

The Digital COC by Major Laura Little

Over the past decade, the Marine Corps has devoted considerable funding and research to the development and employment of C2 Systems. The emphasis on command and control (C2) systems is driven in part by the joint vision goal of *full spectrum dominance* – “the ability of US forces, operating unilaterally or in combination with multinational and interagency partners, to defeat and adversary and control any situation across the full range of military operations.” The fundamental operational concepts of full spectrum dominance fall into four areas: Dominant Maneuver, Precision Engagement, Focused Logistics, and Full Dimensional Protection. To achieve full spectrum dominance, it is believed that *information superiority* and innovations to improve operational capability will ultimately lead to decision superiority. The purpose of this paper is to exam the employment of C2 Systems based on the initiatives of MAGTF-6 during Combined Arms Exercise (CAX) 3 and 4.

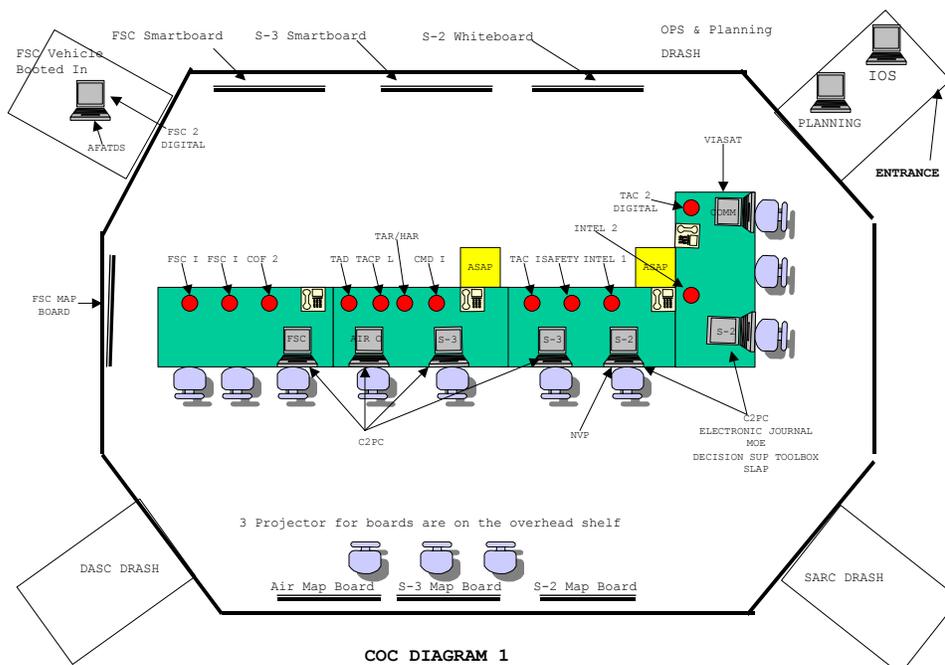
A Brief Overview of the Systems

- Global Command and Control System (GCCS): GCCS is fielded at the CINC, Joint, MEF, and MSC level. The system assists in the maintenance of dominant battlefield awareness through a fused, integrated, near real-time picture of the battlespace. It supports planning, mobility, sustainment, intelligence, the Common Operational Picture (COP), and the Common Tactical Picture (CTP) information requirements. This system was not employed during CAX 3 and 4.
- Intelligence Analysis System (upgraded to Intelligence Operations Server/Intelligence Operations Workstation (IOS/IOW V2)): This is the principle Marine Corps intelligence system that provides semi-automated intelligence support to operations, an all-sourced intelligence fusion capability, and current information on the enemy, weather, and terrain. The intent of this system is to facilitate timely information access, efficient imagery and local intelligence data fusion, rapid tactical intelligence production and dissemination, and access to joint, theater and national intelligence.
- Tactical Combat Operations (upgraded to Intelligence Operations Server/Intelligence Operation Workstations (IOS/IOW V1)): The IOS/IOW V1 is considered a maneuver information system. Its primary purpose is to provide timely information on friendly and enemy units to help commanders and their staff conduct operations planning and make critical C2 decisions. This system is integrated with the intelligence system (IOS/IOW V2) and aides in the processing and fusing of tactical information to form a common picture of the battlefield. It also supports development of courses of action (COAs) and the preparation and dissemination of Operational Plans, Operational Orders, and overlays.
- Command and Control Personal Computer (C2PC): C2PC is the user graphic interface program for IOS V1 and V2. The program is commonly found on the IOW computers and can be loaded on additional computer hardware assets.

- Advanced Field Artillery Tactical Data System (AFATDS): AFATDS is a multi-service fire support system developed by the US Army. The primary purpose of the system is to support the maneuver commander with timely, accurate, coordinated fires, and command and control. AFATDS can manage fire plans, target lists, maneuver control measures, fire unit and ammunition information, meteorological and survey information, BDA and movement control. It's designed to integrate artillery, mortar, naval gunfire, and eventually close air support (CAS). The system is capable of supporting tactical artillery fire direction, target management, fire support planning, fire mission processing, movement control, and artillery mission support. It also allows the maneuver commander's input for High Value and Priority targets and preplanned triggers.
- Theater Battle Management Core System (TBMCS): TBMCS is a joint forces aviation information and decision support system. It provides air operations planners the ability to produce, generate, disseminate, and monitor the execution of the Air Tasking Order (ATO), Air Defense Plan, Master Air Attack Plan, Target Nomination List, joint integrated prioritized target list, and Air space Control Order (ACO). TBMCS is integrated with GCCS. This system was not employed during CAX 3 and 4.

Employment of C2 Systems at the Special Purpose MAGTF level during CAX

During CAX 3 and 4, 2002, MAGTF-6, under the leadership of Colonel John Coleman, Commanding Officer of 6th Marine Regiment, demonstrated a sincere effort to integrate Marine Corps C2 Systems into their Combat Operations Center (COC) in support of combined arms training. In addition to doctrinal single channel voice nets typically employed in support of MAGTF operations at CAX, 6th Marines and supporting units implemented a data network architecture using both multi-channel radio (MRC-142) and the newly fielded Enhance Position Location Reporting System (EPLRS) to disseminate friendly and enemy situation as well as fire support coordination graphics. Diagram 1 depicts the MAGTF COC layout used to maximize the use of C2 systems in support of operations.



As depicted on Diagram 1, the right white board displayed the enemy situation. The majority of information used in developing the intelligence picture was collected via doctrinal voice nets from reconnaissance teams, subordinate elements, and higher headquarter intelligence summaries. The MAGTF S-2 section processed this data, and manually updated a C2PC intelligence overlay. The enemy overlay was then disseminated to subordinate units as required. All information was also sent via traditional voice nets.

The middle smart board displays the friendly situation. In most cases, subordinate units reported their position via traditional voice nets. The MAGTF S-3 section then manually updated the positions and disseminated friendly force positions via C2PC “tracks”. (Automatic updates to connecting computers when a change occurs in location.) During CAX 4, 2nd Tank Battalion supported the initial operation, testing, and evaluation of the mounted Digital Automated Communication Terminal (DACT). The DACT is a sub-notebook size tactical computer that provides an interface to C2PC as well as position location information (PLI) via a GPS receiver. With the EPLRS radio as the primary communication path, locations of various tank battalion weapon systems were automatically updated in C2PC (when line of sight to EPLRS radio relay was possible). The MAGTF S-3 also disseminated and collected (from subordinate units) operational overlays in support of operations. At the direction of the Commander, during critical stages of the fight, the center smart board was also used to periodically superimpose enemy positions and threat rings onto friendly positions and overlays, hence providing a common tactical picture.

The left smart board supported the fire support coordination center (FSCC). The FSCC section created graphics in C2PC to assist in fire support and de-confliction. Information displayed included series target locations, artillery and mortar gun target lines, battle positions (BPs) for rotary wing aircraft, attack cones/azimuths for fixed wing in conjunction with ground forces, and enemy disposition. Diagram 2 is an example of a fires graphic display.

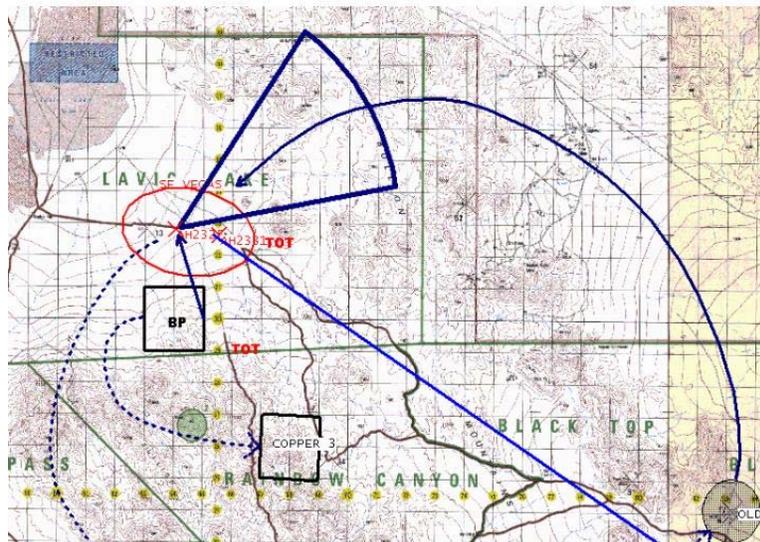


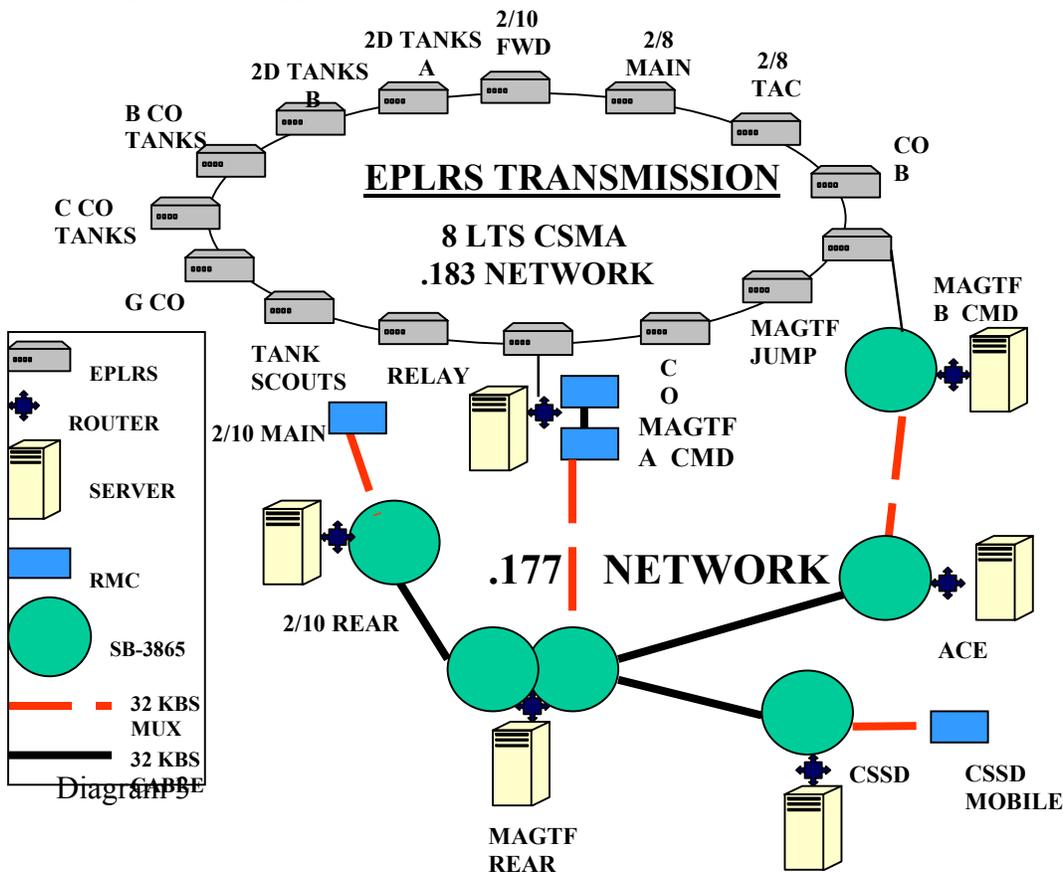
Diagram 2

In an effort to enhance information flow, MAGTF-6 installed the commercial shareware product ePop. The intent of the software was to automated journals, eliminate yellow canaries, and support a more rapid dissemination of information and intelligence. (Note: MAGTF-6 ran a

closed secret data network. EPop is not currently authorized for use on SIPRNET.) The software was employed as an “instant messenger” internally within the MAGTF COC and between the MAGTF and subordinate elements. A unique feature of the software is its splash screen delivery that immediately projects the message on the screen. The message is also retained in a log that allows the Commander and/or staff to review messages sent.

6th Marines also employed the Naval Visual Program (NVP). NVP provides an enhanced 3-D graphical representation of the battlespace. This program allows the Commander, staff, and pilots to visualize the terrain and airspace in relation to enemy positions, weapons systems (to include ADA threat rings), and fire support coordination measures. The intent of the MAGTF Commander was to integrate this tool with C2PC. This was not achieved based on technical interface issues, but the utility of NVP was demonstrated during combined arms rehearsals conducted prior to execution.

The communication architecture to support the employment of C2 Systems was accomplished through continuous experimentation, trial, and error of MAGTF communicators, network specialists, and systems operators. The Marine Corps Tactical Systems Support Activity (MCTSSA) and support contractors also provided technical assistance in working through architecture and system interface issues. Diagram 3 provides a basic overview of the communication architecture used to support C2 systems during the final exercise of CAX 4. The primary communications systems in support of data connectivity were multi-channel radio (MRC-142) and EPLRS. The MAGTF employed a rear command post as the hub for communications to facilitate seamless connectivity to subordinates as the MAGTF forward command elements (Alpha & Bravo) displaced in support of operations.



Observations

The efforts of the Marines of MAGTF-6 to implement and use the fielded C2 Systems cannot be understated. There is no readily available standard operating procedure (SOP) to reference and little information exists to model or demonstrate a complete C4I architecture and how it should be employed. The following bullets are provided based on observation of select TTECG staff:

- Increased engagement and awareness of officers, NCOs, and junior Marines. It was clearly evident that Marines from the principle staff down to junior Marines manning C2PC terminals and viewing the large screen boards had an increased understanding and awareness of the friendly and enemy situation, and combined arms fires being prosecuted.
- Common enemy and friendly picture throughout the MAGTF. Keep in mind, the information is only as good as what is reported and voice communications is still required to fully disseminate intelligence. As the Marine Corps moves from manual to automated updates on friendly positions via position location devices such as the DACT, software alerts and procedures should be implement to warn of lost communications to a vehicle and/or unit, especially when in the offense (i.e. the symbol blinks or changes color). Without positive communications, PLI information may not be accurate and may create the potential for fratricide.
- Rapid and timely dissemination to subordinate commanders via multi-channel radio links. It was evident that the ACE and Artillery Commanders and staffs had enhanced awareness during the conduct of operations and were better able to support the MAGTF and ground commanders.
- Both battery and manual backup procedures were in place to support loss of generator power. Using marine batteries, the MAGTF had the ability to run its C2 network for an estimate of 30 hours if generator loss occurred. Per diagram 1, traditional paper maps were maintained and updated during operations. The only true impact on loss of power involved the power of the overhead proxima displays.
- 6th Marines operates with a near mirror image Alpha and Bravo Command configuration. The Alpha Command COC is a DRASH tent configuration while the Bravo Command is still in SICPS tents. Radio and terminal equipment configurations were nearly identical. During the 2 ½ day CAX 4 final exercise, the Alpha/Bravo Command Elements displaced twice (afternoon of Day 1, evening of Day 2). The complete setup of the Bravo Command Post took approximately 2 hours and 45 minutes.
- EPLRS is a challenging system to initially configure. This is complicated by the inability of units to routinely practice/exercise EPLRS radios without the Net

Control Station (NCS), a division asset. Line of Sight (LOS) considerations for this UHF based radio system make it a challenging system in mountainous terrain without adequate relays, especially during offensive operations. Reliability is questionable without proper resources, training, and planning of relay sites.

- AFATDS operated on a closed VHF (SINCGARS) based network between the MAGTF Command Element, Artillery, and Infantry Battalions. The system was not extensively used between the MAGTF and subordinate command fire agencies. Other than basic targeting and gun geometry displays, the primary use of the system was e-mail/text messages. At the Artillery Battalion level, AFATDS interfaced with the Battery Computer System (BCS). (AFATDS has not been fielded to the Battery level yet.) Calls for fire, quick fire plans, fire support coordination measures, and text messages were routinely exchanged between the Artillery Battalion Command Post and its subordinate batteries.

Concerns and Considerations

- AFATDS. There are significant interoperability issues between AFATDS and C2PC. For example, Fire Support Coordination Measures created in C2PC can be displayed in AFATDS, but are not interpreted by the software as a control measure to warn of potential problems. Targeting information can't be sent between the two systems. AFATDS is also unable to properly process a Suppression Enemy Air Defense (SEAD) mission without processing two missions. In terms of enemy and friendly situation, significant unit naming issues exist. AFATDS won't allow an unrecognizable unit symbol name to pass from the IOS/C2PC if it isn't already defined. From a fires planning and processing perspective, most of the AFATDS applications are not used based on perceived difficulty and lack of training and confidence in the system.
- C2PC. Based on experiences with the CAX program, few units at the regimental level and below have truly exercised C2PC to the extent of 6th Marines. The primary concern is that unless the Marine Corps puts these systems on line and truly exercises them to identify both strengths and weaknesses, product improvement will be misguided. Marines "in the fight" need to provide input to make C2PC and other C2 Systems a better tool.
- Instant Messenger. A splash screen "instant messenger" capability, such as ePOP, can assist in rapid dissemination of information. This shareware product did have some problems however. During operations, messages sent were not always received or splashed on the screen. Backup voice procedures are a must until the technology and software become more reliable and are accredited for use on SIPRNET.
- Naval Visual Program (NVP). This software tool provided a useful 3-D representation of the battlefield terrain, enemy threat rings, and operational graphics

overlays. The lack of interface with C2PC however created considerable extra work for the MAGTF. Units cannot afford to recreate the graphics in each system. Interoperability between the C2 Systems is critical. Secondly, a high-end computer processor is required to use the software.

- Communication Architecture.
 - Considerations should be made to enhance both the multi-channel radio communication, and network monitoring/troubleshooting capabilities at the regimental level. Whether deployed as the Ground Combat Element (GCE) of a Marine Expeditionary Brigade (MEB), a Regiment within a Division, or the Command Element of a special MAGTF, more robust communication systems and tools are required to increase bandwidth and troubleshoot data networks. During CAX 4, the primary means of monitoring and troubleshooting data circuits was the use of the “PING” command. There are a number of initiatives underway, to include the imminent fielding of the SMART-T EHF satellite terminal, Tactical Data Network (TDN) Servers, and upgrades to the MRC-142 multi-channel radio (with FCC-100 multiplexers) that will address some of these issues, but regular review is necessary. The Table of Organization (T/O) for Regiments should also be reviewed to support the increased fielding and emphasis on these systems. Emphasis on Systems and Technical Control is critical to proper troubleshooting and integration.
 - A second issue is the training and employment of EPLRS. The limited availability of the net control station, coupled with no formalize MOS training has significantly hampered the ability of units to train with this complicated system. Future product improvements of EPLRS intend to downsize, eliminate the current NCS configuration, however until this is actually fielded, the practical training and use of all C2 system at the tactical level will be impeded. This issue must be resolved.
 - A third concern is the line of sight limitation of the EPLRS (UHF) radio system. Extensive relays are required in the offensive. Thus far, Infantry Regiments have been fielded with 8 radios and Infantry Battalions with 6. When considering the employment of the radios to include a Main CP, Forward/Tactical CP, CO’s vehicle, and possible rear CP, the number of radio assets available for relays is limited. A possible consideration for MEB level operations is to employ an EPLRS capability with specially designed antennas in our C-130s (tanker/DASC-A), F-18D TAC(A)/FAC(A), and C&C Helicopters. Based on terrain, vulnerability of rotary wing aircraft to enemy fire, and time on station considerations, fixed wing platforms may be better suited to support EPLRS connectivity.
- Power. 6th Marines temp loaned a number of generators from the Combat Engineer Battalion. As command elements become more electronics based, additional generator support is required. The fielding of various C2 systems have not

accounted for power requirements nor considered regimental organization for operations in the field with rear, main, and tactical command posts. Backup generator capability is a must if sustained operations are to occur. Second, with an increased reliance on electronics gear comes an increase reliance on mobile air-cooling systems to keep the gear operational in a desert environment. Portable, mobile systems are available, but still require an external power source.

- Network Systems Management. As C2 Systems are fielded to functional areas such as Intelligence, Operations, Fires, Aviation, Logistics, etc., the need for overall network management increases. Where is the line drawn between the communicator (the path provider) and the functional operator of the box? Who setups up the C2PC gateway or manages the IP addresses within an S-2 section? During CAX 4, a number of clichés occurred based on Internet Protocol (IP) address management. As Command Elements at all levels passes control of the fight between Alpha/Bravo or Main/TAC/Jump elements disconnects occurred in IP addressing that ultimately led to a critical computer off the net and no longer receiving updated information. This was further compounded by the occasional computer failure that resulted in a new machine with another IP address being added to the net. There is no SOP for reporting and disseminating changes during these types of transitions. Naming standards should be considered for units (enemy/friendly), files, overlays, etc. The job will most likely fall under the responsibility of the S-6, but are the trained Marines available to support this critical function?
- Information Management. Information is intended to help create situational awareness as the basis for a decision and to help coordinate actions during execution. With the increased use and reliance on C2 Systems comes the potential for information overload. It's important that information be streamlined to support the Commander's Critical Information Requirements (CCIRs). Each member of the MAGTF must continuously ask the following three questions:
 - Does the information I need already exist?
 - Who else needs the information?
 - What is the most efficient and effective way to transfer the information?

Development of an information management and dissemination plan can assist in identifying information requirements and methods for dissemination and reporting. Too much information can be as bad as too little information in support of decision-making. Diagram 4 (developed by 7th Marines) is an example of how an information dissemination plan may be developed.

Types of Information Communications	Single Channel	C2P C/ IOS		Telephone	AFA TDS		Message Traffic	E-mail SIPR/NIPR	Homepage	Messenger
		Graphics	Chat		Fires	Plain Mag Text				
SALUTE Rep to Higher	S						P	T		
SALUTE Rep from Lower	P	S								
INSUM										
RFI's from Lower	P							S		
RFI's to Higher										
Warning Order							P	S		T
Frag Order							P	S		T
Operations Order							P	S		T
Operations Graphics		P								S
SPOT Rep	P	S								
Situation Rep/ SLANT	P	S								
Pos Reps	P	S								
M/CM										
Obstacle Overlay		P								S
Obstacle Report	P									S
Fire Support Coord	S				P					
Fires Status Report	S				P					
Air										
Allocation transmissions	P									
ATO								P-TBMCS		
Air Support Request	P			S						T
Log SITREP from lower	P									S
Log SITREP to higher	P			S						
Rapid Resupply Requests	P									S
Movement Control										
LOGAIS				S				P		
NBC										
Chemical Downwind Msg										
To lower										
NBC-1 & 4										
NBC-3										
NBC-4										
NBC-6										
Principle communiques										
Personnel Report	S			T				P		
Casualty Report	P			S						
Combat Replenishment	T			S				P		
SIR	P			T				T		
Chaplain										
Services Report										

Diagram 4

- Training.** The 6th Marine command element demonstrated outstanding knowledge and understanding of C2PC at both the officer and operator level. The subordinate units of MAGTF-6 were less experienced; however, with use and practice increased proficiency. To make C2 Systems a valuable tool requires a solid understanding of what the system can and cannot do and operator training and practice. A concern lies in the lack of education provided at the formal schools. As a 2001 graduate of the Marine Corps Command & Staff College, I can attest that virtually no instruction was given on what these systems can do in support of MAGTF operations. Our instruction in school was limited to a few days of C2PC training that was never enforced as a required method to create operational overlays, etc., during the Marine Corps Planning Process block of instruction. AFATDS, TBMCS, and the Intelligence/Maneuver Systems were never introduced in the context of MAGTF operations. Without the officer corps on board with a working knowledge, it's unrealistic to expect that operator training will ever be a priority in a unit. Trying to make the systems work with limited training and knowledge typically leads to frustration and the systems are stored away in some corner.

Conclusion

There is much debate at what level and how much units operating at the tactical level should rely on automated C2 Systems. Mobility, interoperability of systems, and reliability are some of the issues routinely discussed. The Center for Army Lessons Learned (CALL) published

some of the experiences of the 1st Brigade Combat Team, 4th Infantry Division in implementing C2 Systems in Dec 01. Of note were some of the “Myths of Digital Technology” that appear applicable to the Marine Corps.

- Myth Number 1 – “Tactical Combat Operations Centers will get smaller using information technology.”
 - Additional support equipment is required to use C2 Systems; however, as demonstrated by 6th Marines, a digital COC can be setup and operational in under 3 hours. A key to success will be properly designed tents, trailers, equipment, practice, and Marines to operate the systems. Current T/Os do not necessarily support use of these systems in the environment that tactical units will operate (Main and Fwd Command Posts).

- Myth Number 2 – “Training will take less time. Some believe that it is easier using information technology.” The Army sited a three step process on training with information systems that applies to all units:
 - “First, we must train the individual and teams on the basics of being a Soldier” or Marine (do they know how to do their job)
 - “Then we must train them on the technology. How does it work, what are its capabilities and limitations?”
 - “Then we must train them on the application of the technology. How can we apply what we now know about the new technology to how we improve our lethality, survivability, and ability to manage the tempo of the battlefield?”

There is a large training investment to get these systems working for us. Lack of training and proper support in the form of standard operating procedures within Divisions and MEFs in the areas systems integration/architecture and functionality will continue to frustrate units.

- Myth Number 3 – “We need ‘contractor battalions’ to support us.” Early on, this may be the case; however, with training and practice, Marines will be able to install, operate, and maintain these systems.

- Myth Number 4 – “Digitization will show us an immediate impact on battlefield operations.” As the Army cited, this is probably the most dangerous myth. People are touting that information technology is going to show an immediate impact on our ability to conduct warfighting. What we need to remember is that technology is still in its infancy. It isn’t always reliable, nor is it easily sustainable. Second, Units still lack the time to train on the systems.

A large investment has been made across the Services to develop and field C2 Systems. The experiences of 6th Marines during CAX 3 and 4 demonstrate some of the significant capabilities that these systems can produce if used, and the areas where additional work is needed.