STRATEGY RESEARCH PROJECT

INFORMATION FUSION – BATTLESPACE DOMINANCE

BY

LIEUTENANT COLONEL MELITA McCULLY
United States Army

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Information Fusion - Battlespace Dominance

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LTC Melita McCully

Dr. Herbert Barber
Project Advisor

U.S. Army War College
CARLISLE BARRACKS, PENNSYLVANIA 17013

ABSTRACT

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Communications Systems are intended to ensure the Commander is not a prisoner to his/her command post. Previously the objective for Command, Control, Communications, Computers and Intelligence (C4I) has been to ensure the Commander retains access to information and is able to make timely decisions from any place on the battlefield. Fusion of multiple C4I systems is possible with the advent of inexpensive commercial off the shelf (COTS) technology. COTS enables commanders to deftly exploit C4I systems and achieve battlespace dominance. This paper proposes an interim C4I architecture for the current force. The proposal includes a C4I fusion pit, which enables the Commander to have a common, near real-time picture of his battlespace. The paper also outlines several interim fixes to narrow bandwidth constraints for information systems data exchange. The solutions incorporated in this paper are low-cost economical solutions. The resource constrained environment of the current force has been considered throughout the development and implementation of all proposed solutions. (6,611 words)

TABLE OF CONTENTS

PREFACE

This paper is the culmination of a two-year project. It began as a vision communicated to me by my Division Commander, MG Leon LaPorte. As the Commander of the 13th Signal Battalion, 1st Cavalry Division, I was dual-hatted as the Division Signal officer (G6). In my capacity as the G6, I was challenged in the spring of 1996 to initiate development of a Fusion Pit at the DMAIN CP in coordination with the Division Operations Officer (G3). In the ensuing months, the Commanding General's dream matured having generated the synergy that led to accomplishment of all critical tasks. As the G6 and Signal Battalion Commander, I was tasked in multiple directions. Consequently my subordinates are truly responsible for the fruition of the dream.

During subsequent exercises and operations I was privileged to observe the value added to Division operations by the introduction of the C4I enhancements described in this paper. Truly it was a labor of steadfast and loyal love by the many soldiers who served as members of my team. I would be remiss if I did not mention the names of some of the critical players. Special recognition belongs to my iron Majors in the G6 office, Tom Fitzpatrick, Mearen Bethea, and Vernon Lister. They were assisted by Captain Dino Perone, CW2 Kurt Prokarym, CW2 Earl Johnson, SSG Case, MSG Nancy MacDonald, SGM Jessie Husband, and many other junior non-commissioned officers and soldiers. The other half of my team of iron Majors Jim Kohlmann, Jeannie Tibbetts, and Robert Bethea—aided by my resourceful team of technicians CW3 Greg Malfas, CW2 Curtis Newkirk, CW2 Craig Jackson, SFC Gabhart, CPT Bob Purtle, LT Steve Isenhour, LT Chris Schaft and many others—ensured that all of the pieces were in place to make the vision a reality. Constant vigilance, unparalleled technical prowess, a dedication to excellence, and perseverance—all of these fail to adequately describe this outstanding team of professionals. One word captures my feelings about them and the unnamed soldiers who together made all my dreams a reality — *My Heroes*!

A team is only as strong as its weakest link. Fortunately. I was blessed with the very best in my right hand person, CSM Juan Gaitan. CSM Gaitan ensured that there were no weak links on the 13th Signal Battalion team.

I was also fortunate to be mentored in the completion of this project and all of my projects during command by some of the most outstanding professionals in our current force. These leaders embody the essence of professionalism. Thus, I must thank them for the confidence they displayed in allowing me to

command my battalion and make their visions come true. They demonstrated daily that the deadline for new ideas is to be announced.

During this time my "Battle Buddy" was the G3, LTC Jerry Ferguson. Jerry was always there both when I was in command and again here at the Army War College as I labored to complete this paper.

This paper is addressed to the digital Warfighters. Professional warriors in the current force who remain frustrated by the paucity of technologically enhanced tools. My intent is to inform them of a possible solution, which required minimal resources to implement and execute. The solutions identified in this paper capitalize upon current force skills. No additional training classes are required to implement this gap-filler solution. If the reader requires additional technical details regarding the systems described, please contact the author or the G6, 1st Cavalry Division, Ft. Hood, Texas.

I sincerely appreciate the patience, guidance, and support provided to me by two members of the faculty during my preparation of this paper. Professor Jim Hanlon, my editorial advisor, and Dr. Herbert Barber, my project advisor. Individually they devoted countless hours reviewing my attempts to communicate thoughts in an imperfect manner. Due to their tutelage, this paper is finally ready for any who may be interested in the subject.

Finally, I want to assume total responsibility for any inaccuracies or inconsistencies in this paper. The bulk of the paper was reconstructed from my personal notes and files maintained during my two-year command. Any errors are mine and not a result of my staff or other members of my team.

LIST OF ILLUSTRATIONS

INFORMATION FUSION - BATTLESPACE DOMINANCE

"Information is the key to effective synchronization. Synchronization requires early decisions that enable the staff to arrange the battlefield activities in time, space, and purpose to produce maximum relative combat power at the decisive point."

—FM 101-5

INTRODUCTION

The Army After Next (AAN) envisions the potential force, while Advanced Warfighting Experiments (AWE) and the Force XXI process represent a coordinated effort to maximize capabilities in the programmed force.[1] During the interim, the current force must be postured to shape, respond, and prepare. The current force will continue to be stretched as it responds to crises across the spectrum of conflict. The challenge for the current force is to fully capitalize upon available digital command, control, communications, computers, and intelligence (C4I) capabilities. Commanders want to fully exploit these C4I systems today. Integration of low cost commercial off the shelf (COTS) garrison and tactical C4I systems into our current structure will provide battlespace dominance. C4I system enablers will allow current force commanders to exploit current

weapon systems, synchronize friendly forces, and maintain superiority on today's battlefield. Warfighters must be able to precisely apply lethal combat power to enemy centers of gravity.

Fiscal constraints necessitate difficult choices in the allocation of scarce resources. Senior leaders are challenged to maintain balance between competing fiscal requirements of the current, programmed, and potential force. Procurement dollars must be focused on the programmed force, while Research and Development dollars are earmarked for the potential force. Allocation of limited current force operations and maintenance funds to exploit C4I capabilities will ensure current force lethality on today's battlefield. Evolutionary C4I materiel enhancements to the current force, capitalizing on COTS technology, could potentially reduce personnel resource requirements in the near term.[1] The Army's current power projection force Army must be equipped with the requisite C4I tools to fully exploit all weapon system platforms.

BACKGROUND—THE ULTIMATE GOAL

Commanders at every echelon repeatedly ask for automated command and control (C2) systems which will enable them to see the enemy while simultaneously synchronizing combat power across the battlefield. Program Executive Office (PEO) Command and Control Systems (CCS) at Ft. Monmouth is actively pursuing such

a system. PEO CCS is working in close coordination with TRADOC Program Integration Office (TPIO) at Ft. Leavenworth and the 4th Infantry Division's Force XXI at Ft. Hood. The PEO CCS flagship program is designated Maneuver Control System/Phoenix (MCS/P). Recent field tests have demonstrated that C4I platforms such as MCS/P cannot be developed in a laboratory. But as the system evolves, users will discover that MCS/P fulfills a multitude of automated C2 requirements. Some of the capabilities MCS/P is expected to satisfy include: automatic electronic data distribution, real-time situational awareness, effortless decision displays, accurate real-time portrayal of the battlefield, and a capacity to enter the enemy's decision cycle while simultaneously enhancing the synchronization of friendly force elements.[2] A review of MCS/P system requirements reveals it is an attempt to exploit multiple artificial intelligence applications. Initial capabilities field-tested to date include development and distribution of operations plans (OPLANs) and operations orders (OPORDs), maps and overlays automatically posted with the current situation, and pre-formatted message dissemination. MCS/P ultimately will meet the C4I battlefield requirements of the programmed force. Help is really on the way!

MCS/P is the center of the Army Tactical Command and Control Systems (ATCCS) program initiative. In the future, omni-

replicators or like technology will allow Maneuver Force Commanders to simply consult their MCS/P terminal for a current situation update. This is possible through automated exchange of critical data elements between MCS/P and the remaining ATCCS. Five distinct C4I highways (see Fig. 1) support the automated video and data exchange among the ATCCS. Although the highways are separate, ATCCS enables data to transit all of the highways. Research and development issues associated with fielding MCS/P, a system of systems, have frustrated commanders and engineers alike. But software and hardware engineers continue to work tirelessly to satisfy battlefield commanders' requirements.

Other elements of the ATCCS program continue to reach maturity so they can be fielded to the current force. The center of the ATCCS program, MCS/P is like wise the most complex member of the ATCCS family. Battlefield commanders continue to be frustrated by the failure of the PEO to deliver a system which satisfies today's current force requirements. TRADOC's TPIO is responsible for integration of all ATCCS. Individual TRADOC System Managers (TSMs) located at proponent schools oversee the development of the individual ATCCS battlefield systems. MCS/P is intended to be the Warfighter's primary C2 tool. (See Fig. 2 for a graphical representation of the ATCCS.) Software engineers persevere in their quest to field a mature,

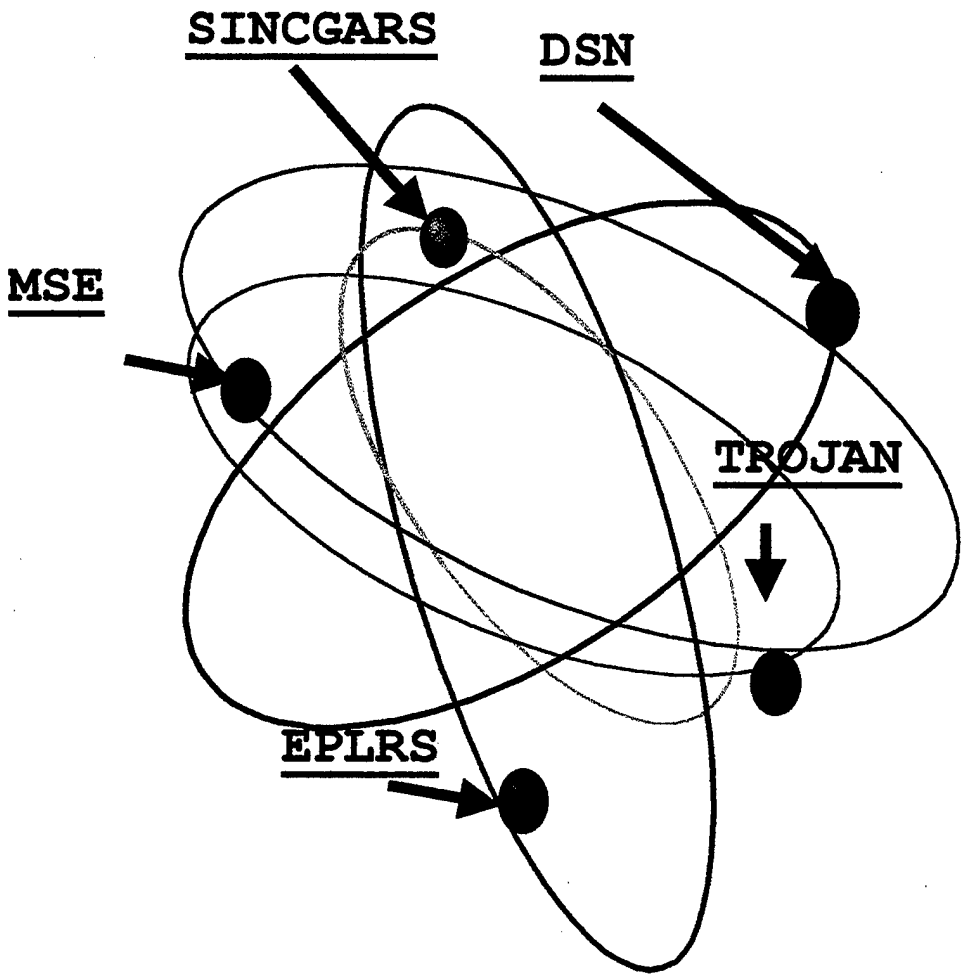


Figure 1: Digital C4I Highways

Note that a typical division or corps has multiple distinct C4I highways that are not interconnected.

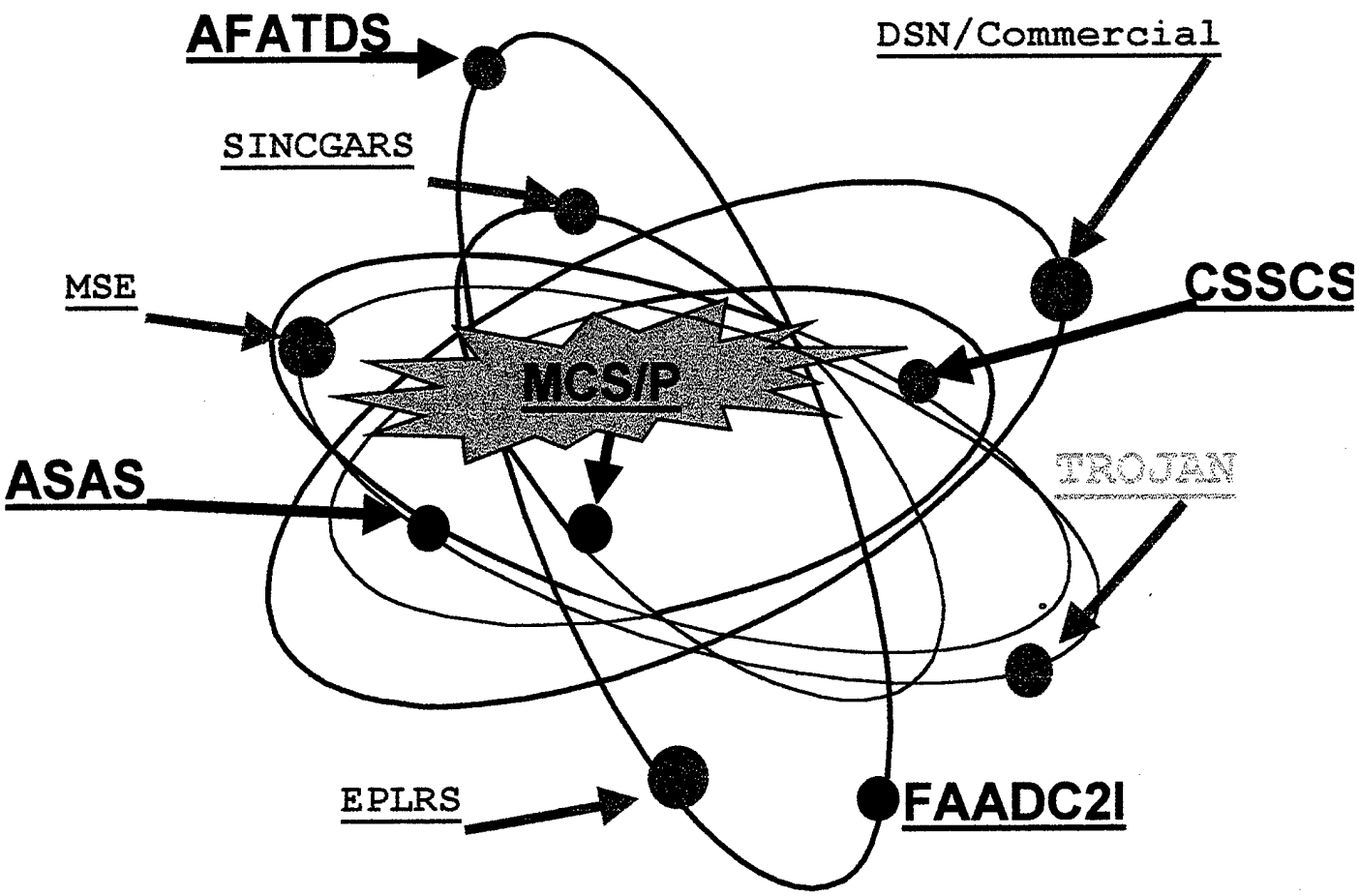


Figure 2: ATCCS Systems Overlaid on Digital Highways

Note that the ATCCS systems are able to communicate via the C4I Digital highways that are not interconnected. Communications is achieved via a combination of software and hardware fielded with the ATCCS.

responsive C2 system fully interoperable with the Joint Service Global Command and Control System (GCCS). GCCS has undergone initial fielding to theater joint force commanders and service component HQs. Unfortunately, during intense field testing, the Army's MCS/P has not demonstrated readiness for worldwide fielding. Unquestionably an alternative interim C2 system is required today.

The MCS/P Limited Users Test (LUT) was conducted during ATCCS VI Initial Operational Test and Evaluation (IOTE) 1st quarter FY 97. The 1st Cavalry Division was assigned the lead for this intense three-month field test and evaluation. MCS/P software enhancements are being implemented concurrently with field testing during the 4th ID AWE. Senior leaders of the operational and acquisition communities are confident that MCS/P field testing during the AWE will lead to a proven, battle-ready C2 system.

ATCCS

The Division routinely employs four of the five ATCCS systems depicted in Fig. 2. The Forward Area Air Defense Command, Control and Intelligence (FAADC2I), and Advanced Field Artillery Tactical Distribution System (AFATDS) were initially fielded in FY 95 and 96. PMs continue to upgrade these systems. FAADC2I terminals are deployed at all CPs and at every Division echelon. The FAADC2I proponent within the Division is the Air

Defense Artillery (ADA) Battalion (BN). Members of the ADA BN familiarize combined arms leaders with the capabilities and application of FAADC2I. System operators are all assigned to the ADA BN. FAADC2I transits the EPLRS highway at echelons below the Brigade Combat Team (BCT) Headquarters (HQ). The ADA BN has been fielded 126 EPLRS to facilitate FAADC2I operations within the Division. FAADC2I is linked to operators of the Avenger and Bradley Stinger Fighting Vehicles in the Division via EPLRS. MSE pipes provide the FAADC2I highway link between maneuver BCTs and Division HQs CPs.

The Division Artillery (DIVARTY) field-tested AFATDS during the fourth quarter of FY 95, followed by an aggressive fielding and implementation plan. DIVARTY continues to work closely with the PM and TSM; their combined efforts are facilitating significant enhancements to AFATDS. AFATDS utilizes the digital SINCGARS highway at BCT and below. AFATDS data is exchanged on the MSE highway from the BCT to higher HQs. AFATDS is linked via SINCGARS to fire support weapon system platforms.

ATCCS enhancements have also proliferated the G2 operations. Prior to Army-wide fielding, the G2 was provided an early version of All Source Analysis System (ASAS) and the ASAS Collateral Work Station (CWS). The G2 has deployed ASAS CWS at the Division Main (DMAIN), Division Tactical (DTAC), and Division Rear (DREAR) command posts (CPs). At the same time the

G2 maintains an Intelligence Homepage utilizing Netscape Navigator. Users at all Division CPs are able to access the Intelligence Homepage via the Mobile Subscriber Equipment (MSE) Tactical Local Area Network (TACLAN).

As noted earlier, the 1st Cavalry Division supported the three-month ATCCS VI IOTE throughout the first quarter of FY 97. In addition to the MCS/P LUT, the major system under test was Combat Service Support Control System (CSSCS). Logisticians were satisfied that initial capabilities provided by CSSCS warranted deployment during Warfighter 1997.

Still under development and product improvement, CSSCS will ultimately integrate numerous stovepipe logistics and personnel support systems. Currently the system possesses limited capability. However, with the support of the Division Support Command (DISCOM) Commander and the Assistant Division Commander for Support (ADC{S}), the Division has implemented CSSCS at the BCT Trains, DMAIN, and DREAR. Ultimately the system will be resident at additional CPs.

THE INTERIM PERIOD - PROBLEM

Individual Major Army Commands (MACOMS) are designing field expedient solutions which satisfy automated C2 requirements pending the fielding of MCS/P. The proliferation of "homegrown system" solutions, coupled with the plethora of inexpensive COTS being introduced on the battlefield, poses a significant danger

to current force readiness. Homegrown systems emerge from individual commander's initiatives to fully exploit C4I technology. Arguably these homegrown systems barely measure up to the capabilities which MCS/P will ultimately deliver. But homegrown systems are available today. Post—Cold War Army fiscal constraints challenge commanders to develop new efficiencies and solutions. A typical homegrown system consists of a combination of commercial software and hardware. Locally developed tactics, techniques, and procedures (TTP) enable operators to effectively employ these homegrown systems. In a perfect world, the TTP are scrupulously documented in the unit tactical standard operating procedure (TSOP). The pace of events coupled with competing mission requirements for personnel resources means we have only limited TTP documentation.

Units with homegrown C4I system solutions have created new challenges. Probably the toughest challenge is sustainment of the homegrown system. Sustainment poses an aggregation of personnel and funding problems. Limited resources are stretched as dedicated soldiers accomplish their doctrinal mission while also maintaining non-resourced homegrown systems. Dwindling resources limit commanders' ability to sustain training and maintenance of these homegrown systems.

Readiness of current force units has been degraded due to personnel turbulence, which necessitates training new personnel

on homrgrown systems. Personnel readiness is also diminished as soldiers encounter a myriad of homegrown systems as they move through the current force. Commanders must supplement local SOPs with the TTP for homegrown systems. Critical personnel resources are diverted to maintenance and sustainment of homegrown systems, while these same personnel are simultaneously being challenged to maintain crew proficiency on doctrinally fielded systems.

Unfortunately locally developed systems frequently reflect the technical strengths and personalities of assigned persons. As key technicians and leaders depart, sustainment challenges intensify. Incomplete documentation befuddles new personnel and consumes more resources. Subsequently new personnel develop different solutions to the same problems, only proliferating issues of non-standardization. Resultant duplication of resources applied to solve the same problem only aggravates the situation. The bottomline impact of homegrown systems falls on our Army's most critical resource — the people.

THE REQUIREMENT

The current force has an immediate requirement for a common low cost adaptable C4I system. This system must enable commanders to exploit multiple generations of C4I and weapon systems fielded to the current force. This low cost C4I system must take advantage of resident C4I tools. The Army cannot

afford to assume additional sustainment costs for training and maintenance of homegrown C4I systems. A quick assessment of the common capabilities of homegrown systems reveals that they meet the elementary requirements of MCS/P in an unsophisticated and immature manner. Unlike MCS/P, homegrown systems do not incorporate artificial intelligence applications. Clearly limited Army resources must remain focused on MCS/P. However, investment of minimal local funds in a standardized interim system would enable commanders to exploit some of the digital C4I systems capabilities today.

Interim C2 system capabilities include: automatic electronic data distribution, real-time situational awareness, effortless decision displays, accurate picture of the battlefield, access to the enemy's decision cycle, and simultaneously enhanced synchronization of friendly force elements.[3] Note that the current force interim C2 requirement is identical to the ultimate requirement for MCS/P. The principal difference is in the solution, or the fielded system. The interim system must harness resident system capabilities of garrison and tactical C4I platforms. Commanders must accept the fact that the interim system will lack many of the objective capabilities of the objective MCS/P system. The benefits of the interim system are readily apparent. Sustainment challenges will be greatly reduced through Army-wide use of one interim system. A lead

agency within TRADOC should be assigned responsibility for documentation of an interim C2 system. Either the TRADOC Battle Lab at Ft. Leavenworth or Ft. Gordon could be assigned this responsibility. The Battle Lab, working with an element from the Army Materiel Command (AMC), should publish the specifications for the interim system components. A list of potential commercial sources should supplement the specification list. Fiscal reality and responsible command dictate that the Battle Lab should document a solution which includes C4I components with an aggregate retail value of less than $200K.

The ultimate beneficiary of a standardized interim C2 system will be our soldiers. As soldiers move through the current force, they will encounter a standardized interim C2 system. Leaders and led will not be challenged to learn local TTP, or to develop new TTP and/or new solutions to old problems. Instead, soldiers can focus their energy on mission accomplishment.

THE BUBBA SOLUTION

An example of a homegrown system, which could serve as the model for the Battle Lab, is the one developed and employed by the 1st Cavalry Division. Nicknamed "Bubba", the Division's system has proven the feasibility and application of several COTS to tactical operations. Bubba components include a combination of systems already fielded to the Division, supplemented by new C4I COTS software and hardware. The most

obvious changes to the Division Main (DMAIN) Command Post (CP) included additional video monitors, a PA system, and a radio microphone switcher. One-time savings realized from several resource initiatives provided the requisite funds for the Division to pursue these C4I enhancement initiatives. The initiatives included purchase of the new Bubba equipment, upgrades to the tactical C4I network, and reconfiguration of staff cells at critical Division Command Posts (CP). The Division Commander initially focused all resources on the DMAIN "Fusion Pit". Subsequently Fusion Pits were installed at other Division CPs. Dwindling resources in future budget years will only exacerbate problems proliferated by the introduction of homegrown systems. A standardized C2 system is a force multiplier! Imagine the dividends in operations, training, and C4I if current force users had a standardized C2 system like Bubba. So the Army should select the best current homegrown system or a hybrid of the various homegrown systems. The new system selected by the Army, will then become the standardized interim C2 system for the near future.

INFORMATION FUSION PIT IMPLEMENTATION

THE VISION

Prior to the 1997 Warfighter, 1st Cavalry Division CPs were upgraded with inexpensive COTS hardware and software. These upgrades enabled the Division Commander and his staff to more

fully exploit digitized platforms. Initially the Division Commander communicated his vision for a Fusion Pit at DMAIN. In close coordination the G3 and G6 designed the Fusion Pit. While the G3 focused his energy on construction of new map boards, a dais, and the battle captain's platform, the G6 concentrated on the COTS materiels requisite for fusion pit operations during the height of battle. Following installation of the C4I enhancements, G3 and G6 energy was redirected at documentation of the new TTP. The TTP was further refined during initial field operations in conjunction with a Division Command Post Exercise (CPX) in December 1996. The new TTP and "Fusion Pit" C4I enhancements enabled 1st Cavalry Division to expeditiously fuse information in order to achieve battlespace dominance during the 1997 Warfighter.

THE WARFIGHTER EXERCISE EXPERIENCE

The inordinate growth of information horizontally and vertically challenge the intellectual and decision—making prowess of commanders at every echelon.[4] A Fusion Pit simply enables the Commander to focus information from multiple systems on one focal point (See Fig. 3). Two conditions of our high tech current force limit commanders' ability to assimilate the myriad of information delivered by multiple digital weapon and C4I systems simultaneously. First, commanders must deal with the sheer volume of data generated during simultaneous

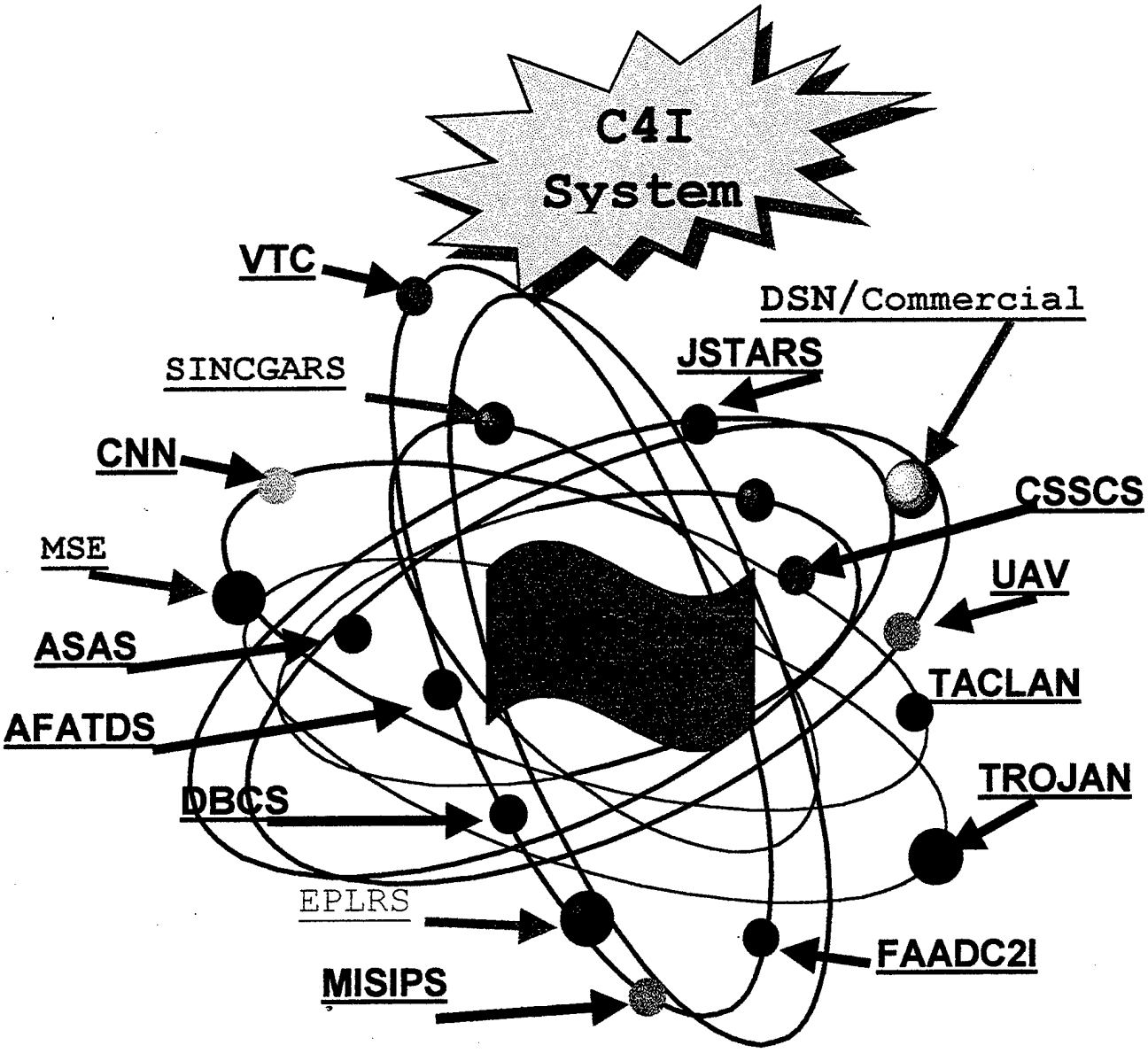


Figure 3: Principal C4I System Enablers

This Figure depicts all of the C4I enablers to include the digital highways, ATCCS systems, and other C4I systems resident in digitized organizations. These systems are all present in the Fusion Pit.

battlefield operations. Second, no automated system can replace the art of battlefield command as practiced by current force leaders.[5] Advocates of many expert systems claim that they can replace human actors. But ultimately the decisive factor will always be the art of war as executed by the battlefield commander. "Direction and instruction can be sent through a computer screen—inspiration and motivation cannot."[6] The sheer magnitude of available information inspired the Division Commander to envision the "Fusion Pit".

1st Cavalry Division's BCTP Warfighter provided an opportunity for the Division Commander to fully validate COTS upgrades to Division CPs. This Warfighter broke the paradigm in several ways. The Division was able to employ more digital C4I platforms than previous units during BCTPs. Additionally, the Army's Chief of Staff directed the BCTP Senior Controller to move to the next phase in the evolution of the BCTP. The 1st Cavalry Division mission was to conduct a forward passage of lines (FPOL), attack in zone, and—given the opportunity—to conduct a pursuit, penetration, and exploitation as part of the III Corps attack north during the BCTP Warfighter.[7] The Division's effective attainment of the mission with minimal combat losses in unprecedented time is attributable to the

convergence of multiple C4I elements of power in the Fusion Pit. Concentration of information in the Fusion Pit enabled individual battlefield functional area (BFA) experts to effectively prosecute their portion of the plan in a synchronized manner. Throughout the Warfighter, the Chief of Staff orchestrated multiple moving pieces at the DMAIN. Fusion Pit feeds from the deep operations cell, air defense artillery section, G3 Plans, and the multiple G2 intelligence systems enabled the Division to exploit technology, applying lethal precision fire power at decisive points throughout the exercise.[8]

DIGITIZED WEAPON SYSTEMS

Perhaps the preeminent digitized heavy force in the world, the 1st Cavalry Division has incorporated numerous force modernization enhancements since 1994. The principal digitized weapon system platforms include the M1A2 Abrams Tank and the M113A3 Bradley Fighting Vehicle. Fire support systems include the M109A6 Paladin and Multiple Launch Rocket System (MLRS). Aviation assets include Apaches and Blackhawks. Air Defense platforms include Avengers and Stingers.

C4I SYSTEMS

The Division has also been outfitted with state-of-the-art C4I systems. Transmission systems include: SINCGARS FM radios, Enhanced Position Location Reporting System (EPLRS), Mobile

Subscriber Equipment (MSE), and Trojan. These separate non-integrated C4I transmission systems together form the digital highways for the 1st Cavalry Division. (See Fig. 1 for a visual representation of these C4I highways.) Other Division's C4I systems include: G2 piloted Unmanned Aerial Vehicles (UAV), Joint Surveillance Target Attack Radar System (JSTARS), and EPLRS Situational Awareness Terminals (SAT). Digital Battle Command System (DBCS) software installed on the SAT empowers selected soldiers at every echelon to exchange critical C4I data. The G2 staff has several C4I tools including the multispectral imagery processor (MSIP), RAID, and an early version of the ATCCS All Source Analysis System (ASAS) with a collateral workstation (CWS). Garrison systems routinely deployed to the field and integrated into the CPs; they include Microsoft Office, Microsoft Mail, and Netscape Navigator. When deployed to the field, these garrison systems function IAW III Corps Tactical Local Area Network (TACLAN) SOP. The TACLAN and ATCCS systems all compete for limited space on the MSE highway. Other commercial systems routinely deployed to the field at the Division Main CP includes the VTEL video teleconference (VTC) system utilizing dedicated MSE pipes. Staff at the Division Main CP utilize "Burger King" style mikes for eavesdropping between cells and for information exchange between the G3 Fusion Pit OIC and all other BFA cells. Laser pointers and a public

address system are employed during briefings and mission status updates to key leaders.

INTEGRATION OF DIGITIZED WEAPON PLATFORMS AND C4I SYSTEMS

The ultimate challenge for senior leaders in the Division is integration of these powerful C4I enablers. When these C4I tools were integrated utilizing a combination of COTS in the Fusion Pit and locally developed TTP, Warfighters demonstrated an unprecedented ability to put steel on target in a synchronized, precise, and lethal manner. The current force wants to achieve information dominance on today's battlefield! The simultaneous fusion of critical C4I information at Command Posts throughout the Division enables the Commander to set the conditions for success, thereby achieving battlespace dominance.

THE FUSION PIT

The Division Commander's vision in 1996 led to a Fusion Pit located at the DMAIN CP.(See Fig. 4) Figure 5 depicts a sketch of the DMAIN Fusion Pit. At a cost of less than $200,000, COTS hardware (two large screen video display systems, a touchpad control, video camera, public address (PA) system, FM radio switcher and a master control unit) was purchased prior to the December 1996 CPX. The new system nicknamed "Bubba" was

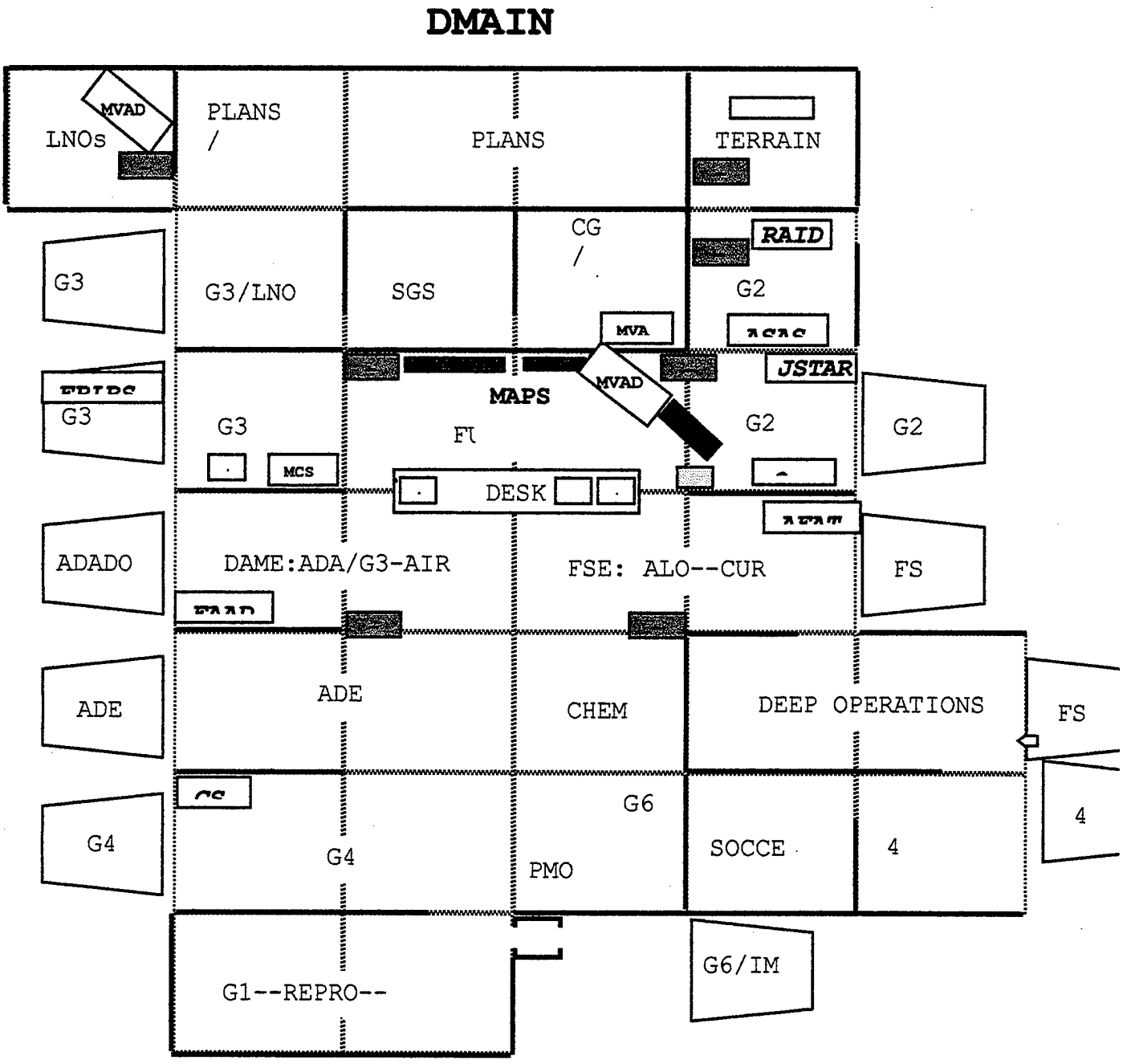
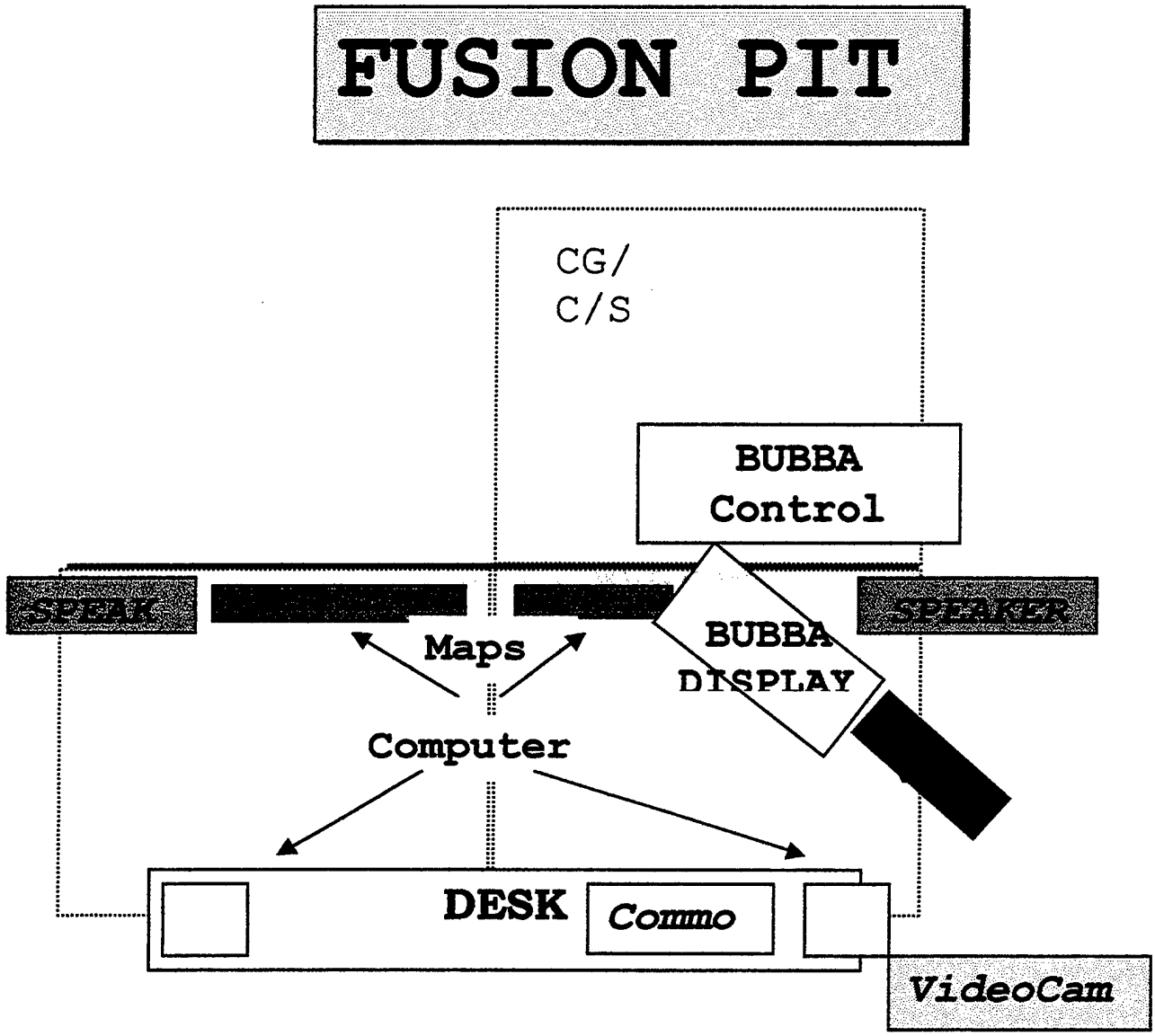


Figure 4: Illustration of DMAIN CP



*Radio Switcher, Telephones, Speakers, under

Figure 5: Illustration Of DMAIN Information Fusion Pit

installed in the Fusion Pit. Subsequently smaller versions of Bubba were purchased and installed at the Division Tactical (DTAC) CP(Fig. 6) and Division Rear (DREAR) CP(Fig. 7).

FUSION PIT COMPONENT OPERATIONS AND MAINTENANCE

All of the new components installed at the three CPs were covered by factory warranties. Additionally, soldiers from the G3, G6, and DISCOM received minimal instruction from the vendor on the operation of the touch pad, radio switcher, monitors and PA system. Personnel from the G6 Office and the 13th Signal BN were provided familiarization training on the wiring and maintenance of Fusion Pit components.

SHORTCOMINGS OF THE FUSION PIT

Increases in "to accompany troops" (TAT) equipment for the non-standard COTS equipment during deployments proved to be a major shortcoming associated with the addition of Fusion Pits. The DMAIN and DTAC CPs are contained in a combination of Standardized Integrated Command Post (SICP) Tents, wheeled and tracked vehicles. Set-up and tear-down time are lengthened. However, the Division Commander believes the enhanced capability compensates for full operational capability delays during set-up at the DMAIN and DTAC. The battle staff proceeds to perform critical combat tasks while other personnel complete Fusion Pit

DTAC

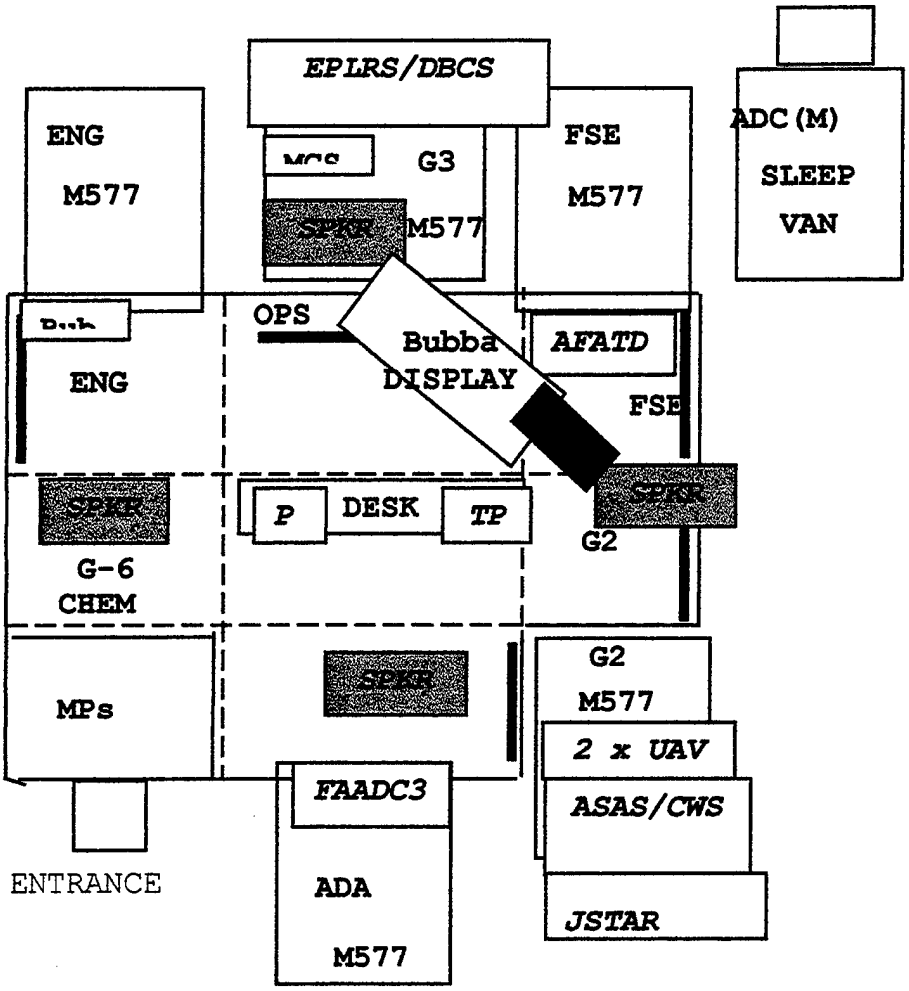


Figure 6: Illustration of DTAC CP

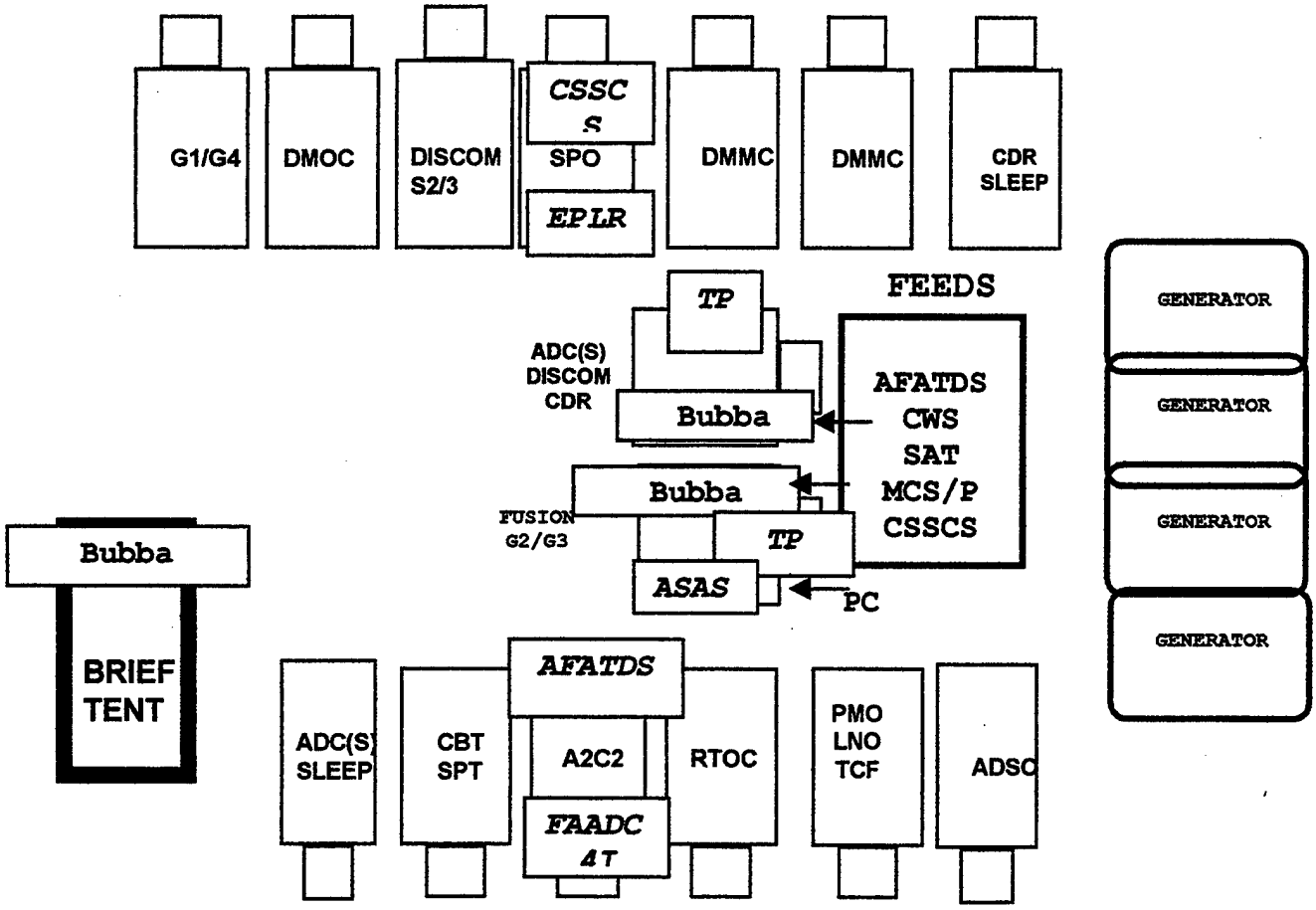


Figure 7: Illustration of DREAR CP

installation. At the DREAR the Fusion Pit is housed in EXPANDO Vans thus installation and set-up time have not been degraded.

PROGRAMMED FORCE - FUSION PIT

Force XXI experiments include a variation of the Fusion Pit housed in an Expando Van at the 4th ID DMAIN. The Army requirement continues to specify lightweight large flat screen monitors. The monitors are not simply large-screen televisions. They must be capable of projecting a minimum 85 khz scan rate from multiple C4I systems. Despite the high-resolution quality, map boards are still integral to Fusion Pit operations. Until the commercial sector can produce a low cost, large, lightweight flat screen approximately 8' X 10' which satisfies C4I system display specification rates, Commanders must continue to rely upon traditional paper map boards (see Figs 4 & 5).

GARRISON C4I TOOL APPLICATIONS

The objective Army Battle Command C4I System is MCS/P. The Army's AWE supports ongoing field-testing and enhancements of MCS/P. The 1st Cavalry Division received 56 MCS/P systems in conjunction with ATCCS VI IOTE. MCS/P utilizes the UNIX operating system on a Sun workstation. The MCS/P offers tremendous potential for future application in the programmed force. Upon full maturity and satisfactory system acceptance testing, the expert system MCS/P will revolutionize CP operations at every echelon.

INTERIM C2 - TACLAN

In the interim, the Army must respond to the resounding demand for a simple low cost C2 system. The 1st Cavalry Division has utilized a typical homegrown system since 1995. This system is commonly referred to as the III Corps Tactical Local Area Network (TACLAN). The Division Staff assisted by technicians from the Signal Battalion developed and implemented the 1st Cavalry Division TACLAN. TACLAN is an outgrowth of the garrison information system. It functions on the same principles as the garrison e-mail and office information systems, utilizing Microsoft Office and Microsoft Mail. Not an expert system, it does not meet objective Warfighter requirements. However, it is an interim low-cost gap filler. TACLAN offers a reasonable 50% solution. Users transport garrison laptop computers to tactical operations centers. Since the III Corps garrison wide area network is unclassified, users are also required to swap computer hard disks in their computers. Tactical hard disks are clearly labeled U.S. Secret, facilitating field training and wartime operations.

TACLAN SERVERS

Deployable lunchbox and notebook Pentium computers have been configured as servers. New Pentium lunchbox computers were integrated into the network prior to the March 1997 Warfighter exercise. Early generation laptop servers were relocated to the

Signal BN and six of the Brigade CPs. G6 System Administrators at the DMAIN, DTAC, DREAR, and Simulation Center maintained the lunchbox servers. Deployment of servers to all critical nodes enabled immediate exchange of critical C4I data. The G6 office assumed the lead for procurement, engineering, and installation of the new servers. The G3 and G6 continue to implement TACLAN improvements. Enhancements have included training selected Division, Brigade, and Signal Battalion personnel as systems administrators. The unit system administrators are certified following the G6's in-house training. System administrators are fully capable of independent installation, operation, and maintenance of unit servers.

Battlespace awareness has dramatically improved with the introduction of Netscape Navigator homepages. G6 personnel have also installed software, which enables system administrators at CPs to compress files prior to transmission by utilizing COTS data compression software. Integration of servers at all separate CPs enables trained personnel to pull critical C4I data from other servers and store it locally. Examples of files pulled and stored locally at CPs include the G3-produced commanding general's (CG) update briefs and the G2-produced Intelligence Homepage.

CG'S UPDATE BRIEFING

Critical C4I producers and users of the TACLAN include staff at Division, Brigade, and separate BNs. Until MCS/P matures and develops the capability to exchange C4I data with other ATCCS, critical combat power, intelligence, operational plans, orders, and graphics are maintained in the CG's Update Briefing. All staff sections at the DMAIN provide updates a minimum of two times daily, or as the situation dictates. G3 is the proponent for the Update. Operators and supporters can rapidly ascertain combat power of all maneuver forces simply by accessing the combat power Excel spreadsheet contained within the CG's Update Briefing Directory. Ultimately the integration of MCS/P and CSSCS will satisfy this requirement in near real-time. The CG's Update also includes a recap of fragmentary orders (FRAGOs) and graphical laydown of orders, to include supporting BOS plans. The G2 includes an enemy order of battle and graphical Priority Intelligence Requirements (PIR), along with status of completion in the CG's Update. The servers also contain electronic copies of OPLANs and OPORDs.

INTELLIGENCE HOMEPAGE

The Intelligence Homepage is another interim gap-filler. Until the ASAS CWS is deployed to all Division CPs, the Intelligence Homepage serves as the single source for graphical weather and intelligence data. The G2 staff laboriously

analyzes and pulls critical data from multiple C4I tools to include ASAS, UAVs, MSIP, RAID, CNN, Air Force Weather Detachment and other intelligence sources. The Intelligence Homepage is routinely updated during exercises and combat operations. Graphical intelligence summaries have replaced long narrative dissertations. This packaging enables warfighters to rapidly distill thousands of bits of information utilizing a combination of COTS hardware and software.

The foundation for all locally produced C4I data exchanged on the TACLAN is the same software utilized in garrison by staff officers and non-commissioned officers. Netscape Navigator, Microsoft Office, Mail, and Windows are common user friendly programs. There is no sustainment training associated with the employment of these garrison systems in a field environment. The combat power charts, operational and intelligence graphical summaries, and Intelligence Homepage are normally pulled and stored on the CP local server by a trained soldier, Moreover, each of these products can also be e-mailed to users via the TACLAN.

Narrow Pipes - The Solution

Introduction of voluminous amounts of C4I data associated with current force operations continues to challenge signal planners and operators. The ultimate challenge has been to provide timely exchange of critical C4 data via the narrow 9.6

kbps MSE packet switch network pipes. During the 1st Cavalry Division Warfighter, GTE loaned the III Corps new experimental 256 kbps cards, which significantly expanded the narrow MSE pipes. The cards proved invaluable; they enhanced speed of service for packet switch subscribers at critical CPs. These same cards were also successfully employed on the VTEL VTC link, thereby eliminating the requirement for dedicated MSE transmission links in support of the VTC. The one downside of the new cards is loss of two voice trucks in the Small Extension Nodes (SEN), where the cards were installed. However, with the explosion of C4I data, the number of telephone calls has been reduced.

In modern battle, the magnitude of available information challenges leaders at all levels. Ultimately, they must assimilate thousands of bits of information to visualize the battlefield, assess the situation, and direct the military action required to achieve victory. —FM 100-5

CONCLUSION AND RECOMMENDATION

CONCLUSION

The current force will continue to be challenged to assimilate thousands of bits of C4I data from multiple sensors, weapons systems and other C4I enablers. ATCCS and GCCS remain as the ultimate solution for the programmed force. Fiscal reality will dictate when units receive these solutions.

Interim "homegrown systems" now present a problem as potential readiness detractors. Standardization of an interim C4I solution for the current force will enable the Army to make the best use of limited resources.

RECOMMENDATION

The two most critical enablers to battlespace dominance are timely information fusion and distribution. Assign the lead for documentation of the interim information system to a TRADOC Battle Lab. Task AMC to provide support in identification of potential low-cost sources for local procurement. Assume risk and accept the fact that the interim system will not incorporate expert systems or artificial intelligence applications. Continue to direct resources at the ultimate ATCCS solutions.

APPENDIX A - ACRONYMS

AAN Army After Next

ADA Air Defense Artillery

ADC(S) Assistant Division Commander (Support)

ADE Assistant Division Engineer

AFATDS Advanced Field Artillery Tactical Data Distribution System

AMC Army Materiel Command

ASAS All Source Analysis System

ATCCS Army Tactical Communications Control Systems

AWE Advanced Warfighting Experiments

BCT Brigade Combat Team

BCTP Battle Command Training Program

BFA Battlefield Functional Area

BN Battalion

BOS Battlefield Operating System

C2 Command and Control

C4I Command, Control Communications, Computers and Intelligence

CCS Command and Control System

CG Commanding General

CNN Cable News Network

COS Chief of Staff

COTS Commercial off the Shelf

CP Command Post

CPX Command Post Exercise

CSSCS Combat Service Support Control System

CWS Collateral Work Station

DBCS Digital Battlefield Command System

DISCOM Division Support Command

DIVARTY Division Artillery

DMAIN Division Main

DMMC Division Materiel Management Center

DMOC Division Medical Operations Center

DREAR Division Rear

DSN Defense Switched Network

DTAC Division Tactical Operations

EPLRS Enhanced Position Location Reporting System

FAADC2I Forward Area Air Defense Command, Control and Intelligence

FM Field Manual (when referring to military publications)

FM Frequency Modulated (when referring to communications)

FPOL Forward Passage of Lines

G1 General Staff Personnel Officer

G2 General Staff Intelligence Officer

G3 General Staff Operations Officer

G4 General Staff Logistics Officer

G5 General Staff Civil Military Liaison Officer

G6 General Staff Signal Officer

HQs Headquarters

IM Information Manager

IOTE Initial Operational Test and Evaluation

JSTARS Joint Surveillance Target Attack Radar System

KHz Kilohertz

LNO Liaison Officer

LUT Limited Users Test

MACOM Major Army Command

MCS/P Maneuver Control System/Phoenix

MSE Mobile Subscriber Equipment

MSIP Multi-Spectral Imagery Product

PA Public Address

PAO Public Affairs Officer

PC Personal Computer

PEO Program Executive Office

PIR Priority Intelligence Requirements

PM Program Manager

PMO Provost Marshal Officer

RTOC Reserve Tactical Operations Center

SAT Situation Awareness Terminals

SEN Small Extension Node

SGS Secretary General Staff

SICP Standardized Integrated Command Post

SINCGARS Single Channel Ground Airborne Radio System

SOP Standing Operating Procedures

SPO Support Operations Officer

TACLAN Tactical Local Area Network

TAT To Accompany Troops

TP Telephone

TPIO TRADOC Program Integration Office

TRADOC Training and Doctrine Command

TSM Training Support Manager

TSOP Tactical Standing Operating Procedures

TTP Tactics Techniques and Procedures

UAV Unmanned Aerial Vehicle

VTC Video Teleconference

ENDNOTES

[1] Annual Report on the Army After Next Project, Knowledge & Speed (Department of the Army, July 1997), 5.

[2] PM OPTADS, MCS Product Brochure, Department of the Army, undated), 2.

[3] PM OPTADS, MCS Product Brochure, Department of the Army, undated), 2.

[4]Captain Joseph S. McLamb, "The Future of Mission Orders" (Military Review, September, October 1997), 71.

[5]Ibid., 72.

[6]Ibid., 73.

[7]1st Cavalry Division Warfighter II OPORD Mission Analysis Briefing, 3 March 1997, slide 9.

[8]LTC Melita McCully, Personal Notes, March 1997.

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