AIR FORCE AND ARMY DIGITIZATION AND THE JOINT TARGETING PROCESS FOR TIME-CRITICAL TARGETS

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The application of new technology towards the digitization of command and control systems has the potential to provide near real-time situational awareness to commanders and increase the timeliness and accuracy of the processes involved in targeting time-critical targets throughout the battlefield. This paper narrowly focuses on the digitization of Air Force and Army command and control systems and the implications of that digitization for the joint targeting of time-critical targets.

The Air Force is fielding the Theater Battle Management Core Systems (TBMCS) and the Army is fielding the Army Battle Command System (ABCS). Both the TBMCS and the ABCS comprise a system of systems with modular hardware and software packages that provide command, control, communications, computers, and intelligence capabilities for the warfighters. These systems are migrating towards joint interoperability by adhering to the architecture and protocols of the Defense Information Infrastructure / Common Operating Environment (DII/COE) mandated by the Joint Chiefs of Staff.

Time-critical targets, such as theater ballistic missiles or surface to air missiles, are fleeting in nature with typically only a short window of opportunity in which to acquire and attack them. Using digitized systems speeds up the targeting process so targets can be attacked within this window.

The data link capabilities inherent in digitized systems are increasingly leading to sensor-to-shooter links that reduce the amount of time required to acquire the target, decide if it is important enough to attack with a limited attack resource, and then attack it. Sensor-to-shooter teams on the future battlefield can be linked into a seamless network such that anything that can be found on the battlefield can be killed.

Overlapping attack capabilities of the Air Force and Army can be better managed with the digitized command and control systems, provided they are interoperable and properly connected. For optimal employment, all elements on the battlefield need to be connected with digitized systems, including allied and coalition forces.

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INTRODUCTION

On-going digitization efforts have the potential to provide near-real-time situational awareness to commanders at all levels on the battlefield and significantly reduce the amount of time required to execute the targeting cycle. Improvements in sensors, weapon systems and information processing are leading towards a definition of combined arms operations that includes the activities of all the services and those of multi-national forces. As one military writer says,

> *In future wars... the interests of mission effectiveness will require cross-service communication as a matter of routine. The US is approaching a time when an Air Force sensor operator and coordinator could assign a Navy platform to launch an Army weapon in support of Marine operations.* [1]

However, there is still much work to be accomplished in the joint arena to make this happen. After-action reports on the Gulf War contain anecdotal reports of coordination problems between the US Air Force and the US Army, particularly with regard to deep operations against Iraqi armored forces. [2] These reports reinforce the notion that the battlefield integration and synchronization of joint targeting operations is a problem now. How much more so will it be a problem with the implementation of initiatives aimed at digitization of the battlefield? Will the digitization make coordination, integration, and synchronization easier, or will it make it more difficult? These and other issues will be explored in this paper as it attempts to answer the main question "Will Air Force and Army digitization improve the joint targeting process for time-critical targets?"

For the purposes of this monograph, digitization refers to the application of digital technology to the Command, Control, Communications, Computers, and Intelligence (C4I) systems that allow for the collection, exchange, and employment of information.

Digitization efforts are currently focused on improving situational awareness by speeding the flow of information and reducing the time required for decision-making. This monograph focuses on digitization as it applies to the joint targeting process for time-critical targets. The rapid maturation of digital technology will make the military more reliant on digital technology. This technology has the potential to improve joint targeting operations by reducing the element of surprise and the element of chance, and by reducing the reaction and prosecution time for targeting.

The Army's Advanced Warfighting Experiments (AWEs) have been achieving relative success, and the Army is considering accelerating the Digitized Army of Force XXI by two years.[3] The Air Force is scheduled to field the first operational version of its Theater Battle Management Core Systems in 1998. Therefore, it is imperative that each of the services ensures the adequate convergence of technological changes with new doctrine and procedures in time for the next major conflict.

In order to focus the research, the monograph topic has been narrowed to only discuss the joint targeting process for surface time-critical targets, with emphasis on Air Force and Army digital C4I systems that impact on this process. Chapter 2 will discuss Air Force and Army digitization efforts, joint interoperability and the joint targeting process, with emphasis on targeting time-critical targets. Chapter 3 will analyze the implications of digitization on the joint targeting of TCTs, and Chapter 4 will provide concluding remarks.

CHAPTER 2

DIGITIZATION AND TARGETING

This chapter discusses the ongoing digitization efforts of the Air Force and the Army and attempts to migrate towards joint interoperability of all service component systems. This is followed by a discussion of the joint targeting process and the concept of time-critical targets.

Air Force Digitization Efforts

US Air Force C4I systems in place or in development are grouped under the heading of the Theater Battle Management Core Systems (TBMCS). The TBMCS link force-level and unit-level entities that collectively are known as the theater air control system (TACS). The TACS includes the AOC, Air Support Operations Center (ASOC), Wing Operations Center (WOC), Squadron Operations Center (SOC), Control And Reporting Centers (CRC), and other entities and work centers. Key components of the TBMCS include the Contingency Theater Automated Planning System (CTAPS); Combat Intelligence System (CIS); Wing Command and Control System (WCCS); Command and Control Information Processing System (C2IPS); and an integrating display component such as the Global Command and Control System (GCCS) Common Operational Picture (COP) (See Figure 1).

While various components of the TBMCS are currently in use (e.g., CTAPS, CIS, and WCCS), the first official release of TBMCS 1.0 is scheduled to be fielded in December 1998. It was originally due to be out before that, but due to various CTAPS and funding problems, was delayed. This first release is aimed at integrating the applications into a common system of systems to support combined and joint air operations. One fallout of the release delay is that it will include additional applications in the first release, including integration with the GCCS Common Operating Picture, Modernized Integrated Data Base (MIDB), and GCCS imagery. The functionality of TBMCS includes intelligence processing; air campaign planning, execution and monitoring; aircraft scheduling; unit-level maintenance operations; unit-and force-level logistics planning; and weather monitoring and analysis.[4] At the force level, TBMCS supports the AOC and the ASOC. At the unit level, it supports the wing commander through the WOC, Maintenance Operations Center (MOC), and Squadron Operations Center (SOC). The CTAPS is widely deployed now and is used by all four services (the Army uses a CTAPS remote terminal to receive the Air Tasking Order (ATO) and report information back to the AOC/ASOC). CTAPS is used to automate the functions of an AOC and ASOC. At the AOC, it automates the intelligence, planning, operations, and system administration functions. Remote CTAPS terminals are located at the ASOC, at CRCs, and with sister service units and ships. The remote terminals are used to receive the ATO and Airspace Coordination Order (ACO) messages and provide information such as mission, resource, aircrew, and airbase status back to the AOC for further planning and tasking.[5]

The TBMCS home page contains generic information about the elements that comprise the TBMCS and some of the interfaces, subsystems, and communications of the TBMCS. The Air Force Electronic Systems Command keeps this site updated with the latest developments related to TBMCS.[6]

1. Contingency Theater Automated Planning System (CTAPS). Designed to aid the TACS in the planning, tasking and control of theater air operations. Modules within CTAPS are shown below.

Advanced Planning System (APS)	Imports orders of battle, the Target Nomination List (TNL) and the Airspace Coordination Order (ACO) from other modules, and planners then use this data to develop air battle plans and generate the MAAP and ATO.
Common Mapping System	Used in the APS and CIS modules, provides functions to display, manipulate, and annotate maps and imagery.
Airspace Deconfliction System (ADS)	Provides automated tools to deconflict airspace and define required airspace control measures (ACMs), graphically display airspace with ACMs, and output a formatted ACO.
Message Analysis (MA)	Provides for receipt and dissemination of AUTODIN message traffic.
Joint Interoperability Tactical Command and Control system (JINTACCS) Message Preparation and Parsing (JMPP)	Sends the ATO to units without CTAPS by using the AUTODIN message transmission system.
Computer-Assisted Force Management System (CAFMS-X)	Used to disseminate, access and retrieve ATO information. It is linked to tasked units by remote workstation for sending and receiving mission updates.
Combat Air Force Weather Support Package (CAFWSP)	Provides weather information to the AOC from the Defense Automated Weather Network.
Route Evaluation Module (REM)	Provides operational planning factors like distance to target, threats, and location of friendly airspace to help develop courses of action.
Automated ATO System (AATOS)	Gets the ATO from the AOC to units equipped with modular control equipment (MCE).

2. Combat Intelligence System (CIS). Provides a standard, automated intelligence workstation to receive, correlate, store, and disseminate intelligence data from multiple sources. Modules within CIS are listed below.

CIS Core Software (CCS)	Provides tools for electronic combat analysis, image processing, presentation graphics, word processing, and electronic mail.
Automatic Associator (AA)	Processes, correlates and displays near real time ELINT data.
Data Manipulation (DM)	Maintains and displays enemy order of battle from a variety of local, theater, or national databases.
Rapid Application of Air Power (RAAP)	This targeting and weaponeering module uses data from the DM module to select and prioritize targets based on provided objectives and produces Candidate Target Lists, conducts weaponeering on the targets, provides a TNL, and assists in the battle damage assessment process.
Improved Many on Many (IMOM)	Provides graphical electronic combat (EC) analysis to support the EC plan.
Joint Munitions Effectiveness Manual (JMEM)	Automates the weaponeering calculations and passes the results to the RAAP module.

3. Wing Command and Control System (WCCS). Provides unit-level commanders and staff with an automated capability to maintain unit resource data to support peacetime and wartime missions; it supports the four major wing functional areas of operations, maintenance, munitions and weather.

4. Command and Control Information Processing System (C2IPS). Provides automated data and message handling and decision support tools to support Air Mobility Command planning, scheduling and execution of airlift and refueling missions.

(5) Global Command and Control System (GCCS) Common Operational Picture (COP). Under development, the COP will provide a map-based display of the air, land, and surface situation for graphic situational awareness. This will standardize displays among the various theater AOCs, which currently use different software packages to display information from the CTAPS modules.

Fig. 1. Theater Battle Management Core Systems (TBMCS) Components and Functional Modules.[7]

Army Digitization Efforts

On the Army side, the Army Battle Command System (ABCS) comprises the system of systems that will provide C4I for the soldier on the ground. Key components of the ABCS include the Army Global Command and Control System (AGCCS); the Army Tactical Command and Control System (ATCCS) and the Force XXI Battle Command Brigade and Below (FBCB2) system (See Figure 2).

1. Army Global Command and Control System (AGCCS). The GCCS is an automated C4I system that is replacing the World Wide Military Command and Control System (WWMCCS). The AGCCS is basically the GCCS with Army functionality added to it and serves as a key interface to the Joint Staff and other services.

2. Army Tactical Command and Control System (ATCCS). A system comprising systems for each of the five battlefield functional areas (maneuver, fire support intelligence, air defense, and combat service support). The functional components of the ATCCS are shown below.

Maneuver Control System (MCS)	Provides a relevant common picture of the battlefield to all echelons of command down to brigade level. Provides information on unit task organization, friendly unit status reporting, maps and overlays, message receipt and transmission, orders creation, briefing tools and system management.
Advanced Field Artillery Tactical Data System (AFATDS)	Processes fire missions and other related information to maximize use of fire support assets including mortars, field artillery, attack helicopters, fixed-wing aircraft, naval gunfire, and electronic warfare.
All-Source Analysis System (ASAS)	Provides the enemy part of the RCP. Allows for intelligence preparation of the battlefield (IPB) and receipt, analysis and dissemination of all-source intelligence, imagery, and weather data.
Forward Area Air Defense Command, Control and Communications and Intelligence (FAADC3I) System	Provides the relevant common air picture and allows for engagement of hostile aircraft.
Combat Service Support Control System (CSSCS)	Provides command and control of CSS assets.

3. Force XXI Battle Command Brigade and Below (FBCB2). This is an extension of the ATCCS that provides automated situational awareness to tactical users from the brigade down to individual weapons platforms. It consists of off-the-shelf hardware and software in different configurations tailored to the type of unit, from a system that fits on a Bradley Infantry Fighting Vehicle to a configuration that supports the dismounted soldier.

Fig. 2. Army Battle Command System (ABCS) Components / Functional Modules. [8]

The ABCS integrates the various battlefield automation systems to provide seamless connectivity from individual platforms or designated soldiers up to corps level. They collectively provide situational awareness and decision support tools for the commander and staff to use while conducting military operations.

Joint Interoperability

Preliminary results from testing and initial use of digitized systems in both the US Air Force and the Army indicate the potential for significantly increased situational awareness and reductions in the amount of time required for decision-making and the application of combat power. Since all services are required to migrate their C4I systems to a common architecture called the Defense Information Infrastructure Common Operating Environment (DII/COE),[9] a key assumption is that digitization within the services will lead to transparent interoperability of the various systems from all the services. Given this ultimate interoperability of all systems, there is a need to examine the potential improvements to existing processes that these systems will bring about.

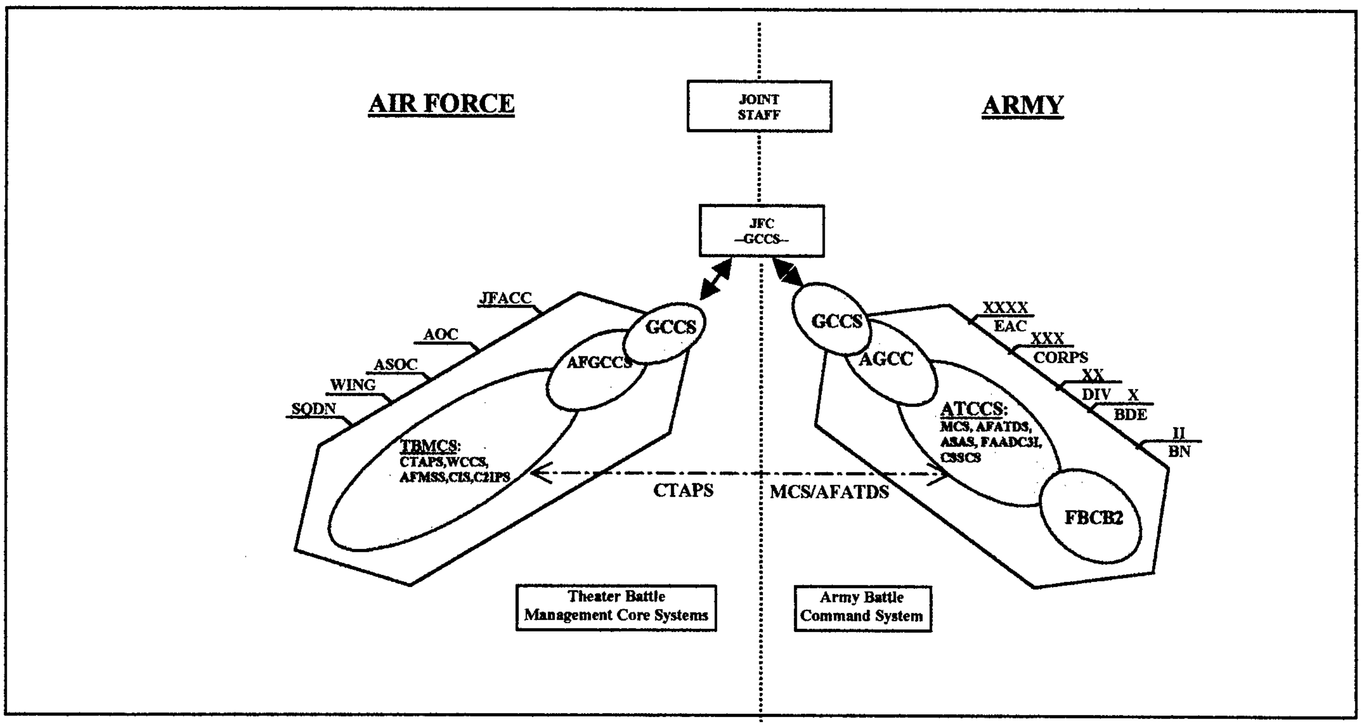

Fig. 3. Theater Battle Management Control System (TBMCS) – Army Battle Command System (ABCS) Comparison.[10]

The DII/COE provides a common software architecture aimed at ensuring interoperability of the various C4I systems within DOD. The COE has been separated into 12 functional areas: message processing; correlation; on-line help; office automation; alerts; developers kit; management; communications; distributed services and object management; data management; file management; and mapping, charting, geodesy, and imaging. Each of these areas can be covered by stand-alone software packages or modules that can be combined to create a working system that performs the desired tasks.[11] Figure 3 shows a comparison of the TBMCS and the ABCS. The GCCS provides joint interoperability at the top echelons of command, while service component systems such as CTAPS and MCS provide a limited degree of interoperability at the lower echelons of command.

Although the various Air Force and Army C4I systems have a limited degree of interoperability now by using software and hardware patches, there is still much work to be done to make the overall C4I system appear to the user as one seamless system that provides a common picture across the battlefield. One example of the types of problems that occur in the area of interoperability can be seen in the early attempts to exchange ATO information. Although the approved method of transferring the ATO from the Air Force to the Army is by USMTF message, the MCS could not receive and parse the USMTF messages generated by the CTAPS software because CTAPS used a more current format of USMTF messages.[12] This problem is easily fixed by updating the message set on the MCS, but highlights the need for not just the same software, but the same upgrade versions of software in order to be compatible.

Current technology limits electronic inter-connectivity and automated data planning. Currently, verbal coordination and deconfliction occurs between the AOC and the Battlefield Coordination Element (BCE), and between the Army's Tactical Operations Center (TOC) and the ASOC. The TBMCS (especially CTAPS) and ATCCS (especially MCS and AFATDS) are being modified to allow sharing of key data. Initially, they will share the air tasking order, airspace control plan, and real-time indirect fire trajectories for coordination and deconfliction of TCT attacks.[13] This will enhance component capabilities to develop pre-planned fire support and airspace control measures. Eventually, TBMCS and ABCS should be able to share other types of information needed for targeting time-critical targets (See Figure 4). This will allow for deconfliction of flight operations and indirect fires during attacks against time-critical targets.

From the Air Component	**From the Ground Component**
Air Tasking Order	Rotary-Wing Aviation Routes
Airspace Control Order / Plan	Attack Helicopter Staging Areas
Valid Targets	SEAD Plans
Airborne and Ground Threats	Artillery Locations and Status
Combined Friendly /Enemy Air Picture	Valid Targets
Fighter Orbit Holding Points for TCTs	ATACMS locations and Status
Fighter Tasking Against TCTs	ATACMS Fires Against TCTs
Engagement Areas (TCT and other)	Air Control Points
Grid Box Activation Intentions	Airspace Control Requests
Target Lists and Nominations	Engagement Areas (TCT and other)
Enemy Orders of Battle	Fire Support Coordination Measures
	Maneuver Unit Locations
	Target Lists and Nominations
	Friendly Force Locations

Fig. 4. Information Requirements for Exchange Between Air and Ground Components.[14]

Current service-unique data links and targeting notations inhibit true joint interoperability, causing the JFC to either locate common terminals at each component command and control agency or try to network dissimilar systems. Battle management systems under development should allow near real-time passing of time-critical targeting information. This requires common targeting terminology, symbology, and C2 links that connect systems vertically and laterally. In addition, systems need to be secure and jam-resistant.[15] The recent release of the AFATDS Update A97 provides one example of the evolutionary development of interoperable systems. It includes a tactical air support module that allows for a direct interface between AFATDS and CTAPS to plan and coordinate close air support and air interdiction missions and non-fire missions such as reconnaissance.[16] Another example can be seen at the Joint C4ISR Battle Center (JBC) at Suffolk, VA, which began a two-year Link 16/VMF interface Advanced Concepts Technology Demonstrator (ACTD). Link 16 is NATO's primary anti-air warfare data link for both naval and air forces. The variable message format (VMF) is the primary messaging format used for ground and air-to-ground tactical digital traffic by US ground forces and others. Link 16 and VMF networks currently cannot exchange tactical data, and portable software is being developed under the ACTD to enable them to do so. The necessary message sets have been identified and the first operational demo is planned for FY99. If successful, The ACTD stands to have a major impact on the ability of air, land, and sea platforms to exchange situational awareness and targeting data. This should solve many of the combined/joint digitization, safety and effectiveness issues.[17]

Joint Targeting Process

The joint targeting process determines the employment of military force to achieve a desired objective. The process is normally described as consisting of a continuous series of phases or steps. The steps of the US Air Force targeting process roughly correspond to the six phases of the joint targeting process: (1) commander's objectives and guidance; (2) target development; (3) weaponeering assessment; (4) force application; (5) execution/planning/ force execution and (6) combat assessment.[18] The US Army uses four steps in its targeting process: (1) decide; (2) detect; (3) deliver and (4) assess (See Figure 5).[19] It is not the intent of this paper to discuss each of these steps in depth.

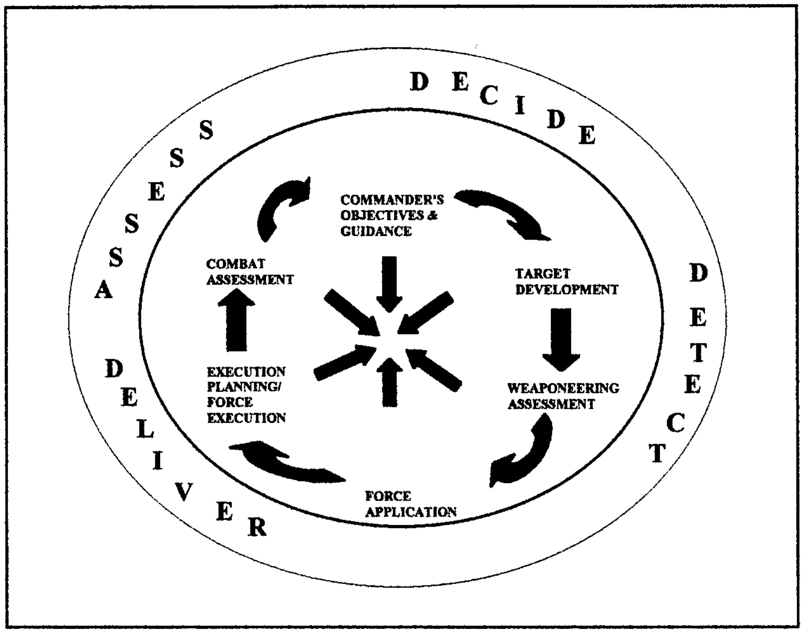

Fig. 5. The Joint Targeting Process and the Army D3A Process.[20]

Several organizations contribute to the joint targeting process. The Joint Force Commander (JFC) establishes the organization or framework to carry out the targeting process. Key players include the J-2, the Joint Intelligence Center (JIC), the J-3, the Joint Target Coordination Board, and the component commanders. The J-2 prioritizes intelligence collection, target detection and validation, and battle damage assessment. The J-2 works closely with a theater JIC to gain access to national-level intelligence support. The JIC supports the JFC and the J-2 by providing all-source analysis and target materials to support the targeting process. The J-3 assists the JFC provide direction and control operations in the targeting process. The JFC may establish a JTCB to review targeting information, develop targeting guidance and priorities, and create joint target lists (JTL). The JTCB has a campaign-level view and is concerned with all joint force targeting. Component commanders help the JFC formulate guidance, operate collection assets, execute strike operations against targets, and conduct combat assessment.[21]

Time Critical Targets

There are various aspects of the targeting process, but this paper will focus on procedures for targeting time-critical targets (TCTs), and more specifically, immediate surface TCTs (See Figure 6). Examples of these include theater ballistic missiles (TBMs) and pop-up surface-to-air missiles (SAMs). Current procedures for targeting TCTs are theater-specific and attempt to make up for the lack of common command, control, communications, computer, and intelligence (C4I) systems to facilitate attack of TCTs.

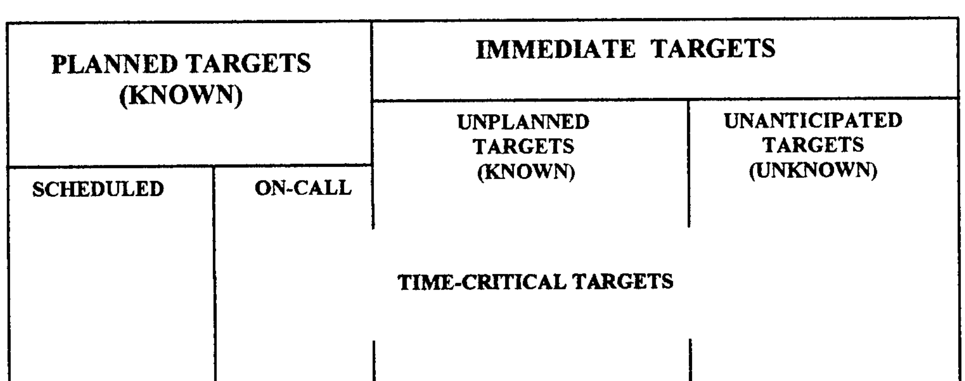

Fig. 6. Time Critical Targets.[22]

AFJPAM 10-225/FM 90-36 makes several points about the targeting process. These include:

(1) Time-critical targets are fleeting in nature, which means that attacks against them are preemptive or reactive in nature, and thus timely detection and attack is very important.

(2) Each service component has some capability to detect and attack TCTs, and this can occur in overlapping areas of interest.

(3) A time-critical target may be simultaneously identified by more than one component. The JFC needs to create procedures for attack that eliminate chances of fratricide and duplication of effort.

(4) Current C4I systems used in the joint environment are a mix of non-interoperable legacy systems developed separately by each service. These systems do not facilitate unified, real-time coordination and deconfliction of all forces.

(5) Various sensors at different echelons do not provide a common electronic picture of the battlefield to all components; each component has a piece of the picture, but nowhere is it totally integrated.

The above factors make it difficult to have complete situational awareness in all dimensions of the battlespace and difficult to apply joint forces against TCTs on a real-time or near-real-time basis.[23] In general, attacks against TCTs are characterized by either reacting to information on new targets or by preemptive measures aimed at destroying TCTs as soon as they are detected. Each service component has the ability to located and attack TCTs in "mutually accessible areas of interest."[24] Since TCTs can be identified by more than one component at the same time, the JFC must establish procedures to destroy the TCT without causing fratricide and without duplication of effort among the components. The JFC currently accomplishes this using procedural, non-automated fire control measures. The joint force planning and execution for TCT targeting operations requires a balance of flexibility and control over large AOs and many complex weapon systems. Synergy, momentum, and unity of effort are required to achieve the JFC's intent. Ideally, a common picture of the battlefield is shared by all components so that the targeting effort is deconflicted and focused.[25] The AFJPAM 10-225/FM 90-36 states that "current JTF C2 systems do not allow unified real-time coordination and deconfliction of all forces and national and in-theater sensors do not provide all components with a 'common picture' of the battlefield."[26]

CHAPTER 3

IMPLICATIONS FOR JOINT TARGETING OF TCT'S

In theory, any combination of new systems and procedures that increases the timeliness and accuracy of an existing process will be an improvement, provided that new problems and pitfalls are not created along the way. Given the composition of the C4I systems fielded or soon to be fielded, we can focus on those systems as they apply to the joint targeting process for TCTs, and test whether those systems increase the timeliness and accuracy of the specific process. Moreover, in order to function in a joint environment and thereby improve the process, the systems of both the Air Force and the Army must be interoperable, and there must be procedures in place for the optimal use of those systems. This chapter analyzes the effects of digitization on each of the steps of the joint targeting cycle, with emphasis on the accelerated nature of targeting required for TCTs. Each step will discuss specific areas of applicability, whether timeliness and accuracy are improved, whether current systems are interoperable, and whether TTPs exist for the optimal use of the new systems. The paper will then discuss how the joint commander can react to time-critical targets using sensor-to-shooter teams and fires coordination nets that links the teams together.

Step One, Receive Objectives and Guidance

In this step planners receive objectives and guidance from higher headquarters. Objectives are goals established to serve the national interests and are developed at national, theater, and service component levels. The National Command Authority (NCA) sets national objectives which are used by the theater CINC to develop theater objectives. These theater objectives are included in theater OPLANs and CONPLANs and lead to specific courses of action in the plans. Components then create further refined objectives based on overall theater objectives. Examples of objectives include priorities for targeting, damage criteria, and any restrictions on force employment.[27]

Guidance sets limits or boundaries and how to attain them. It can be pre-established and general in nature (e.g., principles of war) or can be scenario specific and self imposed (e.g., rules of engagement).[28] The JFC and his staff continuously review and modify guidance and objectives, so a rapid means of transmitting changes is crucial. The goal of digitization with respect to objectives and guidance should be the expeditious flow to subordinates, initially during the planning phases and then as changes occur during execution phases.

Specifically applied to targeting of TCTs, the JFC designates specific TCTs as a priority requiring immediate response. The JFC also directs how coordination, deconfliction, and synchronization occurs among the service components. Examples include assigning specific weapons and sensors to support attacks on TCTs and establishing fire support coordination measures to facilitate attacks.[29]

Currently, objectives and guidance flow from higher headquarters to subordinates via USMTF messages, via telephone or fax, and in OPLANs and OPORDs. Digitization expedites this flow using functions within TBMCS and ABCS. Information can flow from higher headquarters using GCCS down to the appropriate planning and execution levels which are using TBMCS and ABCS elements. Changes to guidance and objectives can be relayed using USMTF messages that are sent directly to the message handling modules of TBMCS and ABCS; using secure e-mail; using file transfer protocol (FTP) files downloaded from classified web sites, or by relaying changes verbally using video teleconferencing. To ensure subordinates know that a change exists, an alert message can be sent that provides visual and audio cues that new information is available. In ABCS, a notification window flashes when new messages have arrived into the system. This allows a command element, such as higher headquarters, to post a change on its own classified web site, then send an alert message to subordinates stating that the change exists for subordinates to download via a tactical internet. These methods allow the rapid dissemination of information both vertically from higher headquarters to subordinates and horizontally among components or supported and supporting units. Both the Air Force and the Army use USMTF messaging and similar e-mail, file transfer protocol, and Internet procedures, so the systems used to accomplish procedures in this step are interoperable as long as both services are using the same version of applicable software.

Step Two, Target Development

During this step potential targets and their sub-components are analyzed to determine their signature (what they consist of and how to recognize them on the battlefield) and significance (why they are important), and to decide which weapons systems may be suitable to strike the targets. Once targets are analyzed for comparative weight relative to other targets or target sets they are put into a target nomination list (TNL). The TNL is cross-checked against the objectives and guidance from step one, and then are nominated to the JFC for approval. Requests for information (RFI) and intelligence production requests are submitted to support target development and post-strike analysis.[30] The Army's 'Decide' phase roughly equates to phase one and two of the joint process. Additionally, this is the phase where the Army creates collection plans, target acquisition tasking, High Priority Target Lists (HPTL), Attack Guidance Matrices (AGM), Target

Selection Standards (TSS), and battle damage assessment (BDA) requirements. The corps or division staff wargames different courses of action to develop high pay-off targets. These HPTs are high-value targets that are critical to friendly success. Targets that can be acquired and attacked are candidates for the High Pay-off Target List, which is internal to the corps or division. Targets that need outside acquisition or attack are sent to higher headquarters as target nominations.[31]

When targeting TCTs this step has to be dramatically accelerated to be of use. There are many specific uses of digitization for this step. The CIS (Air Force) and ASAS (Army) can be used to access target databases in the national-level MIDB to populate their own local database and as the start of a Target Nomination List. This list can be created using the RAAP module in TBMCS. This works primarily for fixed targets and is less than optimal for mobile targets. The RAAP module can help by creating target lists and by checking such database items as category code of the target nomination or its location, or by showing a graphical representation of potential targets. Additionally, the briefing tools of TBMCS and ABCS are used in this step to present the Target Nomination List to the chain of command for approval.[32]

To support analysis and to create target dossiers or folders, imagery can be downloaded, reviewed, and printed using either the 5D Imagery Server or the Image Products Archive (IPA). These imagery servers can be accessed via the classified INTELINK Internet site by using CIS or ASAS. Collection requests, requests for information, and production requests can be submitted via e-mail or file transfer protocol. Digitization can speed the process by using the parallel planning process to get the target nomination list approved and by using e-mail, file transfer protocol, video teleconferences, etc., to reduce the amount of staffing time. The TBMCS and ABCS can also facilitate the exchange of targeting decision support tools such as the high pay-off target list, attack guidance matrix, and other products of this step. For optimal flow of information there must be common procedures agreed to and actually used by both services.

Step Three, Weaponeering Assessment

In this step specific weapon systems and munitions are matched against specific targets based on the desired results against those targets. There are several specific applications of digitization to this step. The RAAP module can be used to conduct weaponeering in conjunction with the Joint Munitions Effectiveness Manual (JMEM) module.[33] The TBMCS and ABCS can provide rapid access to databases of friendly aircraft, weapons, fuses, delivery tactics, as well as damage criteria (e.g., from the Target Selection Standards and the Attack Guidance Matrix). They also facilitate rapid coordination between operations and logistics staff to obtain current numbers and status of systems and munitions.

The TBMCS and ABCS have a limited capability to exchange data, mostly in free text format, which is not as fast or accurate as formatted messages that are parsed into databases automatically. The CIS and ASAS can both access MIDB but cannot currently exchange data directly, although both can talk to the Joint Deployable Intelligence Support System (JDISS), which is the joint-level equivalent of CIS and ASAS. Continued work on the Link 16/VMF interchange will improve interoperability by allowing the translation of formatted messages between the TBMCS and ABCS.

Digitization has the potential to dramatically shorten this step. For TCTs, quick, computer-assisted decisions must be made as to what attack assets will be employed.[34] The TBMCS and ABCS can help make these decisions in a more timely and accurate manner, but they still have to be made by experienced weaponeers. The computer only facilitates the process and doesn't negate the requirement for trained, logically thinking humans to make the decisions. One example of where the computer systems can speed up this step is the use of criteria tables in AFATDS that automatically suggest optimal weapons systems to use against particular targets.

Step Four, Force Application

This is the step where target nominations are matched with the optimum available force. The individual match-ups from step three are synchronized and deconflicted. Computers can help maintain impartiality and eliminate bias for particular weapon systems or munitions by automatically performing the match-up of targets and weapon systems. For example, the AFATDS includes several criteria tables that can be set to automatically designate a specific weapon system, such as mortars, cannon artillery or tactical air support. In the Air Force, the force application process is carried out at the AOC during the ATO process, with the assistance of CTAPS. During the ATO process, mission packages are developed with appropriate support and deconflicted with other mission packages.[35] The primary objective of the force application step is to synchronize the application of lethal and non-lethal force. The key products from this step are the master air attack plan and ATO shell for the air effort or an attack guidance matrix for the ground effort.[36] Digitization can enhance this step significantly. The RAAP module can be used to compile target development results, weaponeering calculations, forces, operational constraints, and damage expectancy calculations. The results of analysis in this step can then be presented in the MAAP briefing using Power Point or similar software. The Attack Guidance Matrix can be created using Power Point in MCS and can be shared among the elements or services using the video teleconference capability.

Step Five, Execution Planning/Force Execution

In this step the Air Tasking Order and the Attack Guidance Matrix guide their respective components in executing attacks. Since battle is a dynamic activity, the commander and his staff continuously monitor and adjust their battle plan as it is being executed. Intelligence analysts continuously update the enemy situation and identify possible new targets. Digitization can be used during this step in several ways. Executing units can receive the ATO and fragmentary orders via file transfer protocol, e-mail or USMTF message. Situational awareness can be enhanced by continuous analysis and validation of the current situation and comparing the yet-to-be-executed portions of the ATO or AGM, making adjustments as necessary. The CIS or ASAS is used to analyze the enemy situation, and the CAFMS or MCS is used to analyze the friendly situation. The AFATDS automatically checks missions against established fire support coordination measures and zones of responsibility. When needed, coordination requests are automatically sent to the unit that established the fire support coordination measure.[37] The most potential for saving time in the joint targeting process occurs in the area of sensor-to-shooter links, which will be discussed later.

Step 6, Combat Assessment

This step evaluates the effectiveness of combat operations and recommends changes to tactics, strategies, objectives and guidance. The three elements of combat assessment are mission assessments (tailored for the planners and the commander), battle damage assessments (tailored for a broad audience), and munitions effectiveness assessments (tailored for pilots, artillery crews, etc.).

Combat assessment requires access to theater information not necessarily available at the national level such as weapon video, mission reports and tactical reconnaissance data. With seamless connectivity of all levels of command, information could be made available to persons at all levels with a need-to-know. Conducting combat assessment requires coordination among combat units and the various echelons of command, up to and including the national-level agencies. Assessments must be made on the basis of all-source analysis and the integration of intelligence and operations information. Specific uses of digitization for this step include coordination among agencies using video teleconferencing, e-mail, file transfer protocol, or message exchanges. It also includes rapid assimilation of data needed to perform combat assessment. It is feasible that all data could be routed to a single area such as the combat assessment cell at the joint force level. Shooters could even send their mission reports (MISREPS) directly to the Air Force Air Operations Center or the Army Deep Operations Coordination Cell using data links such as the SADL or the IDM.

Digitization also allows rapid dissemination of combat assessments, thus letting planners quickly make re-strike decisions and track overall campaign effectiveness. Digitization facilitates the dissemination of messages, such as the USMTF Close Air

Support Summary message (CASSUM), which is a required message from the ASOC to the AOC that gives an initial assessment of CAS mission success. Digitized systems could give the combat assessment team access to intelligence and operations data from the same computer system such as accessing ATO data using CTAPS and enemy threat data using CIS. They could also help share data between shifts during twenty-four hour operations since changeover briefings, pass-down logs, etc. can be stored in the computer and shared among elements.

Reacting to Time Critical Targets

From the discussion above it can be seen that digitization has the potential to improve the timeliness and accuracy of each step of the joint targeting process. When reacting to time-critical targets, the joint targeting cycle must be accelerated to improve the chances of success. The Air Force and Army each have their own methods of reacting to time-critical targets. The Air Force uses ad hoc procedures referred to by the 12th Air Force as flex targeting, while the Army uses an accelerated decision-making process. At the joint force level the commander needs to take advantage of systems and procedures that are already in practice within the service components, but may also need to devise joint procedures that are tailored to the specific situation. There are several different methods/techniques that can be used to react to newly-discovered TCTs. The JFC could delegate responsibility to certain elements or cells within the AOC or DOCC or other entity, such as an airborne command and control platform like AWACS, ABCCC, or JSTARS. The JFC could establish several sensor-to-shooter teams that are responsive to the command cell. It is useful to describe some examples of unique system configurations or sensor-to-shooter teams that exist or are under development. Below is a representative sample of some current and developmental Air Force and Army sensor-to-shooter systems.

F-15E and the Rapid Targeting System (RTS). The RTS, also referred to as the Gold Pan system, transmits information from multiple sensors to a ground station which processes the data and coordinates with the AOC to nominate targets. Once approved, data and imagery of the target is digitally transmitted to an F-15E equipped with a modified AXQ-14 data link pod. This line-of-sight link has been tested out to a range of 220 nautical miles.

Another option is to relay JSTARS synthetic aperture radar (SAR) imagery via the ground station at the AOC for fixed targets, or directly to the F-15E via voice or data link for moving targets. For moving targets, because the JSTARS radar is unable to distinguish friendly forces from enemy forces, kill boxes or engagement zones would be used. The information from JSTARS can be used by the F-15E to cue its targeting pod to locate the moving target. Once acquired by the F-15E, and with approval to drop ordnance, the target is then attacked. A two-ship or four-ship formation could be configured to carry a mix of munitions within the element to ensure the right munitions are available for a variety of targets. The F-15E's long loiter time, large weapons payload and data link capability make it a great asset for TCT combat air patrols (CAPs).[38]

RC-135 and Joint Suppression Of Enemy Air Defense (JSEAD) aircraft. This team focuses on attacking targets with an electronic signature, especially radar-guided SAMs. The RC-135 Rivet Joint aircraft orbits in a stand-off position and collects signals intelligence. When it accurately acquires information on an active threat emitter, it relays target information by voice radio, or in some cases by data link, to SEAD aircraft that are orbiting at a contact point. Some F-16CJ SEAD aircraft were evaluated using the Integrated Data Modem (IDM) to receive target information digitally from the RC-135. The F-16CJ would then use this information to cue its High-Speed Anti-Radiation Missile (HARM) Targeting System (HTS) towards the target, attacking the target with HARMs once the HTS acquired it.

A-10 or F-16C/D with Situational Air Data Link (SADL). A few A-10 and F-16C/D aircraft have been equipped with the SADL, a software programmable version of the Army's EPLRS. It allows the aircraft to receive mission tasking data via data link, helps determine friendly unit locations near the target area, and provides an air-to-air data link for exchange of information among aircraft.[39] These aircraft were used during the Army's March 1997 Division AWE to fly air support missions for the exercise. There is also a plan under consideration to use a battle management platform such as the EC-130E/ABCCC (airborne battlefield command and control center) as a gateway between the JTIDS and SADL to further enhance the exchange of information.

Fighters equipped with SADL would enter a communications net with ground forces that are equipped with EPLRS. The location of friendly forces in the net will display in the aircraft's multi-function display and heads-up display (HUD). The gateway on the ABCCC would automatically convert JTIDS air picture messages (and possibly JTIDS-generated ground picture messages) and transmit them via SADL/EPLRS message over the EPLRS net. This information would be available to anyone on the net, including ground forces. The air-to-air data link capability of SADL would be used to send standard nine-line CAS mission tasking to the fighters for display in the HUD. In return, the fighters could send weapons and fuel status to the ABCCC.[40]

B-1B with upgraded communications systems. At least two B-1B aircraft have been upgraded with beyond-the-line-of-sight data links, with plans to upgrade more in the future. The data links, aimed at connecting the B-1Bs directly to the AOC, consist of JTIDS, Combat Track II, multi-source tactical system (MSTS), and airborne warning and control (AWC) systems. The JTIDS provides a computer display of air tracks. Combat Track II was developed by Air Mobility Command to track aircraft as they fly around the world, and allows a receiving ground station to track where the aircraft are and what their fuel and maintenance status is. It also provides e-mail send and receive capability. The MSTS receives and correlates near-real-time national and tactical intelligence information and graphically displays it. The AWC software quickly identifies friendly and hostile aircraft and provides track data on them.[41] Together, these systems provide crews with improved situational awareness, command and control, and in-flight e-mail. For long-range missions the B-1Bs can be launched towards a general area of operations even before completing normal mission planning. The crews can receive mission data, threat information, etc. while airborne and can then plan the mission en route. Closer in, the B-1Bs can remain on orbit for an extended period of time (up to 10 hours) as an airborne TCT alert aircraft. This gives the JFC a tremendous amount of firepower at his disposal.[42]

JSTARS with direct link to fighter aircraft. This TCT targeting team centers on JSTARS as the sensor and battle management platform, working with fighters equipped with SADL, IDM, or JTIDS. Some A-10 and F-16 aircraft are already equipped with SADL, and others are equipped with the IDM. There are plans to equip JSTARS with JTIDS by 1999 and to equip it with the IDM by the year 2000.[43] National assets or theater intelligence, surveillance and reconnaissance (ISR) platforms such as the U-2 or the RC-135, could cue JSTARS to look in a particular area, or JSTARS could be assigned an area to search with it's radar. Fused data from the various collection platforms could help locate targets and pinpoint TCTs for attack. The JSTARS would either coordinate with the AOC for approval to task the shooters against the target, or would have the delegated authority from the AOC to engage targets when certain conditions were met. The JSTARS would relay target information directly to the fighters via JTIDS or IDM or SADL and the fighters would depart a pre-established orbit contact point and attack the target.

Direct link to the AOC. Many of the concepts to date have involved airborne C2 platforms or forward C2 elements on the ground. There are also concepts that connect the AOC directly to the shooter aircraft. One such concept uses a special CTAPS configuration designated the Time-Critical Targeting Aid (TCTA). The TCTA is a software configuration designed to help the Combat Operations Division of the AOC analyze and assign targets quickly using JSTARS imagery.[44] It was developed specifically for SCUD missile hunting, but would have other applications as well. It provides a Defense Satellite Program (DSP) launch indication cue to JSTARS so that JSTARS can search a target area for moving indicators, as well as identifying targets for weapon assignment within the requisite timelines for theater missile defense (TMD) attack (usually ten minutes or less). The TCTA is connected to the CTAPS LAN within the AOC and receives inputs from the Secret Internet Protocol Router Net (SIPRNET), imagery from an imagery processor, launch indications from CIS, and JSTARS information from a JSTARS ground station module (GSM) that provides a link to the

TCTA. The TCTA is also linked to a JTIDS terminal that supports text message send and receive capability between the TCTA and JSTARS, and between the TCTA and other aircraft that have a JTIDS terminal (e.g., the B-1B).

Unmanned aerial vehicle (UAV) with target designator. This Army concept uses a tactical UAV with a target designator to visually acquire targets and pass targeting data to airborne platforms or ground systems. During a recent test a Hunter tactical UAV tested a laser target designator payload that guided Hellfire, Copperhead, and other laser-guided munitions. During the test the Hunter targeted several tanks for destruction by Hellfire missiles fired from a Kiowa helicopter.[45] This concept has also been considered for use by armored forces armed with tank extended-range munitions (TERM) that can be fired at targets beyond the line of sight of the shooter.[46]

Quick-fire net with the Q-37 target acquisition radar and the Multiple Launch Rocket System (MLRS). When the Army's Q-37 Fire Finder counterfire radar acquires a target it automatically sends target information to the MLRS firing battery using the AFATDS. When pre-defined conditions are met, the battery attacks the target. The combination of Q-37 and MLRS is used primarily for counter-battery fire.

Quick-fire net with observation teams. This concept uses combat observation and lasing teams (COLTs) (six three-man teams in each brigade) to observe tactical areas of interest (TAIs) and report the information and issue calls for fire using EPLRS or voice radio. Once specific method used during the Division AWE was to set up "munitions-unique engagement areas" to track and engage specific types of targets.[47] Different engagement areas could be set up for CAS, attack aviation, sense and destroy armor munitions

(SADARM), or dual-purpose improved conventional munitions (DPICM) to optimize the characteristics of a particular platform or munitions.

Comanche helicopter and division MLRS battalion. This combination was described as the new Force XXI division's "most lethal sensor-to-shooter combination."[48] The Comanche operated well forward of the main battle area and relayed target acquisition data to the division's MLRS battalion. Whereas in the past the MLRS battalion had to remain well behind the forward edge of the battle area for security reasons, the Army has recently started moving it farther forward under the protection of the division cavalry's ground troops, thus extending its range across the battlefield. In the Division AWE the Comanche-MLRS team was able to find and kill the enemy before any other (Army) element. Specific missions touted for the Comanche include armed reconnaissance to seek out the enemy and destroy targets of opportunity; cooperative attack missions, during which it can provide targeting information to support attack by other friendly forces; and high-value target attack missions aimed at finding, tracking and destroying the high-value targets.

There are many other examples of sensor-to-shooter teams that could be put together on a permanent or ad hoc basis. These teams could provide overlapping coverage across the battlefield (See Figure 7). Once the teams are in place the JFC needs to be able to employ them rapidly against time-critical targets. He could take advantage of employment techniques already in place, such as flex targeting in the Air Force or accelerated decision-making in the Army, or he could devise new techniques for use at the joint force level.

Flex targeting is one employment technique used by the Air Force to prosecute joint targeting of TCTs. In the Combat Operations Division of the AOC there are representatives from all the major weapon systems, as well as representatives from combat support elements and other service components. When information about a TCT

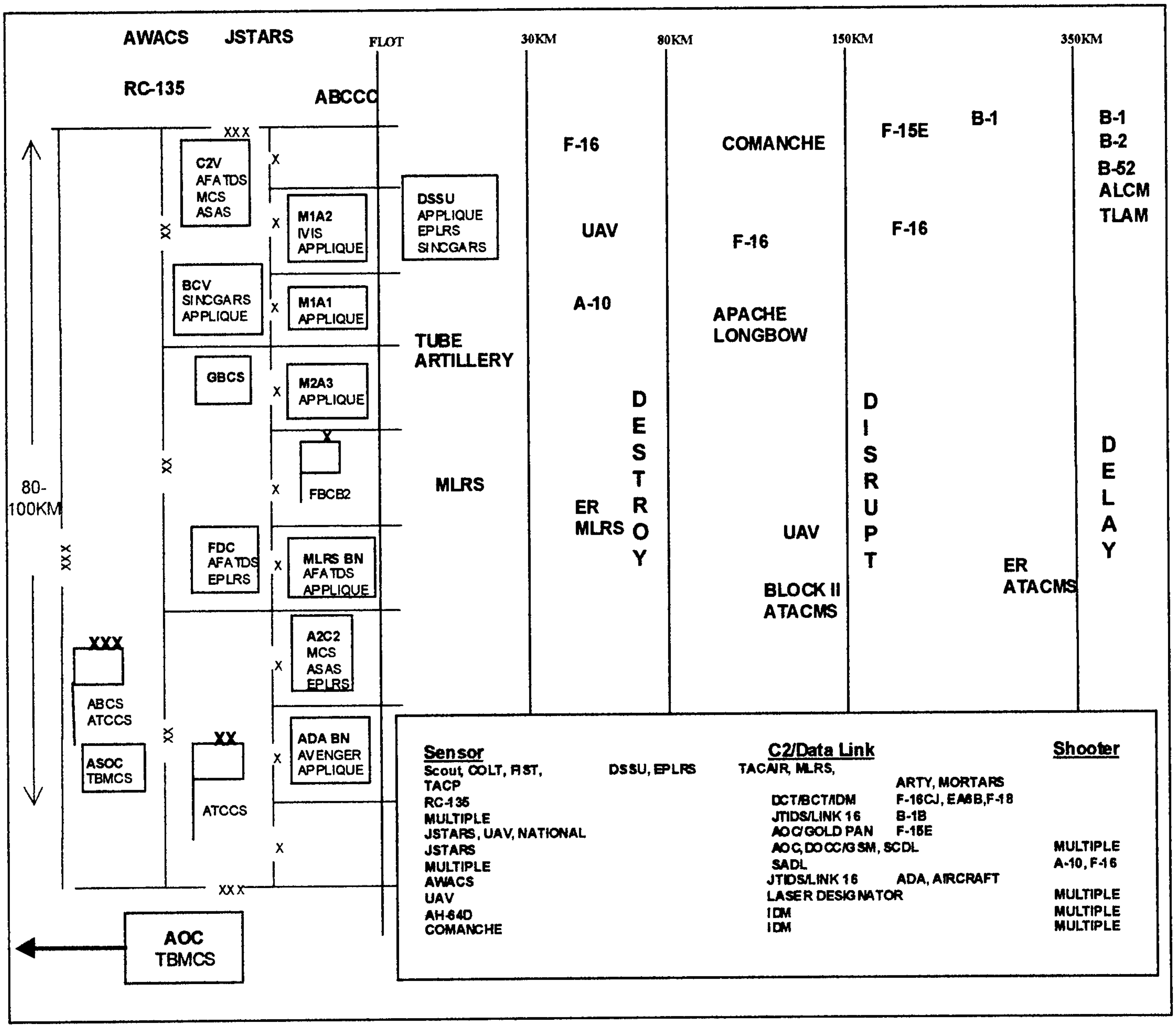

Fig. 7. Sensor-to-Shooter Teams Throughout the Battlefield.[49]

is acquired, the Combat Operations Division calls a huddle of key players to brainstorm the situation and determine the best available response. The Combat Operations Division has information readily available about which strike assets are available and can quickly determine which asset to use. They also have connectivity to those assets via data link or voice communications and can directly or indirectly task the assets to strike the TCT. The specific flex targeting cycle used by 12th Air Force is to observe the critical event, organize assets to respond, develop an appropriate course of action, and then present the course of action to the Joint Force Air Component Commander (JFACC) for a decision. Once the JFACC selects a course of action, the battlestaff executes the approved course of action and later assesses the results of the mission.[50]

The Army uses the military decision-making process (MDMP) to develop solutions to military problems. The process works very well to analyze the mission requirements from higher headquarters and to develop courses of action and associated plans and orders. The normal MDMP process contains seven steps and is very time consuming. It is used when adequate planning time is available, for example during a forty-eight hour or seventy-two hour time period. Though there is not enough time to apply each step to the joint targeting of time-critical targets, the MDMP does provide a logical framework for thinking through what must be accomplished in a time-constrained environment.

"The MDMP can be accelerated by increasing the commander's involvement, which allows him to make decisions during the planning process instead of waiting for detailed briefings after each step; the commander can be more directive in his guidance, saving time by providing more focus up front; the commander can limit the number of COAs developed and wargamed; and planners can increase the use of parallel planning."[51]

Digitization greatly enhances parallel planning by allowing rapid creation and dissemination of decision support templates, courses of action, overlays, briefings, orders, etc. and saves time during meetings by allowing video teleconferencing. When reacting to a TCT, the Army Deep Operations Coordination Cell (DOCC) proceeds in a manner similar to the Combat Operations Division of the AOC. They quickly assemble subject matter experts and run through an accelerated MDMP that results in a decision on what weapon system to apply to the TCT.

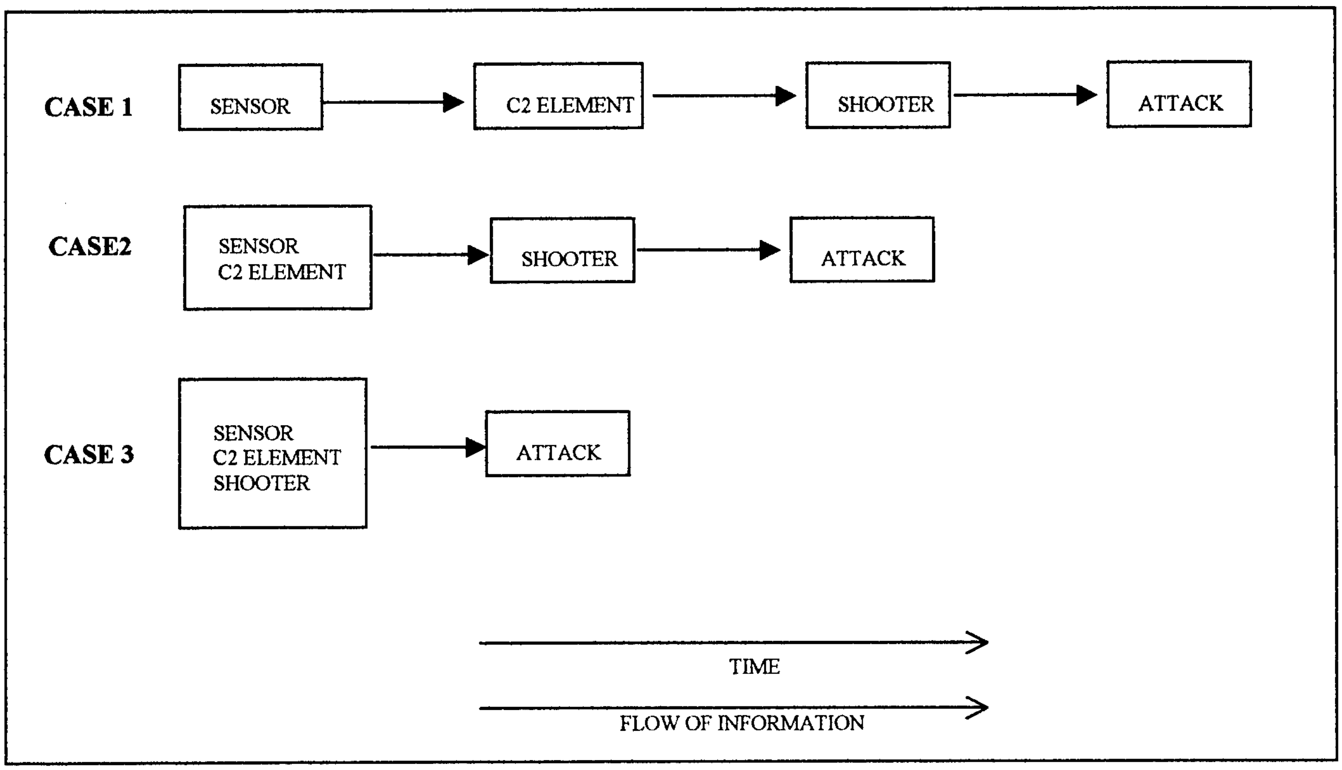

Fig. 8. Digitization Leads to Simultaneous Flow of Information and Reduces Sensor-to-Shooter Timelines.

One way for the JFC to reduce or improve sensor-to-shooter operations at the joint force level might be to establish procedures similar to those used for the Air Force Air Request Net (AFARN). The JFC could establish a network of sensor-to-shooter teams that would be monitored and controlled by command elements. Command elements would monitor the sensors as they detect targets and relay target information directly to the shooter. Approval to strike the target would be assumed unless a command element intervened. The responsiveness of the procedures could be reduced significantly if all elements in the system receive the same information at the same time and can reach a consensus decision to attack in a rapid manner. The simultaneous flow of information to decision-makers and shooters should reduce the time needed to coordinate an attack on a time-critical target. In some systems now the information has to travel from the sensor to the C2 element and then to the shooter (Case 1, Figure 8). When the sensor automatically sends information to the C2 element (for example, by using a live feed from a UAV), the time involved in the sensor-to-shooter loop decreases (Case 2, Figure 8). By increasing the level of digitization (such as providing real-time information in the cockpit of an aircraft) all elements in the sensor-to-shooter team can receive the information simultaneously, and the C2 element can quickly make the decision to attack. In some cases the C2 element can delegate the decision authority to the shooter (See Case 3, Figure 8).

CHAPTER 4

CONCLUSIONS

This paper has attempted to analyze the implications of Air Force and Army digitization on the joint targeting process for time-critical targets. Chapter Two showed that both the Air Force and Army are rapidly developing digitized command and control systems and are attempting to ensure that the systems are interoperable. These digitized systems have significant applicability to the joint targeting process for time-critical targets.

The Air Force is developing the TBMCS to digitize its C4I process at all levels of the theater air control system and to provide interoperability with the joint force-level GCCS. Concurrently, the Army is developing its ABCS with connectivity from the joint force level down to the battalion level. Both services are migrating their C4I systems towards the common architecture outlined in the DII/COE. Once this common architecture is achieved, it should provide the desired seamless connectivity among all the services at all levels of command and control.

The joint targeting process is used as a framework for assigning optimal weapon systems to attack specific targets to meet national and theater objectives, and for following up to ensure the achieved damage meets the desired results. For TCTs the joint targeting process still applies, but it has be greatly accelerated in order to attack them within a short window of opportunity.

Chapter Three analyzed the implications of digitization on the joint targeting of TCTs and showed that all phases of the joint targeting cycle can be enhanced and made faster and more efficient with digitization. Information such as the commander's guidance, target nomination lists, air tasking orders, attack guidance matrices, and threat warning data can be shared faster and more accurately with digital links. The TBMCS and ABCS both use procedures and off-the-shelf software that is becoming a part of everyday life, such as video teleconferencing, e-mail and Internet web sites. Software modules in both TBMCS and ABCS allow for the rapid creation, update and exchange of target databases, air tasking orders, operation orders, fragmentary orders, imagery files, etc. Instant shared access to targeting information from collectors at all levels allows computer-assisted targeting decisions to be made rapidly and accurately with less duplication of effort and less chance of fratricide. During force execution against a TCT digitization has the most potential for improving operations by using maturing sensor-to-shooter links. Each service is developing teams of shooters able to receive targeting data either directly from sensors or from central command and control nodes that have fused and analyzed the information first. On the battlefield of the near future these sensor-to-shooter teams could be organized to provide seamless coverage of the battlefield, the result of which is that anything on the battlefield that is detected can be targeted and killed.

Some of the problems and pitfalls of digitization need to be highlighted. These include the lack of total interoperability among service components; the need for all battlefield elements to be connected to gain full benefit of digitization; the chance that automatic fires could minimize the commander's role in the targeting process; overlapping capabilities that make coordination more important and more difficult; the possibility of excessive reliance on digital systems; over-emphasis on high-value platforms that are limited in number; and a lack of common procedures, terminology, and symbology, each of which are discussed below.

Interoperability. The service components are migrating towards joint interoperability, but still have a long way to go. Current service-unique data links and targeting notations inhibit true joint interoperability, causing the JFC to either locate common terminals at each component C2 agency or try to network dissimilar systems. Battle management systems under development should allow near real-time passing of TCT targeting information. This requires common targeting terminology/symbology and C2 connectivity that connects vertically and laterally.[52] A quick look at the "electronic packets of death," the tasking messages that seal the fate of a battlefield target, reveals that the services are passing similar information in these messages. However, the messages are incompatible because of their different formats. The sooner these message sets migrate to commonality, the easier it will be to create a seamless TCT attack network. Each service is experimenting with unique configurations tailored to their battlefield missions. They are modifying hardware and software at a rapid pace in what is called spiral development in which systems are tested during exercises and then modified based on feedback from users. In some cases contractors sit beside operators and modify the systems on the spot as new ideas surface during system use. A significant challenge is to avoid creating new stove-piped systems by ensuring any new system is DII/COE compliant.

The need for all elements on the battlefield to be connected. One overall conclusion of the Army's 1995 Focused Dispatch report was that the anticipated benefits of digitization cannot be achieved until there is seamless connectivity between the automated systems of all battlefield operating systems. Until then, digitization will actually increase operator workload without a corresponding increase in unit performance. Another conclusion was all friendly elements within a unit's area of influence, including allies and coalition forces, need to have the same high level of situational awareness. Not knowing the location of all friendly forces increases the chances of fratricide.[53] This conclusion was primarily focused on land forces but it can be expanded to include Air Force elements operating in the same area as land forces. The implication is that the services need to work together to share a common air, land, and sea picture of the battlefield, and that all friendly forces need to be connected to the digitized command and control systems to ensure forces at every echelon share the same high level of situational awareness. Moreover, platforms (e.g., aircraft and tanks) are more receptive to digitization, which implies that the potential is greater for interoperability between air forces and mechanized and armored forces than it is between platforms and light infantry and dismounted soldiers. There are efforts underway to develop digitized systems for light infantry and dismounted soldiers to solve this disparity. With the current emphasis on military operations in urban terrain and military operations other than war, this work takes on added emphasis.

Automatic fires. The fleeting nature of TCTs dictates the timely assignment of attack assets with the correct munitions to attack TCTs. Digitization can virtually automate this process with sensor-to-shooter links. Of particular note is the ability of the AFATDS to fully automate fire mission processing. It screens and filters calls for fire and recommends disapproval of missions that don't meet the commander's guidance. It prioritizes missions by importance based on a series of user-defined criteria instead of just processing missions on a first-in-first-out basis. It validates missions against FSCMs and areas of responsibility and electronically requests clearance from the unit that established the control measure. It can also automatically recommend the best fire support asset to engage a particular target as well as recommend the best attack method for the system that it has selected.[54] However, as Jack Kammerer argues, the execution of these "automatic fires" has the potential to completely separate the command and the fire support officer from the "fires loop." He also states that sensor-to-shooter links could result in less responsive fires to subordinate maneuver forces since the high volume of electronic calls for fire could overwhelm control systems.[55] Procedures need to be in place to allow for intervention in the automatic fires process to ensure the command is not removed from the process.

Overlapping capabilities. With the development of long-range attack systems such as the AH-64 Apache helicopter and ATACMS both the Air Force and Army are capable of attacking TCTs across the battlefield. Component capabilities increasingly overlap with regard to sensors, weapons capabilities, and command and control. This is leading to a greater need to deconflict TCT attack operations among the service components. The TBMCS and ABCS can assist in determining the most capable attack system and in coordinating and deconflicting attack operations. Current coordination and deconfliction actions occur between the Air Force AOC and the Army's DOCC, which functions both at corps and division level. As an indication of overlapping capabilities you need only look at an AOC and then look at a DOCC to see how similar they are becoming.

Several proposals have been made to create joint force-level fires clearing houses to improve the coordination and deconfliction process. One proposal is to create a joint force fires coordinator at the joint force level to centrally control joint fires at the operational level.[56] This JFFC would synchronize the attack process, and possibly apportion joint fires systems (such as TLAM, ATACMS, attack aviation) the way that air power is apportioned now by the JFC.[57] Another proposal is to create an effects control center, envisioned as a clearinghouse to manage the fires effects for the combined arms commander. This proposal is based on the premise that firepower on the future battlefield is more focused on the effects desired and less on what platform conducts the fire mission or where that platform is.[58]

Excessive reliance on digital systems. One of the greatest concerns about the new technology is that warfighters will become too reliant on digitized systems and not be able to fight if the systems crash or are otherwise neutralized. There is a tendency to become focused on the digitized system at the expense of using basic skills, knowledge and experience to fight. As one writer puts it, "digital systems cannot replace the commander's judgment and personal assessment of the situation... he must temper information received through digital systems with personal observations and experience, ...and must apply common sense."[59]

Over-emphasis on a limited number of high-value platforms. One aspect of the digitization efforts that became apparent through research is the overemphasis on high-value platforms, especially airborne sensors such as the JSTARS and UAVs. A large percentage of the writings on digitization made mention of how valuable the JSTARS and UAVs are in the new scheme of operations. The JSTARS conduct wide-area searches for targets, and when they find something of interest they cue the UAVs to investigate and to pinpoint targets for attack. Both the Air Force and the Army are counting on continuous coverage by these platforms, but this could lead to conflicting interests and views on how best to use these limited assets, implying that the JFC will have to closely coordinate their employment to ensure their optimal use and deconflict competing requests for their use.

Lack of common TTPs, terminology and symbology. There has been some progress in this area, but each service component still has its own service-unique procedures, terminology, and symbology. There are several useful concepts for targeting TCTs that are specific to a single service (such as the Army's use of NAIs and TAIs) that need to be adopted in the joint environment. Several elements such as the Joint Warfighter Interoperability Demonstration team, the Joint Precision Strike Demonstration team, the Joint Interoperability Test Center, and the Symbology Standards Management Center are working to ensure joint commonality.

Many of the Air Force and Army digitized C4I systems are still under development. The fielded systems may be significantly different from those are being tested now. Regardless of their ultimate configuration, digitized C4I systems hold the promise of an expedited flow of information, shared situational awareness, joint interoperability, graphic portrayal of battlespace, and a reduced chance of fratricide.[60] In short, both Air Force and Army digitization efforts will improve the joint targeting process for time critical targets as long as solutions are found to overcome the problems and pitfalls associated with the new digitized systems.

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ABBREVIATIONS

AA- Automatic Associator

ABCCC- Airborne Battlefield Command and Control Center

ABCS- Army Battle Command System

ACO- Airspace Control Order

ACP- Airspace Control Plan

ACTD- Advanced Concepts Technology Demonstration

ADA- Air Defense Artillery

ADS- Airspace Deconfliction System

AETACS- Airborne Elements of the Theater Air Control System

AFARN- Air Force Air Request Net

AFATDS- Advanced Field Artillery Tactical Data System

AFGCCS- Air Force Global Command and Control System

AGCCS- Army Global Command and Control System

AGM- Attack Guidance Matrix

ALCM- Air Launched Cruise Missile

AO- Area of Operations

AOC- Air Operations Center

APS- Advanced Planning System

Arty- Artillery

ASAS- All-Source Analysis System

ASOC- Air Support Operations Center

ATACMS- Army Tactical Missile System

ATO- Air Tasking Order

ATCS- Army Tactical Command and Control System

AWACS- Airborne Warning and Control System

AWC- Airborne Warning and Control

AWE- Advanced Warfighting Exercise

BCT- Briefcase Control Terminal

BCV- Battle Command Vehicle

BDA- Battle Damage Assessment

C2- Command and Control

C2IPS- Command and Control Information Processing System

C4I- Command, Control, Communications, Computers and Intelligence

C4ISR- Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance

CA- Combat Assessment

CAFMS- Computer-Aided Force Management System

CINC- Commander-in-Chief

CIS- Combat Intelligence System

COA- Course of Action

COLT- Combat Observer and Lasing Team

CONPLAN- Contingency Plan

COP- Common Operational Picture

CSSCS- Combat Service Support Control System

CTAPS- Contingency Theater Air Planning System

D3A- Decide, Detect, Deliver, and Assess

DCT- Digital Control Terminal

DII / COE- Defense Information Infrastructure / Common Operating Environment

DOCC- Deep Operations Control Center

DPICM- Dual Purpose Improved Conventional Munitions

DSP- Defense Satellite Program

DSSU- Dismounted Soldier Support Unit

DST- Decision Support Template

EPLRS- Enhanced Position Location Reporting System

ER MLRS- Extended Range Multiple Launch Rocket System

FAADC3I- Forward Area Air Defense Command, Control, Communications and Intelligence

FBCB2- Force 21 Battle Command Brigade and Below

FDC- Fire Direction Center

FIST- Fire Support Team

FRAGO- Fragmentary Order

FSCM- Fire Support Coordination Measure

FTP- File Transfer Protocol

GCCS- Global Command and Control System

GSM- Ground Station Module

HARM- High-Speed Anti-Radiation Missile

HMMWV- High Mobility Multi-Purpose Wheeled Vehicle

HPT- High Payoff Target

HPTL- High Payoff Target List

HTS- HARM Targeting System

HVT- High Value Target

IDM- Integrated Data Modem

IPA- Image Products Archive

IVIS- Inter-Vehicular Information System

JBC- Joint C4ISR Battle Center

JDISS- Joint Deployable Intelligence Support System

JFACC- Joint Forces Air Component Commander

JFC- Joint Force Commander

JFFC- Joint Force Fires Coordinator

JIC- Joint Intelligence Center

JMEM- Joint Munitions Effectiveness Manual

JSTARS- Joint Surveillance and Target Acquisition Radar System

JTCB- Joint Targeting Coordination Board

JTF- Joint Task Force

JTIDS- Joint Tactical Information Distribution System

JTL- Joint Target List

LNO- Liaison Officer

MAAP- Master Air Attack Plan

MCS- Maneuver Control System

MDMP- Military Decision-Making Process

MIDB- Modernized Integrated Data Base

MISREP- Mission Report

MOC- Maintenance Operations Center

MSTS- Multi-Source Tactical System

NAI- Named Area of Interest

NCA- National Command Authority

OPLAN- Operations Plan

RAAP- Rapid Application of Air Power

RCP- Relevant Common Picture

RFI- Request for Information

RTS- Rapid Targeting System

SADARM- Sense-and-Destroy Armor Munitions

SADL- Situational Awareness Data Link

SAR- Synthetic Aperture Radar

SINCGARS- Single Integrated Circuit Ground-Air Radio System

SIPRNET- Secret Internet Protocol Router Network

SOC- Squadron Operations Center

TACAIR- Tactical Air Power

TACP- Tactical Air Control Party

TACS- Theater Air Control System

TAI- Tactical Area of Interest

TBM- Theater Ballistic Missile

TBMCS- Theater Battle Management Core Systems

TCT- Time-Critical Target

TERM- Tank Extended Range Munitions

TLAM- Tomahawk Land Attack Missile

TMD- Theater Missile Defense

TNL- Target Nomination List

TSS- Target Selection Standards

TTP- Tactics, Techniques, and Procedures

UAV- Unmanned Aerial Vehicle

USMTF- United States Message Text Format

VMF- Variable Message Format

VTC- Video Tele-Conference

WCCS- Wing Command and Control System

WOC- Wing Operations Center

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