated to provide timely concurrency upgrades.

(b) Operationalize our platforms with simulation technology for SA, COA analysis, and change of mission en route rehearsal – linked and populated by C2 systems with 3-dimensional models.

(c) Interoperable live instrumentation with virtual and constructive environments that are embedded in the platform and would stimulate or be stimulated by battle command systems.

(d) Embedded virtual and constructive training capability for anytime, anywhere training that would be laptop based for use in the company area, en route, or in theater.

(e) Provide commanders a true deployable virtual simulator that is consistent with a unit's deployment capability that can withstand harsh environments, require little to no site preparation or infrastructure and has the required support for sustained operation within any given theater.

(f) Develop and integrate Future Modular Force and FCS simulation capabilities.

(g) Create the environment between installations (persistent long haul) and within installations for distributed training and ensure aviation fixed, mobile and laptop live, virtual, constructive simulation capabilities are interoperable with FCS and joint training enablers in order to train, plan or rehearse in a collaborative environment.

(h) Contractually mandate timely simulator upgrades in conjunction with aircraft block improvements.

1. Capability to perform audio and video communications between MEDEVAC aircraft and medical treatment facilities.

(1) Current. FBCB2, BFT (near real time) free text only, with no ability to identify an HH-60 MEDEVAC aircraft from a UH-60.

(2) Mid Term. Development of an Icon for commanders at all levels to have SA on the point of MEDEVAC request. The development of message threads to include an action or response to a MEDEVAC request and the ability to update the original SA icon with responding unit information.

(3) Far Term. No further improvements programmed. A helmet mounted camera with video and audio links will enable the flight medic in an aircraft to contact medical treatment facilities in theater and CONUS for treatment consultations in-flight (tele-medicine).

m. Capability to minimize aircraft turn-around time for refueling and rearming through a flexible system of planned logistics support. This requires the ability to refuel rapidly multiple manned and unmanned aircraft simultaneously with munitions pre-packaged to accommodate rapid rearming and capable of being air transported and emplaced. This should include capability to reconfigure cargo or lift platforms to act as refuelers for other aerial or ground systems including rapid, automated refueling of air and ground unmanned systems with minimum need for human oversight.

(1) Current. The AAFARS is a modular, lightweight, portable combat refueling system designed for rapid refueling of forward-area military aircraft in support of deep strikes. AAFARS has a 240-gallon-per-minute pump that provides fuel to four fueling points at a rate of 55-gallons per minute minimum at each point. AAFARS offers significant tactical advantage with its small size, lightweight, high reliability, low noise, and ease of use. This rugged system is helicopter-transportable and Soldier-portable. It can be assembled in 20 minutes and broken down in 30 minutes in field demonstrations.

(2) Mid Term. No programmed improvements.

(3) Far Term. No programmed improvements.

n. Capability of rapid movement of medium weight, modular payloads utilizing UAS (precise delivery of supplies and repair parts to forward locations).

(1) Current. No programmed capability.

(2) Mid Term

(a) No programmed capability. However, the BURRO is a developmental version of a UAS that has the ability to lift up to 6,000 pounds of cargo. The BURRO supports the Army's transformation to future Modular Force by autonomously lifting munitions, robotic weapon systems, unmanned ground vehicles, and supplies. It also provides unique opportunities to test UAS subsystems such as an obstacle avoidance sensor system using the on-board safety pilot to ensure testing moves as rapidly as possible and that valuable sensors and aircraft are preserved.

Enhanced efforts will develop an external fuel tank providing the BURRO with the ability to fly for over 10 hours and more than 500nm. The aircraft will be continuously tracked through the integration of a satellite communications and tracking system, allowing operators to locate and track mission progress well beyond the horizon.

(b) The Army Aviation and Missile Command Research Development and Engineering Center, Advanced Systems Directorate, will be overseeing the development, fabrication, and integration of the new systems. Demonstrating a capability to remain over a given area for a long period will validate the near term practicality of a number of Army future concepts. The enhanced BURRO will have the ability to position network extension packages over the battlefield for 10 hours at a time, or accurately deliver 1,000 pounds of supplies from a rear area to locations over 200nm away and return.

(3) Far Term. No programmed improvements.

o. Capability to have embedded joint ITV and TAV of aviation air and ground systems for movement planning and tracking.

(1) Current. Units have the capability to electronically track parts via satellite through embedded RF technologies emplaced in shipments and know the status and location of the part throughout shipment.

(2) Mid Term. No improvements programmed.

(3) Far Term

(a) GCSS-A is one of the Army's key maneuver sustainment enablers for effective distribution operations. GCSS-A facilitates management of the distribution pipeline by providing access to TAV information. Through GCSS-A, logisticians will have visibility of supplies and equipment in storage and en route in near real time from the national level to the brigade. Below brigade TAV, information is available when the user connects to the national level. By coupling TAV information with maintenance requirements and analysis, GCSS-A, will provide commanders and logisticians the tools they need to project future combat power and to direct assets to meet critical requirements. Integrating TAV information will allow a better matching of supply to demand, allowing the elimination of large stockpiles of supplies and equipment by having the right stuff at the right time and at the right place. The result will be fewer supplies and equipment requiring movement.

(b) TAV will be used to locate parts worldwide, ship the parts, and track the parts from the supplier to the maintainer. Aviation units will be able to locate parts anywhere in the world, across all Services, and place requisitions electronically. Validation of requisitions will take only a matter of minutes as parts are shipped. ITV is a subset of TAV, will allow units to track parts in transit, and includes real time in-transit status. ITV is not a single automation system; it is a capability.

## Chapter 5 Army Aviation Operations Operational Architecture

### 5-1. Army Aviation Operations Operational Architecture

The primary purpose for developing the Army aviation operations operational architecture products is to support the development of the CCP, and to describe how Army aviation operations integrate with and perform as a part of the future joint force. Included in this plan is a high level operational concept graphic. It is not intended to be a full operational architecture product, but a pictorial illustration of three of the seven key ideas from TRADOC Pam 525-3-0 that include shaping and entry operations, decisive operations, and operational maneuver.



Figure 5-1. Operational Concept Graphic

### 5-2. Shaping and Entry Operations

#### a. Shaping Operations

(1) The integrated use of precision effects and positioning of friendly forces throughout the depth of the AO achieves shaping and sets the conditions for decisive operations. Shaping is an operation at any echelon that creates and preserves conditions for the success of the decisive operation. Aviation enables shaping operations by providing the ability to increase the range of ground maneuver forces and options for vertical envelopment. Maneuver of friendly forces, out of contact, enhances shaping of the operational environment and allows attack at the time and place of our choosing. Additionally, the use of reconnaissance and attack helicopters (enhanced by UAS sensors) expands the commander's area of influence during shaping operations.



(2) The air movement of forces enables the commander to negate the effects of complex terrain and seize the initiative. Vertical maneuver of dismounted forces, anywhere in the operations area, exponentially increases the dilemma of the enemy commander in planning his defense. Vertical maneuver of mounted units adds a new operational dimension to the battlefield, and allows the joint commander to conduct operational maneuver from strategic distances. Similarly, maneuver of friendly forces, out of contact, enhances shaping of the operational environment and allows attack at the time and place of the Army's choosing. The flexibility and agility offered by Army aviation to the maneuver sustainment effort, greatly enhances pulsed logistics operations and subsequent ground maneuver of brigades. Army fixed wing aviation also provides the option of inserting forces into the battlefield area by landing or by airdrop.

(3) Army aviation provides the most responsive and versatile means of providing accurate and responsive SA when seamlessly linked with other joint and Army systems. This awareness provides the commander the ability to set the conditions for current and future operations, the freedom to move through the airspace without risk of fratricide, and the ability to conduct attack operations to destroy key enemy assets, or move to positions of advantage. Assured ground to air connectivity between air platforms and ground command centers will be invaluable in filling information voids in the COP, particularly during the early stages of entry operations. Army aviation is one of several means to provide aerial intelligence collection, SA development, and dissemination of intelligence and SA to aerial and ground forces, to enable the force to gain greater maneuver, firepower, and protection for the force. Armed reconnaissance aircraft, teamed with organic UAS and other joint reconnaissance assets, help fill the void in information gathered from the integrated, National and joint reconnaissance systems. These assets also can reach out to limits of the commander's area of interest. Armed reconnaissance and attack helicopters allow the force commander to deploy quickly interactive and interpretive intelligence collectors over extended distances. Aviation provides the flexibility to shift quickly from a reconnaissance or security mission to an economy of force or close combat attack decisive operation.

#### b. Entry Operations

(1) Using strategic airlift, sealift, and or self-deployment, aviation can rapidly project a sufficient force capability to minimize the risks encountered in the early stages of a crisis response – strategically precluding escalation – while reducing the lift required to deploy and sustain early entry and follow-on forces. Forces that are tailored in accordance with the factors of METT-TC, will conduct early-entry operations. Land force and joint TF commanders will exploit aviation capabilities early on to facilitate force projection, achieve tactical and operational agility, and posture the force for decisive action by setting the conditions and shaping the area of operation with first entry aviation forces. Future aviation platforms will have increased capabilities in self-deployment, which further reduce the inter-theater lift requirements as compared to current systems.

(2) Aviation helps protect the force during entry operations through armed reconnaissance and security, attack, vertical maneuver, battle command, air-to-air combat measures, suppression of enemy air defense, air movement, medical evacuation, airspace

deconfliction and synchronization, and personnel recovery. Manned and unmanned aviation operations provide security, while simultaneously lending fidelity to the COP during early entry, to enhance deployment of ground forces. Airborne C2 aircraft have the battle command capabilities to function as an early entry command post. Army aviation's speed and agility enhances survivability to all elements of the force. If ground LOCs extend for unusually long distances, or are overly hampered by terrain, Army Aviation may be utilized as the primary means for the land component commander to keep the pressure on the enemy throughout the vertical field.

(3) Force protection is enhanced through armed reconnaissance aircraft conducting ground and air security operations and shaping for the main body, and conduct of economy of force missions. Armed reconnaissance aircraft can detect, report, and attack highly mobile missile launchers and support systems. In vertical maneuver operations, the ability of armed reconnaissance systems to pinpoint air defense artillery sites and locate undefended routes is a significant force protection measure. Attack and assault helicopter units contribute to force protection by conducting decisive operations to interdict, to deter, or defeat enemy forces, and to provide additional time for the deployment of follow-on forces. Maneuver by air will be more effective when employed as a part of the joint team, coupled with the rapid advance of ground forces; which in turn, reduces risk, reinforces, expands and exploits the results of the air-based maneuver, and keeps the adversary from isolating the air-delivered force.

### **5-3. Decisive Operations**

a. Decisive operations do not require the presence of overwhelming forces, simply the ability to mass overwhelming firepower and other effects at the time and place where the enemy's assets and strengths are most vulnerable. As an integral part of the joint and Army team, aviation gives the commander the ability to see those vulnerable points and synchronize assets to best support his maneuver forces for decisive action. Aviation's ability to strike and provide enhanced targeting information throughout the area of operations is essential to the success of decisive operations. Aviation's mobility, agility, and firepower compliment the synergistic effects of the joint team to achieve decisive operations. Teaming of attack and reconnaissance helicopter units gives the commander a force that can rapidly build devastating firepower at any point on the battlefield.

b. Utility helicopters and Army fixed wing aircraft will also enhance and extend the capabilities of commanders to initiate, conduct, and sustain combat operations by providing tactical air movement of troops as well as internal and external lift of weapon systems, supplies, and equipment at theater and lower echelons to negate the effects of complex terrain. On the asymmetric battlefield, this translates to the agility to get to the fight decisively and mass combat power or effects as required. Aviation's ability to rapidly conduct intratheater air movement of critical supplies, and provide aerial resupply to forward deployed troops and/or widely dispersed forces are important to the commander's ability to sustain combat operations and maintain his tactical and operational flexibility.

c. Future Modular Forces will employ aviation assets to provide supporting and complementary fires during decisive operations, and other maneuver support at extended

distances, or in conditions that preclude timely and effective use of ground systems. Aviation lends significant capability to fires and their effects when under the conditions below.

(1) Aviation crews employ their sensors in cooperative engagements for timely and accurate fires, to include joint naval or air fires.

(2) Integration of Army and joint NLOS and BLOS fires by an armed reconnaissance aircraft, coupled with its contribution to SA, will enable massing of effects without massing units.

(3) Complementary target acquisition and ISR capabilities are provided by reconnaissance aircraft, UAS, space-based assets, and fixed wing special electronic mission aircraft.

(4) Army heavy-lift helicopters can quickly reposition fires assets and provide ammunition resupply.

(5) Aviation lends significant flexibility in employment of nonlethal effects assets (such as, psychological operations, civil affairs, and others).

(6) Space or high altitude radar enables NLOS communication for sensor to shooter linkage, AC2, ATS, maintaining command data links and facilitating the near real time flow of vital information.

#### **5-4. Operational Maneuver**

a. Army aviation enhances maneuver through increased speed and range of operation, and the delivery of timely and accurate supporting fires. Aviation enables the JFC to reposition forces in depth for immediate operations, exposing the entire enemy AO to direct attack, separating enemy elements, and denying reinforcement and sustainment. Maneuver by air will be more effective when employed as a part of the joint team, coupled with the rapid advance of ground forces, which in turn, reduces risk, reinforces, expands and exploits the results of the air-based maneuver, and keeps the adversary from isolating the air-delivered force.

b. Vertical maneuver of dismounted forces, anywhere in the operations area, exponentially increases the dilemma of the enemy commander in planning his defense. Vertical maneuver of mounted units adds a new operational dimension to the battlefield, and allows the joint commander to conduct operational maneuver from strategic distances. The flexibility and agility offered by Army aviation to the maneuver sustainment effort, greatly enhances pulsed logistics operations and subsequent ground maneuver of brigades. Army fixed wing aviation also provides the option of inserting forces into the battlefield area by landing or by airdrop.

## Chapter 6 DOTMLPF Integrated Questions List

### 6-1. Introduction

a. Significant implications exist for the Army and the joint community as we evolve aviation operations and synchronize these operations across the DOTMLPF domains. Because of the joint interdependence associated with aviation, some study issues transcend the Army's direct role; however, the ability to influence the design and development of the range of DOTMLPF solutions for the joint force is an Army responsibility. The Army should examine specific areas of aviation operations fully as the Army, and the joint community move to an advanced form of integrated joint and Army Aviation operations.

b. The Army concepts used in the development of this CCP include a discussion of the implications of the concepts for DOTMLPF. In many cases, those implications relating to aviation are explicit enough to generate some action for change within the DOTMLPF domains by responsible proponents and agencies. The primary implications arising from the Army Aviation Operations CCP, vice an exhaustive list appear below. However, many of the items cited below will require additional analysis before comprehensive actionable recommendations emerge.

(1) What are the most effective organizational designs to support the Army aviation operations concept?

(2) What are the objective and threshold capabilities required for achieving the support required in the aviation concepts?

(3) What aviation operational capabilities does the Army have to provide other services in order for them to support the joint aviation operations concept?

(4) What aviation training and training support capabilities does the Army have to provide to other services or integrate with other services to support the train-as-you-fight concept?

### 6-2. Doctrine

a. Emerging joint and Army doctrine will focus on the necessary capabilities to engage adversaries across the full range of joint operations sharing common systems, TTPs; and doctrine. Evolving Army doctrine must seamlessly integrate 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. The doctrinal concepts necessary to initiate the organizational and cultural changes are described in the *Capstone Concept for Joint Operations*; TRADOC Pams 525-3-0, 525-3-1, 525-3-2, and the Army's six functional concepts. The Army must also view concept documents in light of existing Army

doctrinal publications such as: FM , FM 3-0, and FM 6-0. As the future Modular Force nears operational readiness, these documents will continue to evolve.

b. The evolution of organizations is driven by concepts and doctrine. Consequently, the Army will require new doctrine and TTPs to effectively plan and manage battles collaboratively. This will require a closer relationship between the doctrinal development process and the experimentation process, particularly with joint and Army future force experimentation. The experimentation process will in turn expedite the fielding of viable systems, and will allow the parallel development of service and joint doctrine that can codify the employment of new concepts, TTPs and technologies. Doctrine questions include, but are not limited to, the following:

- (1) How does joint aviation doctrine influence the conduct of Army aviation operations?
- (2) Is current joint aviation doctrine adequate to execute the aviation concept of operations for the future Modular Force?
- (3) Does joint doctrine adequately address the joint interdependence of the services in the area of aviation operations?
- (4) Is current Army aviation doctrine adequate to execute the aviation concept of operations for the future Modular Force?
- (5) What are the impacts of national ROE, policies, and law on Army aviation doctrine?
- (6) Does Army doctrine for the theater, corps, division, and brigade doctrinal publications address aviation operations adequately?
- (7) Are current TTPs adequate to execute required Army aviation operations?

What emerging aviation technologies, processes, and capabilities should new doctrine include?

### **6-3. Organization**

a. To effectively support future operations, organizations must transform into more modular, scalable, mission-tailorable organizations with multifunctional capabilities. They must become more versatile and agile to support joint operations and must possess capabilities to adequately support the operations of maneuver and support forces. Future operations will require a greater reliance on sustainment and operational maneuver missions; thereby amplifying the requirement for organizations and systems with significantly increased range and endurance. Army aviation organizations must possess the requisite qualities of strategic, operational, and tactical mobility. Strategic mobility to reach the theater; the operational mobility to strike across the entire area of operations; and the tactical mobility to gain positional advantage, adapt to changes in the situation, exploit opportunities as they arise, and achieve decisive outcomes.

b. Joint mutual support becomes the key factor in determining Service roles and missions; mission context will determine the apportionment of Army headquarters and forces. The range of missions assigned to Army forces will force an alignment change from the traditional command echelons. Army HQ will support the combatant commander with the command structure appropriate for land operations. The rank of the commander and the functions of the HQ will not necessarily correspond to the number of forces assigned. In many operations, the number and composition of subordinate units will differ dramatically. As each operation unfolds, the makeup of the deployed Army force will evolve, shifting in composition, as the mission and circumstances require. While units that are stationed with the HQ may align for training and readiness, actual operational groupings will be based upon mission requirements. The Chief of Staff Army's guidance was, "Army aviation as a capabilities based maneuver arm optimized for the joint fight with a shortened logistics tail." Organizational questions include, but are not limited to, the following.

(1) Can current organizational structures be augmented to satisfy the capabilities of Army aviation operations?

(2) Is a new organizational structure necessary to achieve the required capabilities?

(3) What Army aviation operations capabilities should reside in our tactical and operational forces?

#### **6-4. Training**

a. The Army cannot realize necessary doctrine and organizational change without changes to our training systems. Training ensures that our future Modular Force is able to conduct the operations envisioned in our joint and Army concepts. The training required in the future to produce Soldiers, leaders and units, flows from the need for conducting operations in a highly complex, ambiguous environment characterized by challenging simultaneous military, geo-political, and civil situations. Understanding future training challenges requires an appreciation for the relationship between technological advances made over time and the correlating difficulty in learning new systems. Training difficulty increases proportionate to the level of abstraction involved in a given task. The training process requires enforcement and discipline at all levels.

b. Warfighting readiness is derived from tactical and technical competence and confidence. Competence relates to the ability to fight Army doctrine through tactical and technical execution. Confidence is the individual and collective belief that the Army can do all things better than the adversary and the will to accomplish the mission. Closing the gap between training, leader development, and battlefield performance has always been the critical challenge for any military. Overcoming this challenge requires achieving the correct balance between training management and training execution.

c. Army units and Soldiers require a training environment that represents the operational environment in order to conduct full spectrum training. Training simulations that include virtual aviation operations in maneuver, maneuver support and sustainment, and assessment will improve our training opportunities in the functional areas of: battle command, operational

environment awareness, force application, strike operations, protection, and sustainment. Army training must be flexible enough to incorporate new technologies as they become available. The Army must develop Soldiers and leaders who possess a joint and expeditionary mindset and who are able to optimize the capabilities available to them. Training questions include, but are not limited to, the following.

- (1) How is the integration and application of aviation employment included in current training and leader development?
- (2) How can the Army adapt its training to better integrate Army aviation operations?
- (3) How will evolving technologies and ongoing or planned changes in organization affect the ways in which Army units and leaders operate, and what are the training implications of these changes to support Army Aviation operations?
- (4) What training designs will develop enlisted personnel, noncommissioned officers, officers, contractors and DA civilians in order to capitalize on the full range of aviation capabilities?
- (5) What type, scope, and frequency of Army aviation operations training must the future Modular Force conduct to enable effective operations?
- (6) What aviation test and training ranges are necessary (collective and joint)?
- (7) What aviation modeling and simulations are required to support Army aviation operations at the tactical, operational, and strategic levels?
- (8) What joint aviation training is necessary?
- (9) How will aviation units train to meet established deployment time lines?
- (10) How will aviation units train to conduct combined arms air-ground operations in a joint and multinational training environment?
- (11) What is the training requirement for periodic prolonged deployments stressing unit cycling and crew rotation systems?
- (12) How will aviation units conduct regular exercise of joint deployment, multi-modal distribution, port clearing and sustainment training?
- (13) How will aviation units develop and exercise TTPs for pulsed sustainment and mission-staging operations conducted in contested terrain?
- (14) How will aviation units develop field proficiency with advanced systems prognostic/diagnostic evaluation, repair, and replacement?

(15) How will aviation units conduct regular embedded training linked to live, virtual and constructive simulation in a joint environment?

(16) What are the training requirements for conducting sea base operations?

## **6-5. Materiel**

a. Future capabilities required to execute future Modular Force concepts and plans will only come to fruition if the research, development, test and evaluation, and procurement funding is available. While the future is very difficult to predict with any degree of certainty, there are trends that seem undeniable. They include strategic deployments and the rate of deployments will continue; urbanization will increase; asymmetric responses will increase; a peer competitor will emerge; high volume fires can be pivotal; excellence in training will be imperative; and significant increases in structure and funding will not be timely. Therefore, a focused science and technology program is vital. Army aviation modernization and sustainment ensures that the Army maintains and pursues future capabilities within funding and resource levels. These include fielding of new manned and unmanned aircraft, recapitalizing existing aircraft, modernizing the fixed-wing fleet; joint, Army, and multinational forces digitization, connectivity, and interoperability; ASE upgrades; airspace management and deconfliction; weapons modernization; and leveraging technology to reduce costs and improve training.

b. Additionally, the Army must develop future aviation systems with features that augment Soldier survivability by minimizing system detectability, probability of being attacked if detected, probability of damage if attacked, and Soldier fatigue and injury. These systems must leverage prognostic and diagnostic tools to predict and isolate failures, utilize modular repair techniques, incorporate more durable components, and be designed for compatibility with other future Modular Force systems, to include a maximum level of standardization and interoperability with other services and allies at both the platform and unit level. Protecting the Army's most important resource, Soldiers, requires improved measures against a wide variety of threats: ballistic; directed energy; blast; nuclear, biological and chemical; extreme environmental conditions; disease; fire and flame; acoustic energy; shock and vibration; animals; insects; and physical/cognitive challenges. Integrated protective clothing and individual equipment must meet this challenge.

c. The Army must also develop qualitative and quantitative information about relevant human factors, and we must analyze that information to counter these threats. This equipment must be part of an overall Soldier system of systems. Materiel questions include, but are not limited to, the following.

(1) What aviation systems must be capable of functioning and integrating with other manned and unmanned systems and working synergistically in a family of systems team?

(2) What aviation capability is required for conducting mounted operational maneuver of all the BCTs combat configured component platforms with full complement of crew, fuel and ammunition, digitally linked to exploit en route planning and rehearsal, and capable of fighting upon arrival, without reliance on prepared landing surfaces?



- (3) What capability does aviation require to self-deploy to any region worldwide?
- (4) What are the increased payload, range, speed, and endurance requirements for current and future aviation platforms?
- (5) What aviations platforms must be shipboard capable or compatible and able to operate from U.S. and allied ships?
- (6) What aviation systems does the Army need to enhance quality, standardization, compatibility, and effectiveness of multi-band communications systems in NLOS and long distance conditions?
- (7) What aviation ISR assets are necessary to support future Modular Force operations?
- (8) What aviation early warning detection, assessment, and dissemination systems are needed for the future Modular Force?
- (9) How will aviation contribute to the establishment of a single, integrated, network enabled joint battle command system?
- (10) How will aviation enable multi-echelon and multidimensional ISR, fires, and maneuver that are fully networked?
- (11) What are the required aviation capabilities to support the expanding role of unmanned systems on the battlefield?
- (12) What aviation enabled sensor-to-shooter linkages do we need to support future Modular Force operations?
- (13) What aviation capabilities are required to avoid aircraft detection, avoid attack if detected, avoid damage if attacked, and report all engagements of threat air defense systems?
- (14) What counterair capabilities, including self-identification and on-platform positive identification of friend, hostile, and neutral air platforms are required on the aircraft for defensive, offensive, and protective means?
- (15) What real and near real time SA is required in the cockpit?

## **6-6. Leadership and Education**

a. Despite technological developments that will change the way leaders operate, leadership will remain the most essential dynamic of combat power. Future warfare will require leaders to operate more independently as the operational environment expands and units operate on a noncontiguous battlefield under increasingly demanding conditions. Leaders will face harsher challenges to their moral and physical courage. Training will involve more simulations, and battlefield information will involve more virtual representations. Accordingly, leaders will

require keen visualization and cognitive skills. The future Modular Force requires a training and leader education development process that is holistic and mutually supporting. Each portion of the leader development triad (institution, unit, and individual) has a particular role and focus. All three leader development pillars will require strengthening to deal with the challenges of full spectrum operations. To develop leader competencies to perform full spectrum operations, Army aviation requires a coherent strategy that spans education in the schoolhouse and training in the units.

b. Institutional training is the foundation for lifelong learning. It develops competent, confident, disciplined, and adaptive leaders and Soldiers able to succeed in situations of great uncertainty. The institution provides the framework to develop future leadership characteristics that produce critical thinkers capable of full spectrum visualization, systems understanding, and mental agility. It infuses an ethos of service to the Nation and the Army, and provides the educational, intellectual, and experiential foundation for success on the battlefield.

c. Soldier and leader training and development continue in the unit. Using the institutional foundation, training in organizations and units focuses and hones individual and team skills and knowledge. Leader, individual Soldier, and unit training and development continue during operational missions and major training events. These events enhance leader development and combat readiness. They improve leader skills and judgment while increasing unit collective proficiency through realistic and challenging training and real time operational missions.

d. The leader of the future must be self aware and adaptive, comfortable with ambiguity, multifunctional with joint integration, able to predict second and third order effects and able to reconcile tactical and operational dilemmas. Army aviation must be able to provide the appropriate mix of technical and tactical training with focused institutional, unit and individual experiences through training and assignments that will pave the way necessary to achieve the caliber of leader and Soldier required to meet the diverse challenges of full spectrum operations. Key future force aviation leader development and education questions include, but are not limited to, the following.

(1) How do leaders develop broad technical, operational, and tactical understanding of joint systems employment and procedures?

(2) How do leaders visualize and apply joint effects?

(3) How do leaders rapidly synthesize information?

(4) How do leaders leverage digital battle command tools?

(5) How can the Army develop more adaptive leaders competent and confident in all aspects of aviation operations?

(6) How does the Army provide excellent leader development in the area of aviation operations in a joint and multinational construct?

(7) How does the Army develop leaders ready to deal with the complexity of the future operational environment, threats, and interagency implications?

(8) What aviation leader development programs does the Army need in the units and schoolhouse?

## 6-7. Personnel

a. The Soldier remains the centerpiece of the future force. The Soldier is the most important factor in maintaining and affecting unit readiness. The human dimension encompasses aspects beyond just the mental, physical, moral, and spiritual well being themselves. Aviation Soldiers must be physically, mentally, and morally prepared for the stresses generated by the sustained, distributed, high velocity, lethal operations that will characterize unit training and operational deployments. This will become even more important as operations in complex and urban terrain take place with greater frequency. Future Soldiers must be highly competent in their expanded ranges of individual skills and unit collective tasks.

b. Like most aspects of future warfare, information technology will influence Soldier skills heavily. These skills will require institutional pillars of training honed through operational experience and individual study. Embedded training systems linking units and institutional training centers, and deployable simulators and simulations, will help Soldiers maintain the individual and collective skills necessary to remain competent and confident to meet the demanding standards required on the future battlefield.

c. The integration of aviation operations into future Modular Force operations will increase the demands on an already stressed population. Selecting and assigning the right personnel to aviation related positions and occupational specialties is a difficult task. The personnel management system must ensure that it provides the career paths needed to fully utilize the aviation expertise of the force. New organizational constructs may rely on experienced civilian personnel to provide the expertise needed to support training readiness and global aviation operations. The Army can only determine the right combinations of active and reserve organizations, as well as civilian and contractor attendants through thorough research and exercise. Personnel questions relating to aviation operations include, but are not limited to, the following.

(1) How does the Army recruit and retain the enlisted personnel necessary to perform Army aviation operations functions?

(2) What skill sets are required for Army civilian and contractor support personnel?

(3) What is the best means of selecting Army aviation officers (commissioned and warrant)?

## 6-8. 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 Army will have to determine if current stationing plans support future Modular Force units. 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.

b. Facilities need to be capable of supporting new equipment, sustainment and training. Facilities questions include, but are not limited to, the following.

(1) What new ranges does the Army require to accommodate the capabilities of advanced weapon systems, impacts of environmental conditions (high pressure altitude, high gross weight, brown out, white out, under wire, and others) and battle command systems during battalion level collective training?

(2) What new maintenance facilities, motor pools and platform storage facilities does the Army require for inclement weather protection, climate control, and physical security?

(3) What unique facilities, equipment, training areas, and airspace does the Army require to support UAS and MUM teaming training, testing, maintenance and support operations?

(4) What upgrades does the Army require for battle simulation centers, individual and collective air crew trainers?

(5) Are there adequate facilities available to Soldiers, leaders, battle staffs, non-uniformed personnel, and units to attain and maintain acceptable levels of aviation training effectiveness?

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

## 6-9. Summary

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 external challenges of an increasingly demanding tactical environment, diminishing resources, and increased media scrutiny, 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 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; must possess the warrior spirit; must have competent, well trained Soldiers and leaders; must 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 Soldiers and leaders who must use it.

c. The future will require both an unprecedented competence in the core function of combat, as well as unmatched flexibility in other operations. Future battle will require overmatching reach, velocity, and precision, while at the same time demanding sustained, concentrated lethality. The future demands a robust institutional Army to administer and train Soldiers; a powerful, responsive operational Army for execution of missions; and a strong link between both to facilitate the rapid transitions the Army will demand of units operating in the 21st century.

## **Chapter 7**

### **Hypothesis Testing – Experimentation and Wargaming and Study Questions**

#### **7-1. Introduction**

a. The Army is pursuing the most comprehensive transformation of its forces since the early years of World War II. This transformation is happening while the nation is at war. The urgency of supporting the current fight blurs the usual dichotomy between the current and future Modular Force. The Army must seek to accelerate inculcation of select future Modular Force capabilities into the current force to support today's fight, while simultaneously ensuring that today's lessons learned apply to future Modular Force developments. This transformation encompasses more than materiel systems.

b. Adaptive and determined leadership, innovative concept development and experimentation, and lessons learned from recent operations produce corresponding changes in the DOTMLPF domains. Experimentation, wargames and experience are the methods the Army uses to mitigate risk while considering and improving capabilities for the future Modular Force.

#### **7-2. Experimentation**

a. Experimentation is the process of exploring innovative methods of operation to assess feasibility, evaluate utility and or determine limitations of the concepts being explored. Experiments conducted in support of JCIDS efforts use the 2015 – 2024 timeframe. The Army also conducts wargames using futuristic scenarios (15 to 20 years and beyond) to explore concepts in order to better define which of those concepts should be the subject of experimentation. Army experimentation uses discovery (usually in a constructive modeling and simulation environment), hypothesis (also in a modeling and simulation environment but with human in the loop role players) and demonstration (live or simulation) settings. The Army must also design discovery experiments to inform a concept. This setting tends to lack the degree of control necessary to infer cause and effect.

b. Hypothesis testing experiments. Hypothesis testing experiments are the traditional type used by individuals to build, confirm and advance knowledge. This occurs by seeking to falsify specific hypotheses (specifically if...then statements) or discovering their limitations. In order to conduct hypothesis-testing experiments, the experimenter shall create a situation in which he can observe one or more factors of interest systematically under conditions that vary the values of factors thought to cause change in the factors of interest – while other potentially relevant factors remain constant.

c. The Army uses demonstration experiments to display knowledge and the settings tend to be somewhat orchestrated. The Army often uses this method to display prototypes of emerging technologies that are nearing maturity and are potentially ready for fielding to the force

### **7-3. Modeling and Simulations**

The Army often uses models and simulations to make informed assessments. Scenarios or vignettes are built to look at one or more sets of conditions that will best help to evaluate these hypotheses, but the raw data is often not conclusive or requires reasoned review by seasoned subject matter experts to confirm the reliability of these simulation or modeling efforts. It is important for simulation and testing to portray accurately the operational environment to include non scripted, non predictable and realistically represented threat.

### **7-4. Concept Development and Experimentation (CD&E)**

a. CD&E is fundamentally a risk reduction activity; failure to conduct effective CD&E significantly increases developmental risk for the future Modular Force and operational risk to the current Modular Force. We require specific actions to reduce operational risk to the current Modular Force and development risk for the future Modular Force.

(1) *Operational risk to the current Modular Force.* Increase the capabilities of the current Modular Force through prototype experiments that test the compelling solutions and develop DOTMLPF capability packages to support the spiraling forward of future Modular Force capabilities to satisfy critical current force operational needs.

(2) *Developmental risk for the future Modular Force.* Reduce future Modular Force development risk by developing concepts and capabilities that meet the needs of the future joint force commander through rigorous concept development experimentation.

b. Army efforts. Army wargaming and experimentation to support this CCP and its impact on DOTMLPF sets will be primarily developed and studied using approved defense planning scenarios and vignettes. If required, other scenarios and vignettes may be recommended or other methods found to evaluate aspects of Army aviation operations. Experimentation will help define how the capability requirements outlined in chapter 3 of the CCP can best be implemented.

c. Joint efforts. Joint wargaming and experimentation will also support this CCP. Active participation in other Services and joint events are critical to the full assessment of the Army's DOTMLPF solution sets. The Army must test, evaluate, and modify Army aviation

organizations and operations as conditions (scenario, vignette, and others) change during experimentation. The scenarios and vignettes the Army selects to use for experimentation will provide an illustration of how Army aviation organizations will conduct or support operations throughout the deployment cycle while supporting the full spectrum of conflict.

### **7-5. Wargaming**

a. Wargaming is a process of discovery and assessment—discovering insights into the Army Aviation warfighter and 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 Aviation operations. Wargaming examines the Army functional concepts of *Command, See, Move, Strike, Protect, and Sustain*.

b. The results of wargaming inform experimentation and eventually inform the development and/or refinement of Army aviation conceptual operations, TTPs, architectures, and future systems. Wargame personnel lead participation in Army, JIM wargames to integrate Army Aviation assets, concepts, and visions into wargame scenarios, orders of battle, force lay downs, and computer simulations. TRADOC Intelligence Support Activity, Deputy Chief of Staff for Intelligence resources and certifies realistic threat simulations in support of wargaming. This effort is an imperative for the discovery and assessment process.

### **7-6. Past and Future Experimentation and Wargames**

a. Past experimentation and wargames. TRADOC and its proponent schools have conducted extensive experimentation that has implications on this CCP. Major experiments and wargames conducted over the last two years involving aviation operations support include: TRADOC Omni Fusion experimentation to include: Omni Fusion 05 Builds 0, I, II, and III, Omni Fusion 06 Part 1A and 1B (digital warfighter exercise (DWE)), DWE III 07; Aviation brigade map exercise (MAPEX) in FY06; Joint Heavy Lift 8 MAPEXs (3 government, 5 industry) in FY06; HSKT in FY06; ARH-70 and Longbow Block III MAPEX in FY 05; AGSE MAPEX in FY06; JCA/Future Cargo Aircraft Analysis of Alternatives and MAPEXs in FY 05/06/07; Earth, Wind and Fire in FY06, FY07; CASCOM Future Modular Force Logistics computer assisted map exercise in FY06/FY07; Urban Resolve 2015 in FY06 (Human in the Loop 1 and 2) and FY07 (Human in the Loop 3); unit of action focused experiments and events on FCS brigade operations; Unified Quest 2004, 2005, 2006, 2007; and Joint Expeditionary Force Experiment (JEFX) 05, 06 and 07.

b. Future experimentation. Experiments and wargames that will further assist in defining this CCP include : Omni Fusion 08; Earth, Wind and Fire 08; Unified Quest 08; JEFX 08; DWE 08; and theater distribution computer assisted map exercise 08. In addition to these events, there are many small analysis events and experiments that occur within the Air Maneuver Battle Lab and throughout various installations that will also provide insights to further refine this CCP.

### **7-7. Study Questions**

Reference the TRADOC Integrated Questions List, questions which support future aviation experimentation are included below.

- a. In a distributed operation environment, what aviation forces and capabilities does the Army require at each echelon of command?
- b. What advanced training tool sets does the Army need to support adequate Soldier training and development for aviation operations?
- c. What are future Modular Force technology failure vulnerabilities in the area of aviation capabilities?
- d. What aviation based or enabling technologies are so compelling as to warrant immediate prototyping?
- e. What are the primary implications of noncontiguous, high-tempo, distributed, networked aviation operations for battle command?
- f. How is information managed and disseminated to enable a shared level of SA among all echelons?
- g. How does the Army manage and disseminate information to enable a shared level of SA among all echelons?
- h. What are the common elements of mission information that the Army needs to automatically, or manually, display in the cockpit?
- i. What are the minimum information elements, in terms of mission planning and or current execution, that the Army needs to integrate non-FCS capable aviation platforms into the FCS domain?
- j. What cognitive decision programs does the Army need to reduce the workload in the cockpit?
- k. What aspects of the Comanche cockpit program should the Army resurrect to support future aircrews across all platforms?
- l. How does the Army conduct distributed mission planning and rehearsal using simulations?
- m. What is our method for mission visualization, given network-centric data and processes?
- n. What is the Army's process for ERMP employment in support of hybrid and FCS forces across the distributed, noncontiguous operational environment?



- o. How can we expedite air assault and or interdiction attack planning in a net centric environment using distributed mission planning and en route mission assessments?
- p. How will aviation exploit joint effects?
- q. What are the essential ground C2 functions and or information parameters that must be persistent across future battle command platforms for use by aviation elements?
- r. What are the essential aviation C2 functions and or information parameters that must be persistent across future battle command platforms for use by ground elements?
- s. As areas unassigned to maneuver elements expand during ongoing distributed, noncontiguous operations, does the focus of aviation switch from BCTs to support brigades?
- t. What are the unique mission planning and execution parameters associated with support brigades in areas unassigned to maneuver elements?
- u. How do support brigade concepts of operation in a noncontiguous operational environment impact the CAB fight?
- v. What are aviation's required survivability capabilities against a dispersed threat operating in complex terrain utilizing a passive, high density air defense posture?
- w. What elements of intelligence fusion of sensor data is critical for real time display in the cockpit of the future?
- x. What is the minimal data in the cockpit essential for aviation operations?
- y. How does the aviation TOC of the future enable the commander to exercise more positive control over assets via dynamic mission planning?
- z. How does the military decision making process change in a network centric environment?
- aa. Is there a need for an unmanned combat attack platform for future operations?
- bb. Is there a need for an unmanned high speed platform for future operations?
- cc. Is there a need for an unmanned electronic warfare platform for future operations?
- dd. Would the attack/reconnaissance battalions and squadrons be more effective organizations with a mix of AH-64D and OH-58D/ARH-70 (vice pure fleets)?
- ee. Can the ERMP company (12 UAS and 3 GCS) actually support division intelligence and communications requirements, fires brigade requirements, BFSB requirements, and CAB requirements 24/7? What are the TTP for mission planning and execution?

- ff. Where in the CAB should the ERMP company reside to facilitate most effective operations?
- gg. How does MUM teaming affect the organizational structure of the attack/reconnaissance battalion or squadron?
- hh. What does MEDEVAC integration mean to the CAB?
- ii. What is required to ensure the CAB is fully integrated in network fires?
- jj. What does full network integration mean for C2 and distributed mission planning tools in the CAB and battalion headquarters?
- kk. What aircraft or UAS will participate in network fires?
- ll. What is aviation's optimum participation in the NetFires concept?
- mm. What data or information must exist in an automated battle command system for seamless integration and effective fires?
- nn. What are the CAB implications for division level sustainment with regard to the future BCT concept of operation in a noncontiguous operational environment.
- oo. What are the aviation standards, capabilities, and functions required for the One Battle Command System.
- pp. What capabilities and functions will the future C4ISR system of systems need to support the *Strike* concept?
- qq. How can we design the EMPRS to increase the capability to help abbreviate RSOI and the time required for arriving forces to plug into in-theater C4ISR structures?
- rr. How does the CAB employ aircraft (manned and unmanned) in support of the concept of operation for the following units: (1) Division HQ, (2) infantry BCT, (3) heavy BCTs, (4) future BCTs, (5) Stryker BCTs, (6) fires brigade, CSB (ME) and the sustainment brigade?
- ss. What are the requirements the Army needs to create a unified airspace management effort across combined, joint, coalition, multinational, nongovernmental and other governmental agencies?
- tt. What are the staff roles, missions, functions, and systems in de-conflicting airspace for surface-to-air, air-to-surface, and surface-to-surface fires?
- uu. What AC2 information do we require for effective and efficient management of fires?

vv. How does target size, target location (specifically distance to and from the engagement area), and mission duration affect the CAB's ability to execute interdiction attack missions?

ww. What are the staff roles, missions, and functions involved in planning an aviation attack?

xx. How do we employ precision munitions to enhance combat aviation operations?

yy. What fires message sets must be in pilots digital and automation systems for each air platform type—lift, attack, scout, command—how displayed and used to coordinate, synchronize and execute missions?

zz. What data and information must exist in an automated battle command system to facilitate seamless integration and achieve effective fires (from the aviation and artillery perspectives)?

aaa. How does the CAB coordinate distributed planning and mission execution with the Fires Brigade to maximize the destructive potential of the networked fires functionality of the battle command system?

bbb. What are the most effective TTPs for handoff of tactical control of ERMP air vehicles from the CAB to supported brigades/units?

ccc. What are the implications of aviation MUM teaming to networked fires?

ddd. How will aviation units execute personnel recovery, critical resupply and equipment evacuation during continuous operations over an extended noncontiguous operational environment?

eee. How will incorporation of automatic target recognition enhance combat effectiveness?

fff. What communication package should become the standard UAS payload to facilitate division C2?

ggg. What will the airspace environment look like in the 2015-2024 timeframe to include PGM, aircraft, artillery, and UAS?

hhh. What are the implications of aviation operating at sea to include; C2, airspace management, navigation, organization design, equipment, and personnel?

iii. What are the self security requirements of the CAB and how should they be resourced?

**Appendix A  
References**

**Section I**

**Required References**

Army regulations and FMs 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>.

TRADOC Pamphlet 525-2-1

The U.S. Army Functional Concept for See for the Future Modular Force 2015-2024.

TRADOC Pamphlet 525-3-0

The Army in Joint Operations; The Army's Future Force Capstone Concept 2015-2024.

TRADOC Pamphlet 525-3-1

The U.S. Army's Operating Concept for Operational Maneuver 2015-2024.

TRADOC Pamphlet 525-3-2

The U.S. Army's Concept for Tactical Maneuver 2015-2024.

TRADOC Pamphlet 525-3-3

The U.S. Army Functional Concept for Battle Command for the Future Modular Force 2015-2024.

TRADOC Pamphlet 525-3-4

The U.S. Army Functional concept for Strike for the Future Modular Force 2015-2024.

TRADOC Pamphlet 525-3-5

The U.S. Army Functional Concept for Protect for the Future Modular Force 2015-2024.

TRADOC Pamphlet 525-3-6

The U.S. Army Functional Concept for Move for the Future Modular Force 2015-2024.

TRADOC Pamphlet 525-4-1

The U.S. Army Functional Concept for Sustain for the Future Modular Force 2015-2024.

TRADOC Pamphlet 525-96

Future Force Army Aviation Concept of Operations.

TRADOC Pamphlet 525-66

Force Operating Capabilities.

## **Section II**

### **Related References**

A related publication is a source of additional information. The user does not have to read a related reference to understand this publication.

Army Concept Capability Development Plan.

Army Concept Development and Experimentation Plan.

Army Regulation 25-2  
Information Assurance Program.

Army Strategic Planning Guidance.

Capstone Concept for Joint Operations.

CJCSI 3170.01C  
Joint Capability Integration Development System Manual.

CJCSI 3170.01F  
Joint Capability Integration Development System Instructions.

CJCSM 3500.04D  
Universal Joint Task List.

DA Pamphlet 25-40  
Army Publishing: Action Officers Guide

Defense Planning Guidance.

FM 1  
The Army.

FM 3-0  
Operations.

FM 6-0  
Mission Command: Command and Control of Army Forces.

FM 7-15  
Army Universal Task List.

Joint Operating Concepts.

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

**TRADOC Pam 525-7-15**

National Military Strategy.

National Security Strategy.

TRADOC Regulation 10-5

TRADOC Organization and Operations.

TRADOC Regulation 25-35

Preparing and Publishing U.S. Army TRADOC Administrative Publications.

## **Appendix B**

### **Army Aviation Core and Enabling Operations**

#### **B-1. Tactical Operations**

a. Future Modular Force tactical operations are characterized by simultaneous operations distributed across the entire JOA in accordance with the commander's comprehensive view of the campaign. Since this approach is focused on disintegrating the integrity of the enemy's battle plan by exposing the entire enemy force to air/ground attack, rather than rolling his forces up sequentially, aviation units will be required to operate throughout the AO of their respective echelon, as well as the areas that fall outside the AO of noncontiguous subordinate ground maneuver units. Superior SU, based on advanced battle command and network capabilities embedded at all levels with trained battle command staffs, enables ground commanders to operate non-linearly, bypassing what is less important or non-decisive, to focus operations against forces and capabilities most critical to the enemy's operations.

b. As has always been the case in land warfare, all future Modular Force decisive operations are ultimately based on success in close combat, the ability to seize and control key terrain, and to close with and destroy enemy forces. To produce this result, Army aviation plays a major role in development of the situation out of contact, the balanced combination of standoff fires, skillful maneuver, and support of the close assault. It does so by execution of its enduring core competencies of reconnaissance, security, attack, air movement, vertical maneuver, and battle command. In general terms across all aspects of combat operations, be they maneuver, maneuver support, or maneuver sustainment, aviation missions fall within one of these core competencies. The CAB is designed to support up to a four BCT division and more if augmented with additional aviation forces.

#### **B-2. Aviation Core and Enabling Operations**

a. The future Modular Force Aviation Operations CCP reflects six core missions and nine enabling missions. The core missions are depicted graphically (see figs B-2 through B-7) to convey the aviation contribution to the future, complex, noncontiguous joint operational environment. These are not just a way of doing the same thing; they reflect a different way of fighting. Also listed are the aviation enabling missions. These enabling missions are common to and often essential for accomplishment of the aviation core operations. The enablers include manned/unmanned aircraft operations, AC2, ATS, aviation sustainment, downed aircraft recovery, personnel recovery, FARP operations, command and control support, aerial MEDEVAC and aerial CASEVAC. The influence of aviation capabilities (core and enabling missions) in most cases are not confined to a single Army functional concept but often span across one or more of the functional concepts and multiple proponent areas of responsibility (see figure B-1).

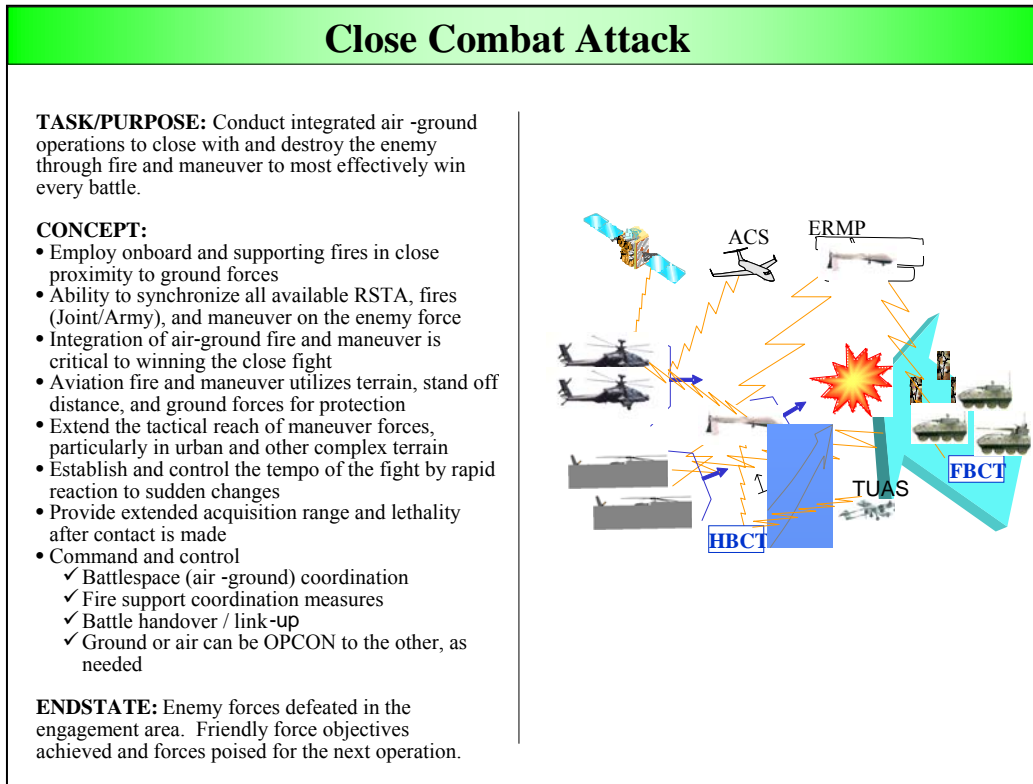
b. These core and enabling missions will be briefly discussed in the following paragraphs. Each of the enabling operations is only represented on the most appropriate aviation concept of operations. Required capabilities for these core and enabling missions are listed in chapter 3.

(1) Close combat attack. One of the inherent strengths and primary purposes of Army Aviation involves operating as a part of the joint/combined arms team in conducting decisive, integrated, air-ground operations to close with and destroy the enemy through fire and maneuver or tactical assault. These operations may take place anywhere in the operational environment, particularly in compartmented and urban terrain, where future Modular Force units are likely to fight. The commander can utilize the capabilities of the airborne BCOTM platform to synchronize close combat operations and MUM teaming to extend the tactical reach of the maneuver commander.

Army Functional Concepts						
	SEE	MOVE	STRIKE	SUSTAIN	COMMAND	PROTECT
Core and Enabling Msns						
CCA		X	X		X	X
Interdiction Attack			X		X	
Ver Maneuver Air Assault		X	X		X	X
Recon	X	X	X	X	X	X
Security		X	X	X	X	X
Air Movement		X		X	X	X
MUM	X	X	X	X	X	X
AC2/ATS	X	X	X	X	X	X
Maintenance	X	X	X	X	X	X
Downed Aircraft	X	X	X	X	X	X
Pers Recovery	X	X	X	X	X	X
FARP Ops	X	X	X	X	X	X
C2	X	X	X	X	X	X
MEDEVAC	X	X	X	X	X	X

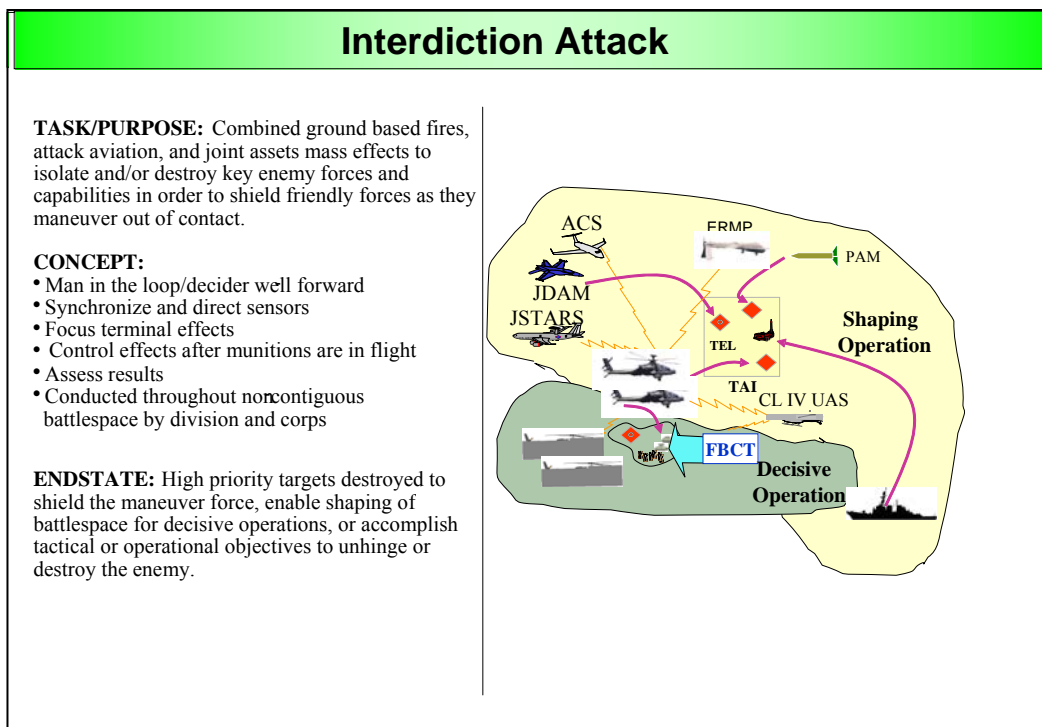
**Figure B-1. Army Functional Concepts**





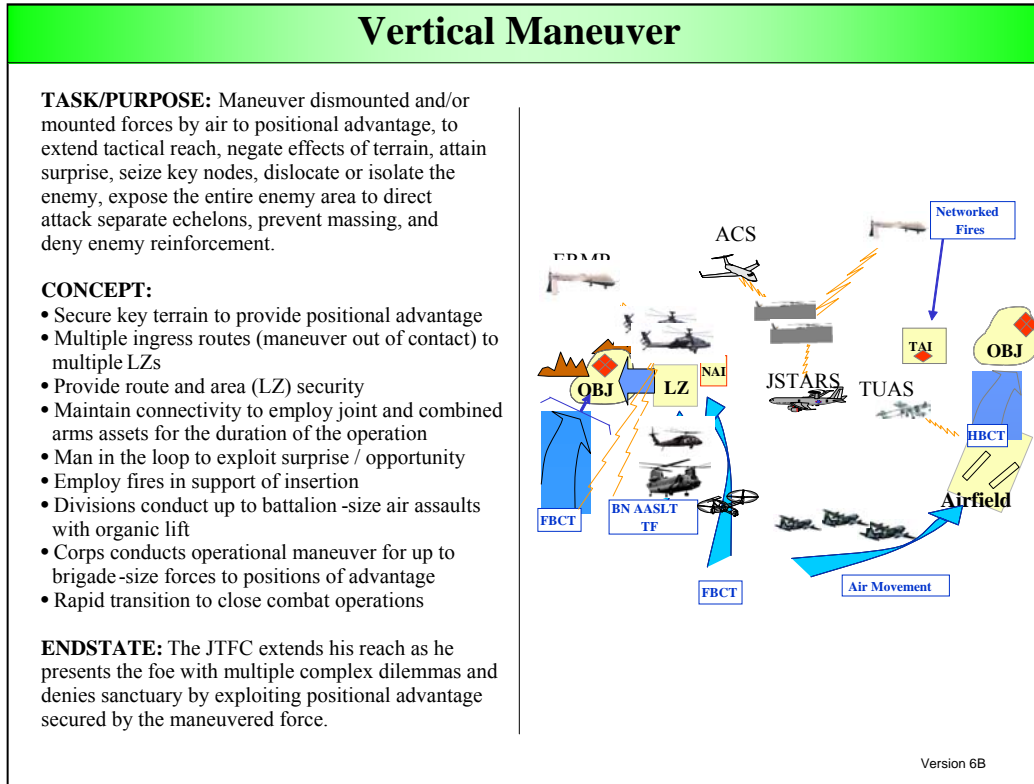
**Figure B-2. Close Combat Attack**

(2) Interdiction Attack. This combines ground based fires, attack aviation, unmanned systems and joint assets to mass effects, in order to isolate and destroy key enemy forces and capabilities and to shield friendly forces as they maneuver out of contact. It is focused on key objectives and fleeting high-value targets such as enemy C2 elements, AD systems, and mobile, long-range surface to surface missiles and artillery, and reinforcing ground forces. Using all sources of precision fires, Army Aviation masses effects without massing forces, to deny the enemy freedom of action, support friendly maneuver, and destroy key enemy forces and capabilities. The robust communications mission package on the ERMP will allow battle command at extended distances. The airborne C2 aircraft is an ideal airborne BCOTM platform for the commander to battle command the interdiction attack mission. Interdiction attack can also include the employment of ground forces when the effects desired include control of the target area or when desired outcomes can only be assured by the action of ground forces. During the conduct of an interdiction attack mission the aviation brigade will normally have direct support of long range fire assets from the fires brigade and OPCON of required reconnaissance assets for planning, queuing and execution of missions.



**Figure B-3. Interdiction Attack**

(3) Vertical Maneuver. This consists of lifting dismounted infantry and mounted forces. Dismounted vertical maneuver or air assault is conducted to extend tactical reach, negate effects of terrain, seize key nodes, attain surprise, and dislocate or isolate enemy forces in contact or in imminent contact. Mounted vertical maneuver is the air maneuver of mounted forces to expose the entire enemy area to direct attack, separate echelons, prevent massing, and deny enemy reinforcement. Mounted vertical maneuver may be an independent action but is normally conducted as a complementary part of a larger operational maneuver of multi-modal means in support of the JFC's mission. Aviation provides lift, aerial reconnaissance, airborne C2, and attack aircraft to support the air maneuver of dismounted or mounted elements of the brigade combat teams. The airborne C2 aircraft can be used by the air-ground commander to synchronize all phases of the vertical maneuver operations. Future Modular Force theater aviation assets will air assault the dismounted combat elements of a battalion in one lift. Similarly, mounted vertical maneuver requires the capability to lift mounted battalions, supplies, and crews to unimproved areas.



**Figure B-4. Vertical Maneuver**

(4) Reconnaissance

(a) This is required to gain information about the activities and resources of an enemy, or potential enemy, or to secure data concerning the meteorological, hydrographic or geographic characteristics of a particular area by conducting operations in the third dimension, through visual observation and other detection methods. Aviation units are able to find/fix threat elements, to help build and share the COP tailored to air-ground team task and purpose, and to focus combat power at the decisive point at the right time. Aviation is a key contributor to reconnaissance may be conducted by air assets (manned, unmanned, or teamed) or integrated with ground maneuver units.

(b) There are three types of recon: Area – a form of reconnaissance operations that is a directed effort to obtain detailed information concerning the terrain or enemy activity within a prescribed area; Route – a directed effort to obtain detailed information of a specified route and all terrain from which the enemy could influence movement along that route; and zone – a form of reconnaissance that involves a directed effort to obtain detailed information on all routes, obstacles, terrain, and enemy forces within a zone defined by boundaries.

## Reconnaissance

**TASK/PURPOSE:** Reconnoiter to find the threat to build and share the common operational picture (COP) tailored to the air-ground team task/purpose, and allow the Commander to focus combat power at the decisive point and time.

**CONCEPT:**

- Conduct as part of an integrated air-ground manned/unmanned team designed to avoid a ground force meeting engagement
- Task/purpose based NAI:
  - ✓ Develop situation out of contact
  - ✓ Sort out HPT
  - ✓ Enable freedom of maneuver
  - ✓ Avoid meeting engagement
  - ✓ Enhance force protection
- Orchestrate recon effort:
  - ✓ Employ on/offboard R & S assets to meet CCIR
  - ✓ Man-in-loop eyes on to 'see first -- understand first'
    - > C2 R & S effort
    - > Cue and be cued
- Apply principles of reconnaissance: gain and maintain contact
- Conduct actions on contact to fix, destroy, or disengage as required

**ENDSTATE:** Friendly force has sufficient SA/SU to enable maneuver out of contact to positions of advantage in order to finish decisively.

The diagram illustrates a reconnaissance network. At the top, several assets are shown: ACS (Air Control System), JSTARS (Joint STARS), ERMP (Enhanced Radar Mission Platform), Joint UAS (Unmanned Aerial System), and EW (Electronic Warfare). These assets are connected via orange lightning bolts to two central yellow boxes labeled 'NAI' (No-Air-Interface). Below the NAI boxes are three blue boxes: FBCT (Forward Battle Control Team), FIRES (Fire Support Coordination), and HBCT (Headquarters Battle Control Team). The diagram also shows various aircraft icons and a 'TUAS' (Targeting UAS) box connected to the right NAI box. The entire network is set against a background of a blue and white terrain map.

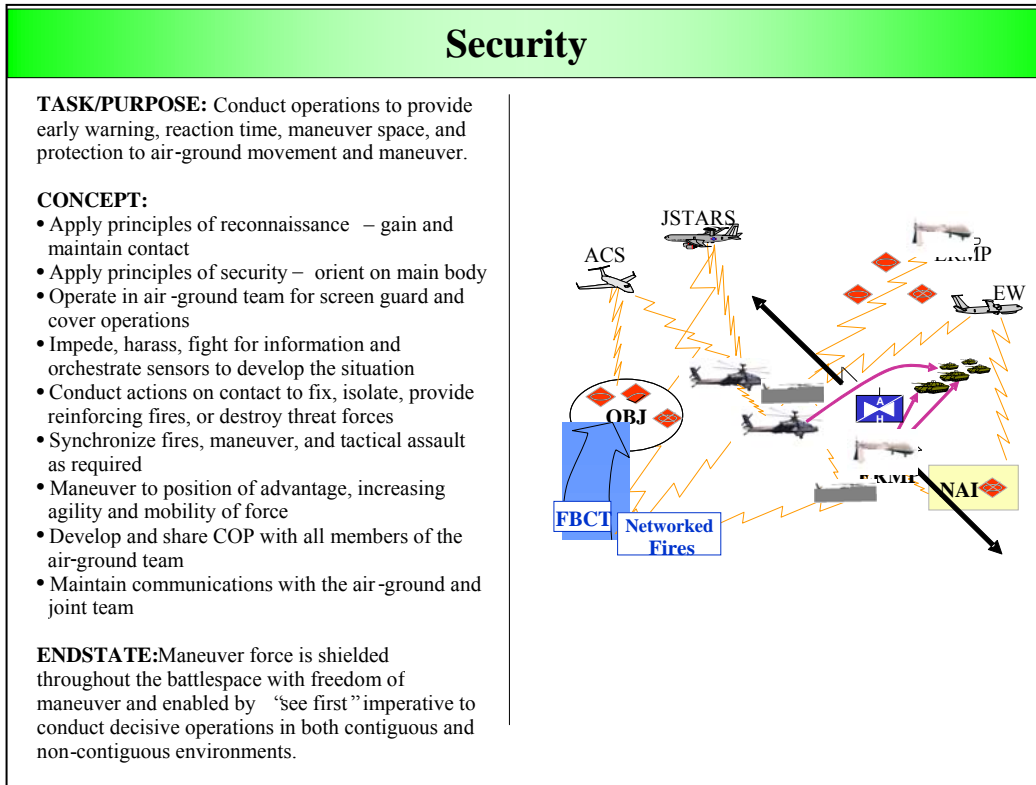
Version 6B

### B-5. Reconnaissance

(5) Security. This consists of conducting operations to allow the commander time to react and maneuver out of contact with the enemy, and provide early warning and limited protection to the air-ground maneuver team. Screen is a security element whose primary task is to observe, identify, and report information, and which only fights in self-protection. Guard is a form of security operation whose primary task is to protect the main force by fighting to gain time while also observing and reporting information, and to prevent enemy ground observation of and direct fire against the main body by reconnoitering, attacking, defending, and delaying. A guard force normally operates within the range of the main body's indirect fire weapons. Aerial security is a specialized area security operations conducted to protect vertical maneuver and air movement operations. Convoy security is a specialized kind of area security operations conducted to protect convoys. Area security is a form of security operations conducted to protect friendly forces, installation routes, and actions within a specific area. Cover is what an aviation HQ can conduct if augmented with ground forces and access to joint fires, and is outside the range of the main body and indirect fire systems.

(6) Aviation will perform crucial tasks in providing *air movement* support to the force as a whole, during SRO and or MSO, or to conduct time sensitive resupply of critical items. Future Modular Force operations will be sustained through a globally-networked, distribution based logistics system. Increased operational distances, non-secure LOCs and a noncontiguous operational environment will result in a greater reliance on aerial distribution platforms as a means of providing responsive and agile support from multiple locations within the theater. This, coupled with increased vertical maneuver support requirements to include preparedness for

quick repositioning of inserted units, will result in increased aviation lift requirements. Also, aviation forces provide movement support for humanitarian crisis, reinforcement in civil disturbances, domestic relief, and major disasters.



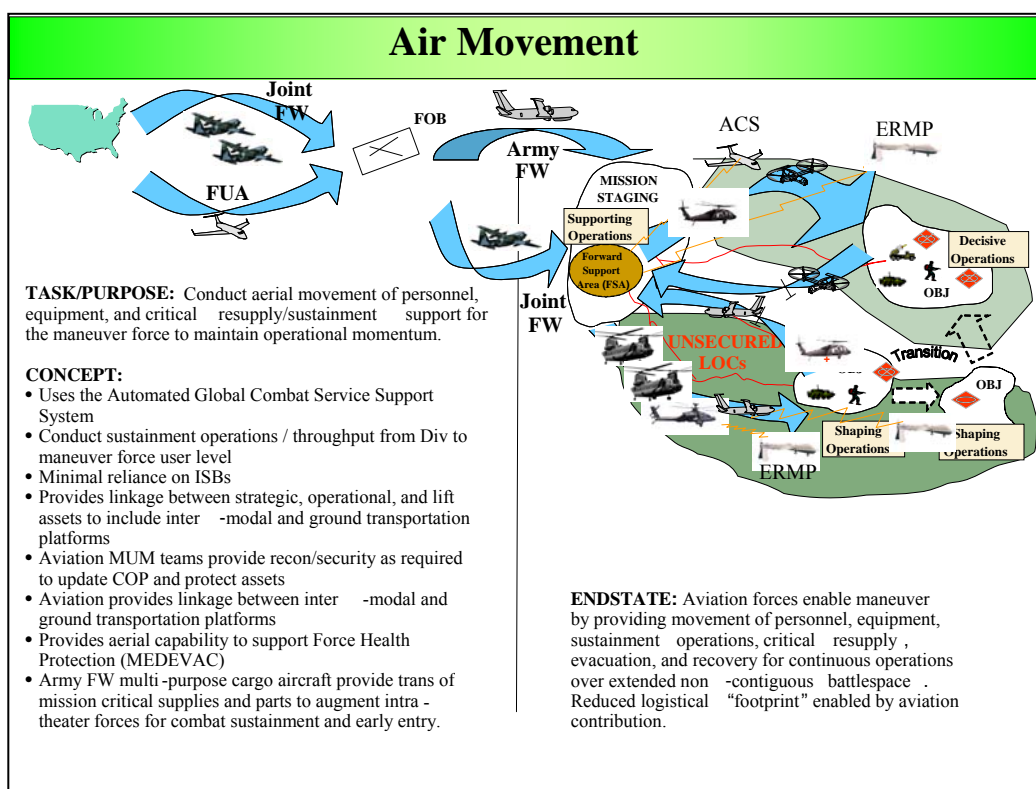
**Figure B-6. Security**

c. Unmanned Aircraft Systems Operations

(1) The ability of Army aviation to accomplish its core competencies is significantly enhanced by the use of unmanned systems, particularly when operating in a teamed configuration. Teaming UAS with manned systems provides enhanced operational (fire, maneuver) efforts while extending the command and control and intelligence capabilities for the commander. The manned and unmanned team provides force protection, reconnaissance, and surgical lethality to the maneuver force. It can operate at extended depth and has the OPTEMPO and modular flexibility to adjust rapidly to changing conditions. Studies have shown that interconnectivity of systems, rather than individual systems, achieves increased operational synergies. Manned aircraft provide man-in-the-loop, well forward to make required decisions and reduce sensor-to-shooter time in dealing with fleeting targets, especially in constrained ROE environments. Unmanned systems provide long-dwell surveillance, detection of CBRN contamination and weapons systems, network extension and jamming, loitering munitions, and reduced risk to Soldiers.

(2) UAS operating in an autonomous mode also provide significant capabilities to future Modular Force units. Long term surveillance, network extension, persistent stare, and operations

with unacceptable risk for manned systems, are just some examples where UAS will operate alone. Developing technologies show promise for use of the UAS in maneuver sustainment support, either as a surveillance platform or as a lift platform in critical limited supply replenishment, over extended distances requiring air LOCs. Additionally, enhancing SA and enabling SU throughout the extended asymmetric operational environment requires a robust suite of reconnaissance and surveillance and network extension assets. The UAS is integral to meeting these requirements and is organic to the air and ground brigades and its subordinate organizations. To optimize reconnaissance and surveillance and network extension functions, the Army must echelon UAS capabilities in a tiered, mutually supportive and hierarchical framework -- from platoon through brigade and above. Networked, unmanned systems will give the commander a valuable tool to gather information, and will augment, as well as supplement, other intelligence assets, while reducing risk factors for Soldiers in combat.



**Figure B-7. Air Movement**

(3) UAS LOIs (see NATO STANAG 4586 Edition 2.4). The flexible nature of UAS offers commanders and staffs a wide range of options to integrate UAS capabilities into the operations plan and to fulfill collection requirements. UAS interoperability and employment options are companion considerations in the development of UAS C2, payload employment strategy, and the operation/collection plan. Army units will incorporate the defined levels of interoperability within the current hardware and software, until hardware and software is available to fully maximize and integrate these levels. Familiarity and application of the levels of interoperability into current operations will prepare units to integrate the future fielding of an Army approved hardware and software system. Multiple levels of interoperability are feasible

between different air vehicles and their UAS GCSs. The levels of interoperability are identified below.

(a) LOI 1. Indirect receipt of unmanned aircraft data. Level 1 involves receipt and display of unmanned aircraft derived imagery or data without direct interaction with the unmanned aircraft. Imagery and data is received through established communications channels most often from the GCS controlling the unmanned aircraft. Level 1 requires a minimum connectivity with JBS, Global Broadcast Service, CGS, or ABCS.

(b) LOI 2. Direct receipt of air vehicle data, (where “direct” covers reception of the unmanned aircraft data by a system, which has direct communication with the unmanned aircraft). Level 2 involves receipt and display of imagery and data directly from the air vehicle without filtering or processing. This requires a system (such as GCS or a remote video terminal) to communicate directly with the air vehicle. At a minimum, level 2 operations require an air vehicle-specific data link and compatible LOS antenna to receive imagery and telemetry directly from the air vehicle. As level 2 operations involve receipt of direct imagery from the unmanned aircraft without any processing by the GCS, RVT operator training is recommended.

(c) LOI 3. Control and monitoring of the unmanned aircraft payload in addition to direct receipt of unmanned aircraft data. Level 3 involves control of the payload separate from control of the unmanned aircraft. In level 3 operations, the payload can be controlled from somewhere other than the GCS (possibly a secondary GCS or an enhanced OSRVT). The enhanced OSRVT, which has a transceiver (instead of a receiver only), could send payloads commands directly to the unmanned aircraft to focus the payload LOS on the ground user’s area of interest. Level 3 operations have the same communications requirements as level 2, plus the addition of payload control software. Level 3 requires commander and staff training on UAS operations, and payload operators trained on payload control operations.

(d) LOI 4. Control and monitoring of the unmanned aircraft, less launch and recovery. Level 4 interoperability is for the unmanned aircraft alone, and does not include payload control that is specified as level 3 control. A system controlling both the unmanned aircraft and its payload is exercising level 3 and level 4 control simultaneously. Level 4 operations have the same hardware requirements as level 3, plus the addition of unmanned aircraft control software. Level 4 operations require additional commander and staff familiarization training on flight characteristics of the air vehicle in use. Unmanned aircraft operators must be trained, qualified, proficient, and current per the operating Service’s regulations for the unmanned aircraft.

(e) LOI 5. Full function and control of the unmanned aircraft to include launch and recovery. Level 5 operations have the same hardware requirement as levels 2 to 4 plus any unique software and launch and recovery equipment (such as, for an automated takeoff and landing capability). The automated system may be a system such as the UAS common automated recovery system, a microwave-based system, or through a differential GPS system such as the one integrated in the ERMP UAS. Level 5 operations require appropriate operator training in flight operations for the specific unmanned aircraft. Unmanned aircraft operators must be trained, qualified, proficient, and current in the operating service’s training and operations regulations for the unmanned aircraft they are controlling.

d. AC2 and Air Traffic Services (ATS)

(1) In the future Modular Force, airspace management occurs in AC2 cells, organic to units from the BCT through to the theater level. These cells combine aviation and air defense artillery personnel who operate in close coordination with the unit's fires cells. The AC2 operations cells at the division, corps, and theater oversee the overall AC2 effort at their respective levels, and support the immediate airspace requirements and the current airspace control order. The cells will also develop airspace architecture for deliberate or contingency plans; plan and update the AC2 estimate and annex to the operations order; work with air and missile defense operations to plan sensor coverage; monitor airspace use in the operational environment; and provide the air picture to the subordinate cells. Fires and airspace deconfliction in the fires cell at the BCT level is closely coordinated between the targeting officer, air liaison officer, fire support coordinator and the ADAM BAE cell.

(2) The fires cell and the ADAM BAE cells should be located side by side in the BCT CP to facilitate rapid coordination. All AC2 cells will have full digital connectivity to the theater battlefield coordination detachment, enabling the BCT to request airspace digitally. This digital connectivity should drastically reduce the processing and staffing time associated with airspace requests. The TAIS is the component of the ABCS for automating and integrating airspace management at the BCT and above. The AC2 elements will be highly trained and proficient in the planning, execution and deconfliction of the airspace with JIM partners, while still providing deconfliction with the host nation's airspace.

(3) ATS will provide the full range of installation and tactical services before, during, and after deployment of forces in support of theater, JIM operations. Army ATS will remain one of the core enablers for AC2, ensuring synchronized access to increasingly congested joint airspace. ATS will acquire, field and deploy smaller, lighter, more efficient, digitally connected, terminal and en route communication and precision navigation systems, to support all future Modular Force operational requirements in the JOA. Terminal air traffic control procedures are applied with varying levels of flexibility at airfields, forward operating bases, assembly areas, and tactical landing and pick-up zones. The primacy of effort in these terminal areas is the separation and sequencing of aircraft landing and departing as well as controlling ground movement activities throughout the runway/landing area. En route air traffic control procedures encompass activities that provide situational awareness, flight advisories, flight following, and navigational assistance to aircraft operating outside of terminal areas. Terminal and en route air traffic control facilities are an organizational element of the CAB and are employed based on METT-TC in support of aviation operations throughout the spectrum of conflict. The ATS company, an organizational element of the CAB, establishes terminal air traffic control tower, and ground controlled approach services in these congested operating areas. The company establishes a fully instrumented navigational capability for helicopters and fixed-wing aircraft operating in and out of these terminal areas.

(4) Additionally, the ATS Company supports other air traffic missions of the CAB with an en route air space information team and a tactical terminal control team, commonly referred to as AIC and TACT respectively. TACTs provide a rapid terminal air traffic control package at congested landing and pick-up zones traditionally identified as short-term environments. TACT



teams are trained in assault zone operations, pathfinder operations, and forward arming and refueling operations. These teams are self deployable but usually conduct operations with inserted assault forces during concentrated aviation activities. TACTs are connected to other air traffic organizations via high frequency voice communication and are usually employed to maintain control of air flow in permissive to semi-permissive environments. The AIC will serve as the Army's execution capability for its AC2 concept. The AIC will be able to monitor airspace assigned by the division and maintain situational awareness of airspace and all airspace users within its assigned area. More significantly, it will be able to communicate to aircraft operating within its assigned area and provide critical updates to emerging airspace deviations. The AIC will ensure aircraft are operating in accordance with the airspace control order and coordinate airspace changes for aircraft operating in close coordination with maneuvering ground forces.

e. Aviation Sustainment Maintenance

(1) Aviation logistics organizations of the future must be tailorable, modular in design, rapidly deployable, and highly mobile. TAV and capability to perform simultaneous operations and automated logistical functions will enable aviation support organizations to adequately support all Army aviation units. Diagnostic and prognostic test equipment, man-portable computer systems, and logistics information systems will be standardized, integrated, and securable. These systems will be linked horizontally across the organization and vertically throughout the maneuver sustainment community. Component modularization will decrease maintenance manpower requirements and repair times while increasing aircraft availability. Innovations in aviation technology will produce aircraft with greater functionality and reliability. Using integrated, diagnostic test equipment and automated information systems, embedded technologies will provide real time aircraft status information.

(2) Two-level maintenance support concept is the goal for the future Modular Force, and will be implemented as the aviation fleet is modernized with aircraft designed for two-level maintenance support. The transition will be gradual and will require operation of both two and three-level systems for some time. The far-term goals for aviation logistics and maintenance equipment include intelligent diagnostics and prognostics, able to detect system failures prior to occurrence (through the use of on-board collection systems) and automatically transmit aircraft systems data to sustainment units, maintenance facilities and FARP personnel. This information will shorten the lead-time necessary for maintenance resupply, refit, and refurbishment, and will optimize the scheduling of maintenance actions with minimal impact on aircraft readiness.

(3) Additionally, standardization of aircraft components and equipment coupled with evolutionary changes in technology will reduce the in-theater logistical footprint as well as operational and support costs. Requisitioned parts will flow through the system in a matter of hours instead of days, and be tracked via embedded electronics so that asset visibility is maintained wherever the unit is deployed.

f. DART. DART operations will be coordinated at division and theater level by the ASB. The GSAB of the aviation brigade at division and theater level will normally accomplish the mission with minimal risk to the Soldiers involved in the operation. The DART extracts an

aircraft from a downed location to a safe location, using aerial recovery kits, a trained recovery team, and recovery aircraft.

g. Personnel recovery. Joint doctrine defines personnel recovery to include combat search and rescue; search and rescue; SERE; and coordination of forcible recovery operations. Combat search and rescue and search and rescue are doctrinally theater component responsibilities. If the Army is tasked to do this mission, the theater has additional communications linkages and detection capabilities, which may enable the rescue operation to be performed more safely and efficiently, within the constraints of METT-TC. The theater will then augment subordinate elements with the required assets in order to accomplish the mission. The TAC has assets to perform this function throughout its entire area of operations. Theater personnel recovery operations will be conducted primarily in support of their own operations (downed Army aircrew recovery) and provide mutual personnel recovery support at both the intra and inter service levels as required. Additionally, personnel recovery contingencies will be incorporated into all mission plans and special instructions will be issued for each plan, and the brigade will be prepared to generate personnel recovery support requests.

h. FARP operations. A FARP is a temporary facility that is organized, equipped, and deployed by an aviation commander. It is normally located in a brigade combat team or support brigade area closer to the area where operations are being conducted than the aviation unit's combat service area - to provide fuel and ammunition necessary for the employment of aviation maneuver units in combat. The forward arming and refueling point permits combat aircraft to rapidly refuel and rearm simultaneously. In some cases it could have maintenance teams co-located for more extended operations and for battle damage assessment.

i. C2 support. The Army aviation airborne C2 system, a UH-60-based package, represents a significant enhancement to the commander's ability to battle command forces. The airborne C2 platform has five operational roles. They are a battle command on the move platform, a ground tactical command post, a jump TOC, an early entry command post, and as a first responder during national disasters. The on-board communications and data linkages allow the commander to be continuously in contact with committed forces, un-tethered to a static operations center, maintain situational awareness, issue and receive fragmentary orders with graphics, synchronize fires and maneuver, and extend his coverage throughout the entire operational environment. Airborne C2 systems are normally found in the CAC of the aviation brigade at future Modular Force division and theater. Aviation provides the platform to support the related tasks and systems that support the commander in exercising authority and direction. UAS can also perform communications relay for C2 efforts over extended distances and allow for extended loiter in order to insure continuous communications to the force commander across the extended distances of the future operational environment.

j. MEDEVAC and CASEVAC

(1) Aero-medical evacuation operations. Evacuation of Soldier casualties is the responsibility of health service support. Aero-medical evacuation is the preferred method of evacuation of seriously wounded and ill Soldiers. MEDEVAC is the tactical evacuation of casualties executed by dedicated, standardized medical evacuation platforms, with trained flight

medics to provide timely patient movement and en route care, to enhance survivability and reduce long term disability. The army provides air ambulances to the combatant commander ensuring medical evacuation support to all members of a combined joint task force to include host nations, interagency, non-government organizations, detainees, DOD and non-DOD civilians and contractors. The theater and division aviation brigades consist of dedicated air ambulance companies. Elements of the air ambulance company can be collocated with health service support organizations, with elements of the aviation TF supporting the maneuver brigade, or for brief periods with the maneuver brigade, to provide air evacuation capabilities throughout the theater area of operations. MEDEVAC aircraft also conduct emergency delivery of blood, biologicals and medical supplies; emergency movement of medical personnel and equipment; and support personnel recovery operations.

(2) CASEVAC operations. CASEVAC is the non-standard evacuation, by aircraft of opportunity, when medical aircraft are not readily available. CASEVAC aircraft do not have trained flight medics to provide en route care. The theater fixed and rotary wing assets and division lift helicopters are an additional responsive means of non-standard transportation for casualty evacuation. The theater may augment either the designated aero-medical evacuation aircraft or assist subordinate elements when the need arises throughout the theater area of operations.

## Glossary

### Section I

#### Abbreviations and Terms

AC2	airspace command and control
AAA	anti-aircraft artillery
AAFARS	advanced aviation forward area refueling system
AATE	advance affordable turbine engine
ABCS	Army battle command system
ACTD	advanced concept technology demonstration
ADAM	air defense airspace management
ADEC	aircraft data exploitation capability
AGM	air to ground missile
AGSE	aviation ground support equipment
AH	attack helicopter
AIAP	Army Information Assurance Program
AIC	Airspace Information Center
AIT	automatic information technology
AMC	aviation maintenance company
AMPS	aviation mission planning system
AMSF	area maintenance support facility
AO	area of operations
AOB	airfield operations battalion
AOBPS	aircrew occupant ballistic protection system
APAS	active passive aircraft survivability
APKWS	advanced precision kill weapon system
APOD	aerial port of debarkation
ARH	attack reconnaissance helicopter
ASB	aviation support battalion
ASC	aviation support company
ASE	aircraft survivability equipment
ASTAMIDS	Airborne Surveillance Target Acquisition and Minefield Detection System
ATAS	air-to-air Stinger
ATC	air traffic control
ATFCS	advanced tactical flight control system
ATNAVICS	Air Traffic Navigation, Integration, and Coordination System
ATS	air traffic services
AVCATT-A	aviation combined arms tactical trainer-aviation
AVCRAD	aviation classification repair activity depots
AW	air warrior
BAE	brigade aviation element
BCOTM	battle command on the move
BCT	brigade combat team
BDA	battle damage assessment

BDAR	battle damage assessment and repair
BFSB	battlefield surveillance brigade
BFT	blue force tracking
BLOS	beyond line of sight
BURRO	broad-area unmanned responsive resupply operation
C2	command and control
C3D2	camouflage, cover, concealment, denial, and deception
C4ISR	command, control, communications, computers, intelligence, surveillance, and reconnaissance
CAB	combat aviation brigade
CAS	close air support
CASEVAC	casualty evacuation
CBA	capabilities based assessment
CBM	condition based maintenance
CBRN	chemical, biological, radiological, nuclear
CBRNE	chemical, biological, radiological, nuclear, explosive
CCP	concept capability plan
CDAS	Cognitive Decision Aiding System
CD&E	Concept Development and Experimentation (Division)
CH	cargo helicopter
CLOE	common logistics operating environment
CMS	combat mission simulator
CMWS	Common Missile Warning System
COA	course of action
CONUS	continental United States
COP	common operational picture
COTS	commercial off the shelf
CP	command post
C-RAM	counter-rocket, artillery, and mortar
DA	Department of the Army
DARPA	Defense Advanced Research Projects Agency
DART	downed aircraft recovery team
DEW	directed energy weapon
DOD	Department of Defense
DOTMLPF	doctrine, organization, training, materiel, leadership and education, personnel and facilities
DVE	degraded visual environment
DWE	digital warfighter exercise
EGI	embedded GPS inertial navigation system
EMPRS	en route mission planning and rehearsal
EOIR	electro-optical infrared
ERMP	extended range multi-purpose
FAA	Federal Aviation Administration
FARP	forward arming and refueling point
FATE	future aircraft turbine engine
FBCB2	future battle command brigade and below

FCR	fire control radar
FCS	Future Combat System
FLIR	forward looking infrared
FM	field manual
FOB	forward operating base
FOPEN	foliage penetration
FSC	forward support company
FUA	future utility aircraft
FY	fiscal year
GIG	global information grid
GMTI	ground moving target indicator
GPS	Global Positioning System
GATM	Global Air Traffic Management
GCCS-A	Global Command and Control System-Army
GCS	ground control station
GCSS-A	Global Combat Support System-Army
GEMISIS	Global Electromagnetic Spectrum Information System
GSAB	general support aviation battalion
HERO	hazardous electromagnetic radiation to ordnance
HLVTOL	heavy lift vertical take off and landing
HNW	highband networking waveform
HQ	headquarters
HSKT	hunter strike killer team
IDAS	intelligent decision aiding for aircraft survivability
IED	improvised explosive device
IETM	interactive electronic technical manuals
IFF	identification friend or foe
IR	infrared
ISB	intermediate staging base
ISR	intelligence surveillance and reconnaissance
ITV	in-transit visibility
JAGM	joint air to ground missile
JCA	joint cargo aircraft
JCIDS	Joint Capabilities Integration Development System
JCM	joint common missile
JEFX	joint expeditionary forces experiment
JFC	joint force commander
JIM	joint, interagency, multinational
JNN	joint network node
JOA	joint operations area
JOC	joint operating concept
JPALS	Joint Precision Approach and Landing System
JTRS	Joint Tactical Radio System
LARC	lightweight active rotor concept.
LIDAR	light detection and ranging
LOC	lines of communication

LOI	level of interoperability
LOS	line of sight
LRF/D	laser rangefinder/designator
LRSD	long range surveillance detachment
LWR	laser warning receiver
LZ	landing zone
MANPADS	Man Portable Air Defense System
MAPEX	map exercise
MDMP	military decisionmaking process
MDSA	modernized day sensor assembly
MEDEVAC	medical evacuation
MEDUSA	multifunction electro-optical defense of U.S. aircraft
METT-TC	mission, enemy, terrain and weather, troops and support available, time available, civil considerations
MFOQA	military flight operations quality assurance
MHE	materiel handling equipment
MITL	man in the loop
MOTS	Mobile Tower System
MOUS	mobile users objective system
MSO	mission staging operations
MMS	mast mounted sight
MTADS	modernized target acquisition designation sight
MTI	moving target indicator
MUM	manned and unmanned
NAI	named area of interest
NECC	network enabled command capability
NLOS	non line of sight
nm	nautical mile
NMP	National Maintenance Program
NVG	night vision goggle
OH	observation helicopter
OLLC	operational level logistics command
OPCON	operational control
OPTEMPO	operational tempo
OPUL	objective pilotage for utility and lift
ORD	operational requirements document
OSGCS	one system ground control station
OSRVT	one system remote video terminal
PAP	persistent aerial presence
PGM	precision guided munition
PNVS	pilot night vision sensor
RF	radio frequency
RFI	radar frequency interferometer
ROE	rules of engagement
ROMO	range of military operations
RPG	rocket propelled grenade

RSOI	reception, staging, onward movement, and integration
RWR	radar warning receiver
SA	situational awareness
SAF	semi automated force
SAL	semi active laser
SAM	surface to air missile
SAMS(E)	Standard Army Maintenance System (enhanced)
SAR	synthetic aperture radar
SARAP	Survivable Affordable Repairable Airframe Program
SATCOM	satellite communications
SEAD	suppression of enemy air defense
SECOMP-I	secure en route communications package-improved
SHFE	small heavy fuel engine
SIIRCM	suite of integrated infrared countermeasures
SINCGARS	Single Channel Ground and Airborne Radio System
SOF	special operations forces
SOSCOE	system of systems common operating environment
SPOD	sea port of debarkation
SRGPS	shipboard relative GPS
SRO	sustainment replenishment operations
SRW	Soldier radio waveform
SU	situational understanding
TAC	theater aviation command
TACT	tactical aviation control team
TADS	target acquisition designation sight
TADSS	training aids, devices, simulators, and simulations
TAI	target area of interest
TAIS	Tactical Airspace Integration System
TAMMS	The Army Maintenance Management System
TASMC	theater aviation sustainment maintenance capability
TASMG	theater aviation sustainment maintenance group
TASS	target acquisition sensor suite
TAV	total asset visibility
TCAS	Traffic Alert and Collision Avoidance System
TCDL	tactical common data link
TDA	table of distribution and allowances
TDMA	time demand multiple access
TERPS	terminal instrument procedures
TF	task force
TOC	tactical operations center
TRADOC	Training and Doctrine Command
TTCS	Tactical Terminal Control System
TTP	tactics, techniques, and procedures
TTVS	Tactical Terrain Visualization System
UAS	unmanned aircraft systems
UH	utility helicopter



UHF	ultra-high frequency
ULLS-A(E)	Unit Level Logistics System-Aviation (Enhanced)
U.S.	United States
VTOL	vertical take off and landing
WIN-T	warfighter information network-tactical
WNW	wideband network waveform

**Section II**  
**Terms**

**acquire**

To obtain data about the friendly force, the environment, and the enemy in order to support development of relevant information and knowledge that supports understanding. (Derived definition from Merriam-Webster).

**aerial port**

An airfield that has been designated for the sustained air movement of personnel and materiel as well as an authorized port for entrance into or departure from the country where located. (JP 1-02).

**airdrop**

The unloading of personnel or materiel from aircraft in flight. (JP 1-02).

**airdrop platform**

A base upon which vehicles, cargo, or equipment are loaded for airdrop. (JP 1-02).

**area of operations**

An operational area defined by the JFC for land and maritime forces. Areas of operation do not typically encompass the entire operational area of the JFC, but should be large enough for component commanders to accomplish their missions and protect their forces. (JP 3-0).

**battle command**

Battle command is the art and science of visualizing, describing, directing, and leading forces in operations against a hostile, thinking, and adaptive enemy. Battle command applies leadership to translate decision into actions, by synchronizing forces and warfighting functions in time, space, and purpose, to accomplish missions. (Derived from FM 3-0 (DRAG)).

**battlespace awareness**

The situational knowledge whereby the JFC plans operations and exercises command and control. It is the result of the processing and presentation of information comprehending the operational environment, the status and dispositions of friendly, adversary, and non-aligned actors; and the impacts of physical, cultural, social, political, and economic factors on military operations. (The Battlespace Awareness Joint Functional Concept).

**civil reserve air fleet**

A program in which the DOD contracts for the services of specific aircraft, owned by a U.S. entity or citizen, during national emergencies and defense-oriented situations when expanded civil augmentation of military airlift activity is required. These aircraft are allocated, in accordance with DOD requirements, to segments, according to their capabilities, such as international long-range and short range cargo and passenger sections, national (domestic and Alaskan sections) and aero-medical evacuation and other segments as may be mutually agreed upon by the DOD and the Department of Transportation. (JP 3-17).

**command and control**

The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. C2 functions are performed through an arrangement of personnel, equipment, communications, facilities, and procedures employed by a commander in planning, directing, coordinating, and controlling forces and operations in the accomplishment of the mission; also called C2. (DOD).

**common operational picture**

Single display of relevant information within a commander's area of interest, tailored to the user's requirements, based on common data and information shared by more than one command. (JP 1-02) An operational picture tailored to the user's requirements, based on common data and information shared by more than one command. (FM 3-0).

**cooperative engagement**

The collective capability of forces in combat to provide mutual support to other friendly units or to benefit reciprocally from receiving support from adjacent units and joint assets, making the focusing combat power as a matter of collaboration between committed commanders rather than a monopoly of the overall commander. (TRADOC Pam 525-3-2, U.S. Army Concept for Tactical Maneuver).

**counter precision and counter anti-access capabilities**

Counter precision refers to U.S. capabilities that are employed to destroy or neutralize enemy capabilities to detect and engage friendly forces at will with precision fires. Counter anti-access refers to U.S. capabilities that are employed to destroy or neutralize enemy capabilities to deny access by air, land, or sea, such as the emplacement of sea mines, capability to contaminate entry points, and the like.

**debarkation**

The unloading of troops, equipment, or supplies from a ship or aircraft. (JP 1-02).

**deployment**

1) In naval usage, the change from a cruising approach or contact disposition to a disposition for battle. 2) The movement of forces within operational areas. 3) The positioning of forces into a formation for battle. 4) The relocation of forces and materiel to desired operational areas. Deployment encompasses all activities from origin or home station through destination, specifically including intra-continental U.S., intertheater, and intratheater movement legs, staging, and holding areas. (JP 4-0).

**directed energy**

An umbrella term covering technologies that relate to the production of a beam of concentrated electromagnetic energy or atomic or subatomic particles. (JP 1-02).

**distribution**

The operational process of synchronizing all elements of the logistics system to deliver the 'right things' to the 'right place' at the 'right time,' to support the geographic combatant commander. Further to this definition, distribution employs a partnership of Army, joint, multinational, and interagency, and commercial capabilities, to provide personnel, equipment and materiel from a source of supply to a point of use or consumption, which includes the last tactical mile, redistribution, redirection, and retrograde activities. Distribution is fully synchronized with the force deployment process and the battle plan, and includes the multidirectional flow of personnel, equipment and materiel, mode and node operations, container and materiel handling, and protective packaging. (JP 4-0).

**embarkation**

The process of putting personnel and/or vehicles and their associated stores and equipment into ships and/or aircraft. (JP 1-02).

**engagement zone**

An area defined by time, geography and air space that is designated to accommodate the employment of joint fires. Engagement zones are normally designated within joint operational environments characterized by multiple forces conducting distributed operations in depth. Engagement zones may also be designated to restrict the type or magnitude of joint fires that may be employed within a designated area of the joint operational environment.

**footprint**

The amount of personnel, spares, resources, and capabilities physically present and occupying space at a deployed location. (JP 1-02).

**forward operations base**

In special operations, a base usually located in friendly territory or afloat that is established to extend command and control or communications or to provide support for training and tactical operations. Facilities may be established for temporary or longer duration operations and may include an airfield or an unimproved airstrip, an anchorage, or a pier. A forward operations base may be the location of special operations component headquarters or a smaller unit that is controlled and/or supported by a main operations base. (JP 3-05.1).

**full spectrum operations**

Military actions that can extend across the entire range of military operations (ROMO) from MCO to stability operations. ROMO and full spectrum operations can be considered synonyms. They can also be described in terms of offensive, defensive, stability, and civil support operations.

**gather**

The non-competitive acquisition of data and information on friendly forces and some aspects of the environment. (Derived from Merriam-Webster Dictionary).

**global information grid**

The globally interconnected, end-to-end set of information capabilities, associated processes, and personnel for collecting, processing, storing, disseminating, and managing information on demand to warfighters, policymakers, and support personnel.

**information management**

Collection, processing, storage, display, dissemination, and presentation, to facilitate situational understanding and decisionmaking while maximizing the effective use of available information resources. (Army Battle Command functional concept). The provision of relevant information to the right person at the right time in a usable form to facilitate situational understanding and decisionmaking. It uses procedures and information systems to collect, process, store, display, and disseminate information. (FM 6-0).

**information operations**

The integrated employment of the core capabilities of electronic warfare, computer network operations, psychological operations, military deception, and operations security, in concert with specified supporting and related capabilities, to influence, disrupt, corrupt or usurp adversarial human and automated decisionmaking while protecting our own. IO engage enemy, adversary, neutrals, and others in the information environment to influence perceptions, affect actions, and generate a range of effects in the information environment. IO includes the use of capabilities to influence perceptions of foreign and friendly audiences. (FM 3-0).

**intelligence, surveillance, and reconnaissance**

An enabling operation that integrates and synchronizes all battlefield operating systems to collect and produce relevant information to facilitate the commander's decisionmaking. Also called ISR. (FM 1-02).

**intermediate staging base (ISB)**

A temporary location used to stage forces prior to inserting the forces into the host nation. (JP 3-07.5).

**intertheater**

Between theaters or between the continental United States and theaters. (JP 1-02).

**intertheater airlift**

The common-user airlift linking theaters to CONUS and to other theaters as well as the airlift within CONUS. The majority of these air mobility assets are assigned to the commander, USTRANSCOM. Because of the intertheater ranges usually involved, intertheater airlift is normally conducted by the heavy, longer range, intercontinental airlift assets but may be augmented with shorter range aircraft when required. (JP 3-17).

**in-transit visibility**

The ability to track the identity, status, and location of DOD units, and non-unit cargo (excluding bulk petroleum, oils, and lubricants) and passengers; patients; and personal property from origin to consignee or destination across the range of military operations. (JP 4-01.2).

**intratheater**

Within a theater. (JP 1-02).

**intratheater airlift**

Airlift conducted within a theater. Assets assigned to a geographic combatant commander or attached to a subordinate JFC normally conduct intratheater airlift operations. Intratheater airlift provides air movement and delivery of personnel and equipment directly into objective areas through air landing, airdrop, extraction, or other delivery techniques as well as the air logistic support of all theater forces, including those engaged in combat operations, to meet specific theater objectives and requirements. During large scale operations, USTRANSCOM assets may be tasked to augment intratheater airlift operations, and may be temporarily attached to a JFC. (JP 3-17).

**joint fires**

Fires produced during the employment of forces from two or more components in coordinated action toward a common objective. (JP 1-02).

**joint strike**

Joint fires that assist air, land, maritime, amphibious, and special operations forces to move, maneuver, and control territory, populations, airspace, and key waters. See also strike; joint fires. (JP 1-02).

**logistics**

The science of planning and carrying out the movement and maintenance of forces. In its most comprehensive sense, those aspects of military operations that deal with: design and development, acquisition, storage, movement, distribution, maintenance, evacuation, and disposition of materiel; movement, evacuation, and hospitalization of personnel; acquisition or construction, maintenance, operation, and disposition of facilities; and acquisition or furnishing of services. (JP 1-02).

**maneuver**

1. A movement to place ships, aircraft, or land forces in a position of advantage over the enemy.
2. A tactical exercise carried out at sea, in the air, on the ground, or on a map in imitation of war.
3. The operation of a ship, aircraft, or vehicle, to cause it to perform desired movements.
4. Employment of forces in the operational area through movement in combination with fires to achieve a position of advantage in respect to the enemy in order to accomplish the mission.

(JP 3-0).

**maneuver support**

Those capabilities that enable the maneuver commander's freedom of action and protect the force. Maneuver support provides a wide range of integrated actions, both proactive and

defensive, to support uninterrupted momentum, allowing maneuver forces to preserve combat power so that it may be best applied at decisive points and times, to foster rapid transitions in operations. (MANSCEN).

**military decisionmaking process**

A deliberate methodical process of analysis, course of action consideration and selection, and translation of commander's intent into plans and orders.

**move**

For the purposes of this concept move is defined as movement capabilities and processes that support strategic to tactical distribution and maneuver in the JOE.

**network-centric operations**

An information superiority-enabled concept of operations that generates increased combat power by networking sensors, decisionmakers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self-synchronization. In essence, it translates information superiority into combat power by effectively linking knowledgeable entities in the operating environment.

**network**

An interconnection of three or more communicating entities and (usually) one or more nodes. A combination of passive or active electronic components that serves a given purpose. (FM 25-1-1 Information Technology Support and Services 25 October 2006).

**networked fires**

A component of the *battle command network* and supporting communications architecture. It is a combination of relevant sensors, effects capabilities, battle command system tools, and communications capabilities available across the BCT. Networked fires enable dynamic application of lethal and nonlethal destructive and suppressive effects.

**nonlethal weapons**

Weapons that are explicitly designed and primarily employed so as to incapacitate personnel or material, while minimizing fatalities, permanent injury to personnel, and undesired damage to property and the environment. Unlike conventional lethal weapons that destroy their targets through blast, penetration, and fragmentation, nonlethal weapons employ means other than gross physical destruction to prevent the target from functioning. Nonlethal weapons are intended to have one, or both, of the following characteristics, they have relatively reversible effects on personnel or materiel, and they affect objects differently within their area of influence. (DOD).

**persistent surveillance**

Continuous or near-continuous monitoring or tracking of targets and areas of interest. It may be accomplished by one type of system or means, or by multiple systems and means. (Derived definition from Battlespace Awareness Joint Functional Concept). A collection strategy that emphasizes the ability of some collection systems to linger on demand in an area to detect, locate, characterize, identify, track, target, and possibly provide battle damage assessment and re-targeting in near or real time. Persistent surveillance facilitates the formulation and execution

of preemptive activities to deter or forestall anticipated adversary courses of action. See also **surveillance**. (JP 2-01).

**precision engagement**

The ability of JFs to locate, surveil, discern, and track objectives or targets; select, organize, and use the correct systems; generate desired effects; assess results; and reengage with decisive speed and overwhelming operational tempo as required, throughout the full range of military operations. (Joint Vision 2020).

**port of debarkation (POD)**

The geographic point at which cargo or personnel are discharged. This may be a seaport or aerial port of debarkation; for unit requirements; it may or may not coincide with the destination. (JP 4-01.2).

**port of embarkation (POE)**

The geographic point in a routing scheme from which cargo or personnel depart. This may be a seaport or aerial port from which personnel and equipment flow to a port of debarkation; for unit and non-unit requirements, it may or may not coincide with the origin. (JP 4-01.2).

**reception, staging, onward movement, and integration**

A phase of force projection occurring in the operational area. This phase comprises the essential processes required to transition arriving personnel, equipment, and materiel into forces capable of meeting operational requirements. (JP 4-01.8).

**reconnaissance**

A mission undertaken to obtain visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy, or to secure data concerning the meteorological, hydrographic, or geographic characteristics of a particular area. (JP 1-02).

**responsive and tailorable organizations**

Proficient, cohesive, task-organized, and networked teams using common procedures, and relevant information capable of responding rapidly to plan and execute a broad ROMO.

**seabasing**

Seabasing is the rapid deployment, assembly, command, projection, reconstitution, and re-employment of joint combat power from the sea, while providing continuous support, sustainment, and force protection to select expeditionary joint forces without reliance on land bases within the JOA. These capabilities expand operational maneuver options, and facilitate assured access and entry from the sea. (Joint).

**self-synchronizing**

The ability to arrange military actions in time, space, and purpose to produce maximum relative combat power at a decisive place and time using the mission and intent and without pauses or transitions to orchestrate the force. (Derived definition.) The collaborative and decentralized initiation and execution of actions by elements of a joint force in support of the desired end state. Also defined as the interaction between two or more entities to operate in the absence of hierarchical mechanisms for joint C2. (Joint C2 FC).

**situational awareness**

Knowledge and understanding of the current situation which promotes timely, relevant, and accurate assessment of friendly, enemy, and other operations within the battlespace in order to facilitate decisionmaking. An informational perspective and skill that fosters an ability to determine quickly the context and relevance of events as they unfold. (Marine Corps; FM 3-0) Situational awareness is knowledge of the immediate present environment, including knowledge of the factors of METT-TC. More simply, it is knowing what is happening around you now. In the context of the cognitive hierarchy, situational awareness is at the knowledge level. (FM 5-0.1).

**situational understanding**

The product of applying analysis and judgment to the common operational picture to determine the relationship among the factors of METT-TC. (FM 3-0).

**surveillance**

The systematic observation of aerospace, surface or subsurface areas, places, persons or things, by visual, aural, electronic, photographic or other means. (JP 1-02).

**target location error**

Generally characterized as the percentage of locations computed that are within a certain distance of the actual firing location for a specific type of projectile. Target location error is generally characterized as the radius in meters from the actual weapon locations that 90 percent and 50 percent of the computed weapon locations would be located. TLE is an important factor in determining the method of target attack. (FM 3-09.12, FM 6-121), Tactics, Techniques, and Procedures for Field Artillery Target Acquisition).

**weapons of mass destruction**

Weapons capable of a high order of destruction and/or of being used in such a manner as to destroy large numbers of people. Weapons of mass destruction can be high explosives or nuclear, biological, chemical, and radiological weapons, but exclude the means of transporting or propelling the weapon where such means is a separable and divisible part of the weapon. Weapons of mass effects are often used to include weapons, such as chemical and biological types, that may cause mass casualties without destruction of human life. (DOD).

**Section III**

**Special Terms and Abbreviations**

This section contains no entries.