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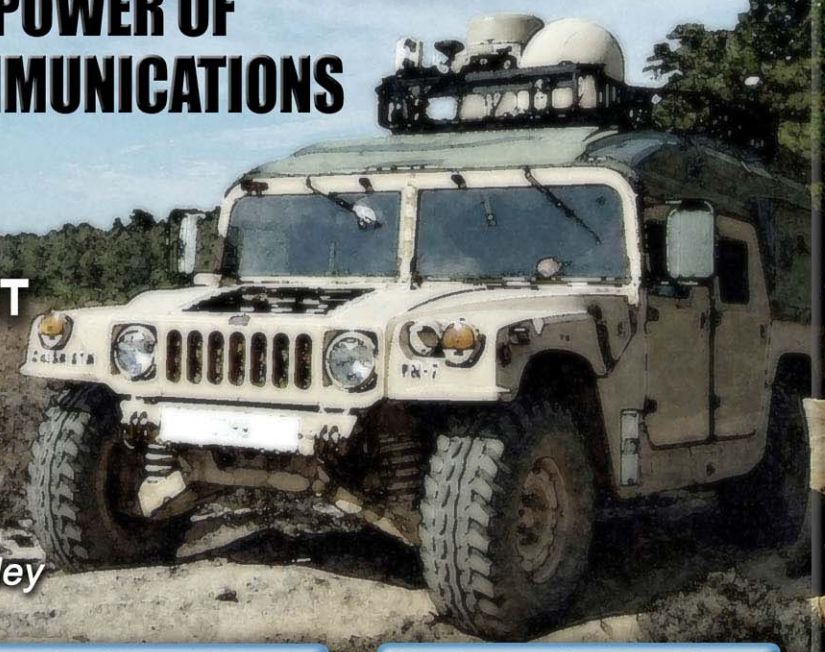
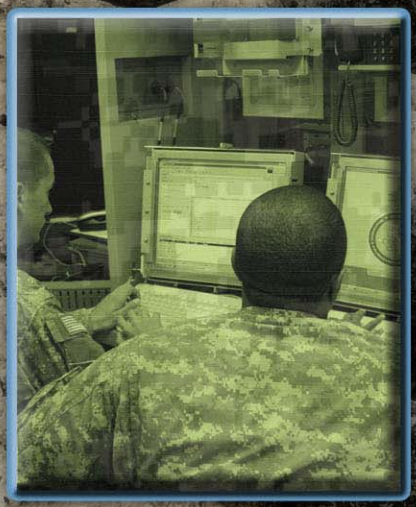
WIN-T

INCREASING THE POWER OF BATTLEFIELD COMMUNICATIONS



"Our Army is not interested in engaging in fair fights."

- BG Jeffrey W. Foley
Chief of Signal



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COMMAND

EDITORIAL STAFF

By Order of the Secretary of the Army:

GEORGE W. CASEY JR.
General, United States Army
Chief of Staff

Official:
JOYCE E. MORROW
Administrative Assistant to the Secretary of the Army
0805802

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Voice of the Signal Regiment

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Supporting the development of the Incremental WIN–T program

Regiment,

In the last *Army Communicator,* I shared our eight critical priorities established in the Signal Center of Excellence Campaign Plan. This edition focuses on one of those priorities: Support the development of the Incremental Warfighter Information Network – Tactical program.

Today, Increment 1 of WIN-T is fielded to 51 percent of the total force and is enabling the exchange of information across the battlefield like never before. This equipment (formerly known as the Joint Network Node) was profiled in a special *Communicator* edition (Fall 2005).

In the pages ahead we will lay out the increasingly powerful capabilities that we will deliver to the force with WIN-T Increments 2 and 3, as they become thoroughly tested and available.

The articles, ranging from general to quite technical, describe future capabilities such as on-the-move network support for command and control; discuss our testing strategy; highlight some revisions to our doctrine, organizational structure, and training; and provide programmatic milestones to keep you informed.

In this era of persistent conflict, commanders demand the rapid transfer of voice, data, and video information. Because our Army is not interested in engaging in fair fights, we will ALWAYS pursue overwhelming advantages in all ways possible. From a communications perspective, this means being equipped with state-of-the-art IT capability and the "know- how" to use it.

Signaleers must guide commanders as they employ the power of a network enabled force in the conduct of full spectrum operations as outlined in the recently published Field Manual 3-0, Operations. Our senior Army leaders get it—they understand the value of the network and the important role that dedicated, skilled signaleers perform. They know that WIN-T is the premier communications program for our future force, as well as the Army's network enabler for the Future Combat System, the Army's flagship program. Leaders acknowledge that the network is the key weapon system that links all sensors, decision makers, and engagement and logistics systems in order to achieve dominant battle command.

BG Jeffrey W. Foley
Chief of Signal

Our senior Army leaders get it—they ... know that WIN-T is the premier communications program for our future force, as well as, the Army's network enabler for the Future Combat System, the Army's flagship program.

In a networked and information-enabled force, fluid arrays of combat forces must be able to spontaneously organize in multiple ways to fight any given opponent at any time.

WIN-T will deliver the core information network to these combat forces for all echelons of tactical communications from theater through select companies. Its advanced networking waveforms for terrestrial, aerial, and satellite-based communications will enable unprecedented operational advantages of shared situational awareness, enhanced speed of command and the ability of forces to self-synchronize – that is a powerful capability.

Capitalizing on state-of-the-art capabilities and commercial off-the-shelf technology, WIN-T will provide guaranteed message delivery of higher priority information within established timelines. The network will be inherently interoperable as we continue to converge all battlefield data over Internet Protocol. Of course, security of the network remains paramount, we must carefully balance the need to share with the need to protect.

I encourage you to read the articles in this edition to learn about current and exciting new WIN-T capabilities that we will deliver to the force. While we cannot provide a network that does it all today, we have made significant progress due to the efforts of many Joint partners, materiel developers, commercial vendors and the U.S. Congress. We are serving in remarkable times and powerful capabilities are on the horizon - stay flexible, adaptive, and embrace the future.

BG Jeff Foley
Army Strong!

CSM's Comments

WIN–T is about Soldiers ...properly trained & motivated leaders

My name is Clark and I'm a Soldier!

Regiment,

We must understand that Warfighter Information Network-Tactical is still about Soldiers; the centerpiece of our all-volunteer force. This superb network is not self-planning, self-deploying nor self-maintaining. The advanced capabilities that WIN-T brings will only happen with properly trained and motivated leaders and Soldiers at every level. Having the information technology capability is not enough – the need for people who know how to use it is what really makes it most powerful and gives us the edge we need to win the global war on terrorism and provide the capabilities necessary to fight-to-win and win wherever we fight.

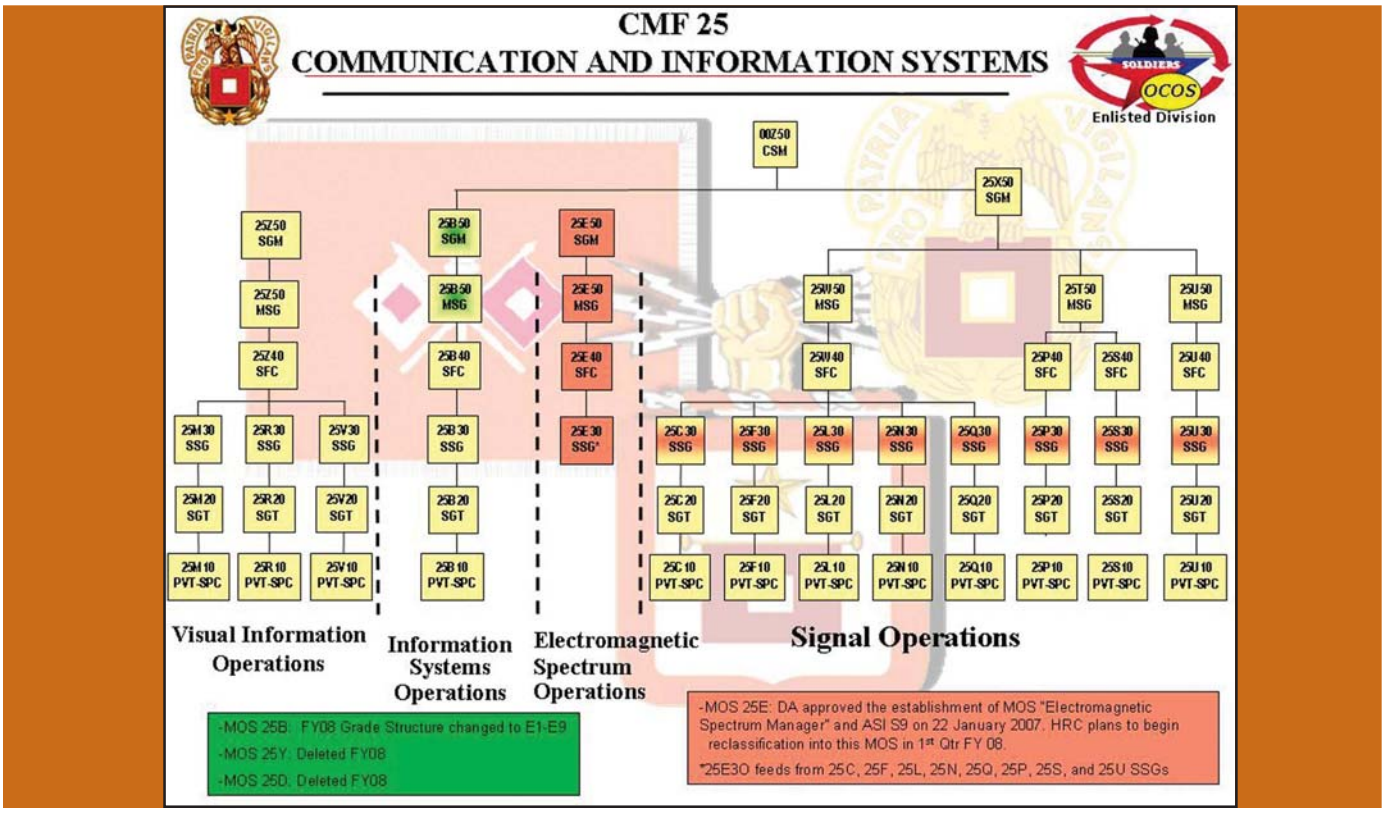
Some things do not change with transformation and modularity and that is the requirement for well-trained, professional Soldiers and leaders to install, operate and maintain this equipment. When your unit is conducting new equipment training, it should be a top priority for your chain of command to ensure every Soldier is set up for success. Soldiers must learn the skills they need to provide these increased capabilities to a network enabled force.

CSM Thomas J. Clark
Regimental Command Sergeant Major

Having the information technology capability is not enough – the need for people who know how to use it is what really makes it most powerful and gives us the edge we need to win the global war on terrorism and provide the capabilities necessary to fight-to-win and win wherever we fight.

We also encourage leaders to use the Signal Center as a training resource; let us know what your shortfalls are and let's work together to solve it. We work for YOU!

CSM Thomas J. Clark
Army Strong and Signal proud!



WIN-T – enabling battle command for the Joint Warfighter through total system Life Cycle Management

By MG Dennis L. Via

The development and fielding of the Joint Network Node over the past four years has resulted in a revolutionary change in command and control communications for our Army.

This enormous change in tactical networks over a relatively short period, has significantly enhanced Army transformation as our Army transitions from the division-based structure to the Brigade Combat Team modular construct while a nation at war.

The delivery of JNN, now Increment 1 of the Warfighter Information Network-Tactical, proved to be a significant enabler for the Signal Corps.

The corps had become severely constrained in meeting the warfighter's ever-increasing mobility and bandwidth requirements using the decades-old Mobile Subscriber Equipment system, which was built primarily as a voice communications system for the United States Army's defense of Germany and the Fulda Gap.

WIN-T Increment 1 provides the new modular force with enhanced video, voice, and data capabilities never before seen on the modern battlefield.

However, this revolution in tactical networking is only just beginning, and is about to unfold even more rapidly as each of the next WIN-T spirals (2, 3, and 4) are fielded and thoroughly integrated across our Army formations over the next few years, marching our Army and the Joint Force into the future.

WIN-T is the "network" in the Army's "Network-Centric" Future Combat System, and as such, has been carefully integrated into the Army Campaign Plan to transform our Army to meet the demands of the 21st Century. And it will be through the collective efforts of the Communications-Electronics Life Cycle Management Command and the organizations that comprise what is known as "Army Team C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance)" (CECOM LCMC, Program Executive Office Command, Control and Communications Tactical, PEO Enterprise Information Systems, PEO Intelligence, Electronic Warfare, and Sensors, and the Communications-Electronics Research, Development and Engineering Center) that will enable the Project Manager and our Army to continue to effectively and successfully "spiral in" revolutionary WIN-T capabilities as the lead catalyst in this continual transformative process.

MG Dennis L. Via
CLCM Commander

Equipment must be operated by trained Soldiers, sustained across a system's lifecycle, and fully integrated to function across the entire spectrum.

In 2009, we will begin delivering WIN-T Increment 2, providing high bandwidth "On-the-Move" communications and network management down to company level. With this capability, Soldiers at the company level will have the capability to maintain situational awareness, receive critical and timely information, and pass operational orders while on-the-move. Needless to say, this is exciting!

But, what appeals most to this Signal Soldier who has spent almost 28 years in uniform, is how this capability will revolutionize the way in which we operate and conceive the network – combining what were once distinctions between satellite and terrestrial communications into a holistically envisioned whole – one that dynamically self forms and self heals. But there's more! Next we add the air-tier.

Much of the focus of WIN-T Increment 3 will be to provide the configuration items that will enable the operational capabilities of the Future Combat System. It will build on Increment 2 by integrating into this holistic network an extended-range pathway for high capacity connectivity using a Firescout and Extended Range Multi-Purpose

unmanned aerial vehicle. This will provide greater support for network planning and execution while on-the-move for maneuver, fires, and aviation brigades.

With Increment 4, we will reach the limits of what we anticipate today for the objective WIN-T system with the capabilities that derive from the Transformational Satellite System. This will add the highest possible levels of protection to the network.

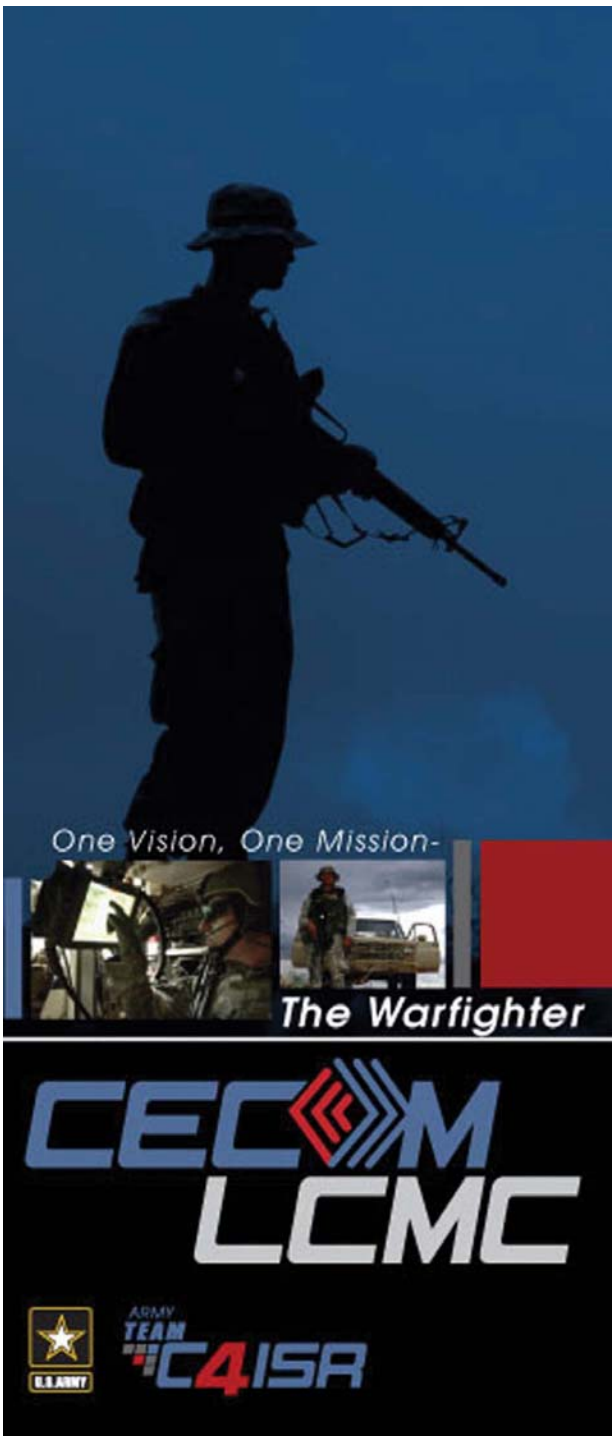
In the United States Army; however, we don't achieve a capability with equipment alone. Equipment must be operated by trained Soldiers, sustained across a system's lifecycle, and fully integrated to function across the entire spectrum.

Right now, organizations from across the Army are engaging with each of the WIN-T increments for further testing and demonstrations and to enable and produce continual refinements, training materials developments and logistics support plans. Fifty engineers from the CERDEC played a significant role in the design and data collection effort of a very successful demonstration of WIN-T Increment 2 in November 2007 that has contributed significantly to the validation of WIN-T capabilities. The manner in which the PM, the Army Test and Evaluation Command, and the CERDEC collaborated in this effort was exemplary, and support such as this will continue, leading to more ambitious testing in late fiscal year 08 and early FY09, and ultimately fielding of WIN-T Increment 2 to Army units in FY10.

Our team at CECOM is playing an essential role and looks forward to being part of what WIN-T will deliver to the Army, and in meeting the Army imperatives in how we expeditiously reset our forces and transform our Army to meet future demands. Our Software Engineering Center ensures interoperability among the software on the network, both in development and post deployment, to ensure network security and compliance. SEC engineers can be found providing a wide range of on-site support to PM WIN-T. They provide oversight for the network architecture and vehicle integration, support acquisition, and also serve as a liaison to the FCS.

Our Central Technical Support Facility at Fort Hood, Texas, was instrumental in the original design and validation of the Joint Network Node and in its integration with the Command Post Platform to test and certify interoperability among the software on the network. That effort played a significant role in the initial success of JNN, and will continue with the WIN-T program. Our Information Systems Engineering Command engineered and installed the regional hub node at the Arifjan, Iraq, dual standardized tactical entry point site and has taken to task the engineering, installation, and testing of the Landstuhl, Germany RHN. The Arifjan fielding was the first RHN fielding and, while in a prototype state, it has already supported WIN-T missions.

As WIN-T increments continue to revolutionize tactical networking, a conceptual transformation is also occurring in sustainment support to the Modular Expeditionary Force. CECOM's Logistics and Readiness Center, in conjunction with PM WIN-T will continuously evaluate the support provided by the Original Equipment Manufacturer, and will look for life cycle cost efficiencies in the transitioning of key support functions to an organic capability. This strategy will rely heavily on a continuing blend of Contractor Field Service Representatives' support from the OEM, and over time, that knowledge base will be transferred to the United States Army workforce, both Soldiers and government civilians, as we gain proficiency and confidence in the system.



With WIN-T Increment 1 now unfolding across the Army as a Program of Record, Two-Level maintenance concepts will drive solutions to sustainability and supportability across the full spectrum of operations. These maintenance concepts will drive spares requirements at the field level, which will necessitate future strategies to accommodate the integration of organic repair capabilities across disparate units. This will also accommodate supportability capabilities at the sustainment level.

The Tobyhanna Army Depot is now involved in the reset of WIN-T Increment 1 and the Secure Mobile Anti-Jam Reliable Tactical Terminal. TYAD is working with PM WIN-T to complete the SMART-T Core Depot Assessment in support of the sustainment of WIN-T.

The CECOM Acquisition Center has provided innovative acquisition support to system development and demonstration of both WIN-T Increment 2, estimated at $120 million, and WIN-T Increment 3, estimated at $940 million.

Meeting an unprecedented challenge in sustaining the force relies on our ability to adequately provide power to WIN-T Increment 1 and its successors in a more effective manner. In the past, Army power generation and distribution equipment was fielded in a "stove-piped" manner to meet individual user power requirements. This stove-piped approach resulted in the fielding of a large number of smaller generators, creating a logistics burden and an increased demand for maintenance and fuel.

Today, command posts are fielded with an electrical power architecture commonly referred to as the CPS (Central Power Solution). CPS provides a smaller number of larger sized generators coupled with power distribution equipment to centrally power multiple user requirements. These "power islands" significantly reduce the amount of fuel required to provide power, reduce the footprint, and provide better reliability, supportability, and readiness.

In the future, we must plan for a common power architecture that will establish power grids to include an intelligent power management capability. This capability will permit the use of renewable energy sources, utility power, on-board vehicle power, and other power sources to minimize the need to operate fossil fuel burning generator sets. In the interim, PM WIN-T and PM Tactical Radio Communications Systems are currently collaborating with PM Mobile Electric Power to migrate all Command Post power generation and environmental control equipment to standard military hardware.

The manner in which WIN-T Increment 1 was delivered to the force will largely continue over the next few years following the CECOM LCMC Army Force Generation model. Although the PM has an extensive new equipment training program that is very well aligned with the phases of ARFORGEN, for the long-term training requirements of the Army and the Signal Corps, it is critical that the U.S. Army Signal Center be equipped with the latest WIN-T technology. We can no longer afford to have our Soldiers train on last-generation technology. Our Soldiers must thoroughly understand that they are a critical proponent and component – in fact, the most important component of Army transformation. Their technical skills and knowledge of network operations must keep pace with rapid change in order to achieve this revolutionary capability.

"From Concept to Combat", the CECOM Life Cycle Management Command and Army Team C4ISR are fully engaged and committed to developing, acquiring, fielding, and sustaining indispensible C4ISR capabilities for the Joint Warfighter. As previously stated, WIN-T, when fully fielded, will completely revolutionize the commander's abilities to effectively C2 their forces down to company level while operating on-the-move. However, at the end of

the day, it will be the Soldier who will truly transform our collective ability to leverage WIN-T and other C4ISR systems and capabilities to meet the current and future needs of the Warfighter.

At CECOM LCMC, our Soldiers, government civilians, and industry partners are proud to be part of this revolutionary process, and in assuring the WIN-T system's effectiveness through total system Life Cycle Management for mission success.

One mission, one vision – the warfighter.

Army Strong!

MG Via serves as the commander, CECOM Life Cycle Management Command. Via leads a world-wide organization of more than 10,000 military and civilian personnel responsible for coordinating, integrating and synchronizing the entire life-cycle management of the C4ISR systems for all of the Army's battlefield mission areas – maneuver control, fire support, air defense, intelligence, combat services support, tactical radios, satellite communications, and the warfighter information network.

Prior to assuming command, Via served as commanding general, 5th Signal Command, and United States Army, Europe and Seventh Army chief information officer/assistant chief of staff, G6.

Acronym QuickScan

ARFORGEN – Army Force Generation
C2 – command and control
C4ISR – Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CECOM – Communications-Electronics Command
CECOM LCMC – CECOM Life Cycle Management Command
CERDEC – Communications-Electronics Research, Development and Engineering Center
CPS – Central Power Solution
DISA – Defense Information Systems Agency
FCS – Future Combat System
FY – fiscal year
JNN – Joint Network Node
JROC – Joint Requirements Oversight Council
LCMC – Life Cycle Management Command
OEM – Original Equipment Manufacturer
PEO – Program Executive Office
PM – Project Manager
RHN – regional hub node
SEC – Software Engineering Center
SMART-T – Secure Mobile Anti-Jam Reliable Tactical Terminal
TYAD – Tobyhanna Army Depot
U.S. – United States
USAREUR – United States Army, Europe and Seventh Army
USSTRATCOM – U.S. Strategic Command
WIN-T – Warfighter Information Network-Tactical

Advancing the Army *through an innovative process*

By BG Nick Justice

The Global War on Terror is fought on a continuously changing landscape, which constantly presents new challenges to the warfighter that are both physical and technological in makeup.

The pace, however, is not beyond the developmental means of the United States Army's materiel community, which incorporates methods of adaptation and innovation to develop command, control, and communication capabilities and battle command applications that effectively support counter insurgency efforts and broadly position its Soldiers to meet full spectrum operations.

The rate of fielding has dictated the need for a large support infrastructure to accommodate the equipping, training, and sustaining of 20-plus brigade-equivalent units per year. To support the scale and pace of wartime fieldings and to adjust to constant resource and schedule tradeoffs, the Program Executive Office for Command, Control, Communications, Tactical has instituted tightly coupled processes between its operational and acquisition communities that allow a clear understanding and prioritizing of warfighter capabilities.

Online communication and resource tools and information tracking systems such as the Unit Set

Fielding Process, the Single Interface to the Field portal, and the Battle Command as a Weapons System Initiative are three specific processes that have been stood up to manage these challenges and direct the implementation of tactical C3 capabilities.

USF is a five-phase process that manages the planning and implementation of fielding and reset for all major Army tactical command, control, communications, computers, intelligence, surveillance, and reconnaissance capabilities. The U.S. Army and, specifically, the organizations of the Communications Electronics Command Life Cycle Management Command, simultaneously provided warfighters with everything they need to perform their mission in combat through the phase of USF. This means providing the Army Battle Command Systems (ABCS 6.4), the communications systems, power, the network, and enablers all at the same time.

The five USF phases are:
1) Planning for fielding and engineering
2) Fielding execution
3) Supporting while deploying
4) Supporting while deployed
5) Resetting to headquarters

The implementation of the Army Force Generation model provides a structured progression of increased unit readiness over time resulting in recurring periods of availability of trained, ready, and cohesive units. Battle update briefings held on a bi-weekly basis coordinate the C3 leads of the USF process and open lines of communication with Army Field Support brigade commanders, engineers and U.S. Army leadership.

The SIF initiative was stood up to provide 24/7 reach back support for warfighters and forward support personnel through a secure C4ISR web portal and a support operations center for on call assistance, whether a capability is under test, in an exercise, or deployed in an operational theater.

The SIF is the primary tool of choice for field support information and integration to be used across PEO C3T and its incident reporting module serves as the standard tool for reporting and tracking issues and trouble tickets for all C4ISR systems. Its field support module is the authoritative source for C4ISR field support personnel data, where related missions, region locations, supported units and contact information will be maintained.

For tactical C3 capabilities, there are two major forces propelling the evolution of capability sets over the next several years: operational lessons learned from the latest major conflicts and force modernization initiatives based upon evolving Network Centric Warfare concepts.

The focus of the BCAWS initiative is on managing the readiness of battle staff, their BC systems, and associated training for command posts and command groups by reporting the status of each as weapons systems. Through monthly reports submitted by unit commanders to the Headquarters Department of the Army, the Army can conduct a full examination of equipment status and training levels related to its fielded equipment. The goal is for a standardized solution for battle command systems to be fielded across the force.

An aspect critical to the drive of these processes has been the institutionalizing of a leadership vision that energizes both the operational and acquisition staffs to deliver the right warfighter capability, at the right time, and at the best possible cost.

Lessons learned from Operation Iraqi Freedom span the full spectrum of operations. During Phase 4 (Initial Entry) and Phase 5 (Decisive Operations) operations in OIF, the importance of mobile command and control, and beyond line-of-sight communications was highlighted. That need was filled at the time with the implementation of the Joint Network Node-Network – a capability that provided battalion-level and above warfighters with the ability to connect to the Army's digitized systems, voice, data, and video via satellite internet connection at-the-quick halt.

The JNN-N has since transitioned to the Warfighter Information Network-Tactical Project Manager office where a second increment initiation will offer a constant satellite internet connection to the warfighter on-the-move. At its core, the WIN-T solution delivers a three-tiered communications architecture (space, airborne, and terrestrial), adds on-the-move operating capabilities, increases available bandwidth, and delivers the level of force modernization required by the Army's emerging Future Combat System. But WIN-T is the backbone to a larger C4ISR capability.

Currently, the primary mobile command and control capability in OIF is delivered by Force XXI Battle Command Brigade and Below blue force tracking on key leader platforms within the Army's maneuver formations. When linked with its satellite communications network, FBCB2's core ability to share a common operational picture can be supplemented by a basic text-based "chat" capability, allowing maximum synchronization of maneuver platforms anywhere on the battlefield. The BFT typical display of blue and red dots depicts friendly and unfriendly forces providing the Soldier with answers to the questions: Where am I? Where are my buddies? Where is the enemy?

A continued effort to increase the density of fielding of this core operational capability across the

Army and Marine Corps may next lead to the introduction of a Joint Battle Command – Platform Product Line.

By leveraging a common software core on a mix of hardware form factors, the Army can extend its critical situational awareness and communications capabilities from maneuver platforms down to logistics vehicles and dismounted Soldiers. In addition, JBC-P will employ Tactical Service Gateways that will allow bridging of tactical enterprise services such as e-mail, enterprise chat, XML-based message exchanges, and Web access onto the bandwidth-constrained platform communications network.

Bringing these anti-fratricidal and awareness capabilities down to the level of the dismounted Soldier is an important advancement for the PEO C3T and a critical one for the warfighter. Although the C2 systems in command posts participate almost constantly in the tactical wide area network, the combat business process has transitioned from well-known, rehearsed, large unit combat operations to emergent, small unit stability and support operations, and counter insurgency operations. In support of this new environment, tactical units have developed a second generation of C2 systems to satisfy evolving unit-identified requirements in the field. These second generation systems consist of an ad hoc architecture of Web servers, database servers, and Web-based software applications to manage the dynamic operational information flow in theater.

The increasing demand for reliable C3 capabilities in OIF led the Army to equip its forces rapidly with an array of commercial off-the-shelf/government off-the-shelf radios and appliqués that have been linked together to form operational, squad level networks. However, continuing advances in technologies allow for smaller, lighter, more rugged, capable, and adaptable systems that can provide greater situational awareness at the Soldier level.

A necessary part of the rapid system evolution within the C3 acquisition community is the ability of captains and majors in the field to translate their aggressive operational and technical experience into recommendations to adapt the U.S. Army's capabilities to support the way they fight.

One such example would be the recently conducted documentation and engineering exercise organized by Program Executive Office for Command, Control, Communications-Tactical to examine the current structure of its tactical operation centers. The six-week event, known as Operation TOCFEST, brought together representatives from government and the U.S. Army's industry partners for an internal evaluation and engineering field study that would provide a Battle Command System-of-Systems engineered baseline solution for command posts for the warfighter.

Finally, the ability to adapt is a direct result of the operational force mentoring the material community in the art of warfare and permitting our presence in their formations. In response to operational lessons learned and as part of its active force modernization efforts, the U.S. Army has instituted processes that streamline its interface to the operational force for equipping, training, and sustaining battlefield capabilities.

BG Justice graduated from the University of Maryland with a Bachelor of Arts degree in history in 1977. He received a Master of Arts degree in Human Resources Management from Pepperdine University.

From July 2007 to present, Justice continues his assignment as the Program Executive Officer for C3T, Fort Monmouth, N.J.

Acronym QuickScan

ABCS – Army Battle Command Systems
AFSB – Army Field Support Brigade
ARFORGEN – Army Force Generation
ATH – At-the-Halt
BCAWS – Battle Command as a Weapons System
BFT – Blue Force Tracking
BUB – Battle Update Briefings
C2 – Command and Control
C3 – Command, Control, and Communication
C4ISR – Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
CECOM – Communications Electronics Command
CLCMC – CECOM Life Cycle Management Command
FBCB2 – Force XXI Battle Command Brigade and Below
FCS – Future Combat System
HQDA – Headquarters Department of the Army
JBC-P – Joint Battle Command – Platform
JNN-N – Joint Network Node-Network
LCMC – Life Cycle Management Command
OIF – Operation Iraqi Freedom
PEO C3T – Program Executive Office for Command, Control, Communications, Tactical
SASO – Stability and Support Operations
SIF – Single Interface to the Field
SOC – Support Operations Center
TOC – Tactical Operation Centers
TSG – Tactical Service Gateways
U.S. – United States
USF – Unit Set Fielding
WIN-T – Warfighter Information Network Tactical

WIN-T

Information = combat power *magnifies effects*

By COL Edward H. Eidson

Information is the element of combat power that allows commanders to magnify the effects of maneuver, firepower, and protection. The Warfighter Information Network – Tactical is the transformational command and control system that manages tactical information transport at theater through company echelons in support of full spectrum Army operations. This network is currently being fielded incrementally to the Army. Today WIN-T Increment 1 has been fielded to about 51 percent of the Total Force. WIN-T Increment 2 builds on Increment 1 capabilities and focuses on providing greater networking support for Brigade Combat Teams. Fielding of WIN-T Increment 2 is planned for 36 BCTs, nine division headquarters, and five regional Network Service Centers.

WIN-T Increment 2 fulfills BCT networking requirements for secure, high-bandwidth communications while At-the-Halt, At-the-Quick-Halt, and On-the-Move. During ATH operations, deliberate network equipment installation and infrastructure emplacement are conducted with the expectation of prolonged static operations. ATQH operations are characterized by temporary halts in which minimal communications are established to perform an immediate mission. The intent is to provide rapid network support and displace quickly upon mission completion. WIN-T OTM equipment provides continuous network connectivity on tactical platforms traveling cross country.

The fundamental resource that WIN-T provides the warfighter is prioritized information. WIN-T Increment 2 combines equipment and Network Operations to deliver information to the warfighter within established priorities and timelines set by the commander. For example, the speed of routine, non-time sensitive information may be required in 15 minutes or less, while survival information may be required in less than 0.5 seconds (objective specification). The WIN-T Increment 2 NetOps capability directs information delivery and adheres to the Global Information Grid Mission Area Initial Capabilities Document. It consists of tools to perform Network Management, Information Assurance, and Information Dissemination Management.

Meeting information delivery time specifications must be balanced with protecting information. Signal personnel use WIN-T Information Assurance tools to secure information in the network and protect it against network attacks. Securing the information is achieved by implementing the "WIN-T Colorless Core" architecture. This is a GIG-compliant security architecture in which all user data, including Unclassified data, is encrypted with NSA-approved Type 1 Communications Security equipment. Wireless transmission links are also encrypted using NSA-approved Transmission Security. The network is protected against attacks and unauthorized access using state-of-the-art commercial software and hardware.

The primary WIN-T Increment 2 configuration item is the Tactical Communications Node. The TCN is fielded at division, brigade and battalion echelons to support tactical command posts during OTM, ATQH and ATH operations. User devices such as telephones and computer equipment will connect to the TCN via interfaces located in the Tactical Operations Centers and

Tactical Command Posts. The TCN provides both Beyond Line-of–Sight satellite and Line-of-Sight terrestrial communication transmission capabilities.

The WIN-T Point-Of-Presence is the primary OTM configuration item that will be installed on the tactical platforms of select commanders and staff officers at division, brigade and battalion levels. The POP enables mobile battle command by providing both secret and unclassified OTM network connectivity. This network connectivity is established using BLOS satellite and LOS terrestrial systems. The OTM minimum user data throughput rate for the satellite system is 256 kilobits per second. When the terrestrial LOS system has connectivity the POP data throughput is 10-20 Megabits per second.

A Soldier Network Extension will be installed on select vehicles at the company echelon to provide an OTM wide area network connection through a BLOS satellite transmission system. The SNE provides Secret data service at 64 – 128 kbps. The primary role of this equipment is to provide legacy radios (Single-Channel Ground-to-Air Radio System and Enhanced Position Location Reporting System) range extension through the WIN-T network. This is especially significant for operations when a company is operating beyond the battalion SINCGARS or EPLRS network range. The SNE will extend legacy radio connectivity over a satellite link so that data exchanges such as situational awareness updates can continue uninterrupted. The SNE also provides support for Secret voice telephone service to a local user.

The WIN-T Increment 2 network is planned and managed using Network Operations and Security Center tools at the division and brigade echelons. The NetOps functions are the same for both echelons, however additional equipment is provided to the Division G6 section to support a larger staff. The primary NOSC capabilities are:

- **Network planning and management**
- **Topology generator to provide map-based network schema and status**
- **Coverage planning for wireless Local Area Networks, HNW, NCW, and HCLOS radios**
- **Information Assurance monitoring and administration**
- **Spectrum planning for all known emitters and Management of Network emitters**
- **Enroute Mission Planning**
- **Key management and Cryptonet planning**
- **Support for Public Key Infrastructure**
- **Battle Command Address Book planning**

WIN-T Increment 2 will provide unprecedented network connectivity for Brigade Combat Teams while they quickly traverse the battlefield during fast moving operations. WIN-T Increment 2 technologies give the warfighter in select Army units improved access to battle command information and applications. The fielding of advanced network capabilities tailored to commanders' information priorities and polices enable them to gain a significant tactical advantage. Mobile network connectivity down to maneuver company level further extends the high capacity tactical network, in order to increase commanders' situational awareness and ability to command and control their units during full spectrum operations.

COL Eidson was commissioned in 1982 and holds a Bachelor of Arts in physics from Carson-Newman College and a Master of Science in systems technology from the Naval Postgraduate School. He has been the TRADOC Capability Manager for Networks and Systems at the U.S. Army Signal Center, Fort Gordon, Ga., since October 2007.

Acronym QuickScan

ATH – At-the-Halt
ATQH – At-the-Quick-Halt
BCT – Brigade Combat Team
BLOS – Beyond Line-of-Sight
COMSEC – Communication Security
EPLRS – Enhance Position Location Reporting System
GIG – Global Information Grid
GIG-MA ICD – GIG-Mission Area Initial Capabilities Document
HCLOS – High Capacity Line-Of-Sight
HNW – Highband Networking Waveform
Kbps – kilobits per second
LAN – Local Area Network
LOS – Line-of-Sight
Mbps – Megabits per second
NCW – Net-Centric Waveform
NetOps – Network Operations
NOSC-B – Network Operations and Security Center – Brigade
NOSC-D – Network Operations and Security Center – Division
OTM – On-the-Move
PoP – Point-of-Presence
SINCGARS – Single-Channel Ground-to-Air Radio System
SNE – Soldier Network Extension
TAC – Tactical
TCN – Tactical Communications Node
TCP – Tactical Command Post
TOC – Tactical Operations Center
TRANSEC – Transmission Security
WIN-T – Warfighter Information Network-Tactical

PMO WIN-T
the future is now!

By COL William C. "Chuck" Hoppe

Introduction

June 5, 2007, was a big day for the Army, the Army Signal Regiment, Program Executive Office Command, Control, and Communications Tactical and Project Manager Warfighter Information Network-Tactical. What was so special about June 5, 2007? That was the day the Under Secretary of Defense for Acquisition, Technology and Logistics, the Honorable Kenneth Krieg signed the Acquisition Decision Memorandum and [Nunn-McCurdy] Certification Package for the WIN-T program. The Nunn-McCurdy certification was the culminating point for two programs, the Joint Network Node-Network program and the WIN-T program. It was also the trigger in an event driven timeline for changes at Fort Monmouth, N.J., and some internal PEO C3T reorganization decisions. In this article, I will briefly describe the major impacts of the series of events that came out of the Nunn-McCurdy certification of the WIN-T program; the reorganization of certain programs within PEO C3T; and give a quick overview of the WIN-T Program Management Office; and finally, give an operational "so what?" as to the impact in the operational community.

What was so special about June 5, 2007? ... The Nunn-McCurdy certification was the culminating point for two programs, the Joint Network Node-Network program and the WIN-T program.

Nunn-McCurdy

Through the calculus of Title 10 United States Code Section 2433, Unit Cost Reporting, program managers of Major Defense Acquisition Programs like WIN-T have some pretty specific reporting requirements to the Congress. Fundamentally, Project Managers are always concerned with cost, schedule, and performance of their programs to ensure the required capability (performance) is provided in a timely manner (schedule) with the best bang for the buck (cost) to support the warfighter while being good stewards of the taxpayers' dollar. For PMs of MDAPs, the Nunn-McCurdy requirements loom large and can have a significant impact on their programs if the tripwires are tripped. The Unit Cost Reporting section of Title 10 prescribes two specific criteria which require the PM to make special reports to Congress and in the case of the second criterion, prescribes that the department certify that program as necessary against some specified criteria or terminate it.

The criteria are strictly metrics-based and when the thresholds are breached, the process is automatic regardless of why the program experienced the cost growth. PMs are required by this part of the law to report cost growths that meet 15 percent growth (called significant cost growth) from the original baseline and 25 percent growth (called critical cost growth) from the original baseline. If a program experiences "critical cost growth," Title 10 United States Code § 2433 (e)(2)(b) requires a written certification of basically five things, the cost of the program and that the program is:

1) essential to national security;
2) there's no alternative which will provide equal or greater military capability at less cost;
3) the new estimated costs are reasonable; and
4) the management structure is adequate.

One of the outcomes of the June 5, 2007, ADM is that the USD(AT&L) certified the restructured WIN-T program in accordance with those criteria. There were two other outcomes of the Nunn-McCurdy process; as just stated, the WIN-T program was restructured and the management structure of the program was modified. The fundamental operational impact of this decision, however, was the Department of Defense's validation of the capabilities in the WIN-T program and continued commitment to bring that capability to the warfighter as soon as possible.

Reorganization of PM WIN-T

The reorganization of the WIN-T program was codified in the June 5 ADM but had been a planned, event driven process by the PEO C3T for a while. Without going through all the history of the Joint Network Node-Network program, which is a huge success story for the Army, suffice it to say that the Army's needs in Operation Iraqi Freedom and Operation Enduring Freedom exceeded the capabilities of the Mobile Subscriber Equipment which was the baseline communications backbone of the Army at the start of those operations. The JNN-N program was the interim solution that moved the Army to an everything-over-Internet-Protocol based architecture

that is command post centric, at-the-halt and at-the-quick-halt, using commercial Ku satellite communications.

As part of the ADM, JNN-N was moved under PM WIN-T and re-designated, WIN-T Increment 1 and broken into two sub-increments. Increment 1a is basically the same JNN capability that has already been fielded to more than 50 percent of the total force (COMPOs 1, 2, and 3) and over 80 percent of active force with the addition of the ability to operate in the Ka spectrum. This ability to operate in Ka gives units the potential to take advantage of the Wideband Global Satellite constellation and reduce the Army's dependency on leased commercial Ku satellites.

Increment 1b is an upgrade to the Increment 1a units that brings two specific capabilities, the SATCOM on-the-move waveform and the DISA "colorless core" information assurance architecture. These two capabilities make Increment 1b units, one hop compatible with Increment 2 units which have, as core capabilities, the SOTM waveform and the "colorless core" IA architecture. All Increment 1 (1a and 1b) units still must operate at-the-halt or at-the-quick halt.

For those that are familiar with the history of JNN, the initial fielding of JNN was to the 3rd Infantry Division. 3ID received as part of its basis of issue, two division tactical hub nodes. After the 3ID fielding, the Army made a strategic decision to reduce the BOI from two TAC hubs to one and augment the tier II architecture with regional hub nodes that would have the capacity to handle three divisions. In order to meet the Army's world-wide mission requirements, there would need to be five RHNs strategically placed throughout the world. The ADM and the subsequent Increment 1 Acquisition Program Baseline made those RHN assets a formal part of the Increment 1 program and added them to the node count of the Increment 1 baseline. The Increment 1 capability is in production as this article goes to print and will be going to operational test shortly after publication.

The original WIN-T program-of-record was a "big bang" program. All the capabilities came at the same time. The old POR was divided up into increments that allow the fielding of mature technologies early. Increment 2 is defined by the June 5 ADM as the "initial Networking-on-the-Move."

Increment 2

The original WIN-T program-of-record was a "big bang" program. All the capabilities came at the same time. The old POR was divided up into increments that allow the fielding of mature technologies early. Increment 2 is defined by the June 5 ADM as the "initial Networking-on-the-Move." Increment 2 is the early introduction of the OTM terrestrial and celestial waveforms, and the network operations systems to manage the new OTM network. These technologies are early releases of the objective technologies that come in Increment 3, but are deemed mature and ready for introduction to the operational Army. The Highband Networking Waveform is the new terrestrial OTM waveform which allows the units within line-of-sight of each other to communicate at significantly higher data rates while on the move. As with any formation traveling over undulating terrain, maintaining line-of-sight can be a challenge. In an Increment 2 unit, this is not an issue. The network is smart enough to detect when a LOS HNW link is degrading and, without operator intervention, switches that link over to the Network Centric Waveform, which is the SOTM waveform. When the node can re-acquire LOS neighbors, the NCW link is dropped, again without operator intervention, and a new HNW link is established. This is a significant operational capability. It allows the network to be ad-hoc, self-healing, and self-forming. In Increment 2, the HNW and NCW waveforms are housed in separate hardware. This HNW/NCW capability basically replaces the JNN capability from division to battalion. Increment 2, however, extends that WIN-T backbone down to the company level with a B-kit that goes in a vehicle at Company level with an NCW link capability, the Soldier Network Extension. The SNE is intended to extend the network to the company level and to provide an alternative to bridge combat net radio clouds with a combat net radio extension; basically using the NCW satellite capability in the SNE as a satellite retrans of legacy and future waveforms. Increment 2 is also in production now and is scheduled for limited user test in Fiscal Year 2009 and a low rate initial production decision in fiscal year 2010.

Increment 3

The ADM defines Increment 3 as "Full Networking on the Move." Increment 3 looks a lot like the original POR; it has all the configuration items that the original POR had. It takes the OTM technologies fielded in Increment 2, repackages them in their final waveforms, final form, fit, and function; it brings the Future Combat System unique CIs to meet the space/weight/power and thermal design constraints of the target FCS platforms. Increment 3 completes the three tiered architecture by introducing the air-tier or

what WIN-T calls, an advantaged node. And, in order to make this all work, the Increment 2 NETOPS is updated with the target Increment 3 NETOPS. Increment 2 is inextricably tied to Increment 3 both contractually and developmentally. The technologies in Increment 2 are early, mature releases of technologies that are threshold requirements in the Increment 3 program. Fundamentally, the Army can't get to Increment 2 without the development of the technologies in Increment 3.

The air–tier seems to be the immediate topic of discussion when Increment 3 comes up. In Increment 3, two unmanned aerial systems get outfitted with WIN-T communications payload packages, the class IV at the FBCT and the ERMP at division. The WCP is an HNW-based payload that allows the network an additional potential path when the terrestrial LOS link is broken. Remember, in Increment 2 the network had two options, terrestrial LOS over HNW or celestial over NCW. The WCP provides that intermediate option. If the terrestrial LOS link goes down and an "advantaged node" is in the architecture, the network can switch to the advantaged node and not have to go up over satellite. In Increment 3, satellite links potentially become the third option. Increment 3 is under development today. It does bring the FCS CIs along with the other capabilities previously mentioned to the rest of the Army.

Increment 4

Increment 4 of WIN-T is defined in the ADM as "Protected Satellite Communications on-the-Move". Protected in this case refers to satellite communications that have characteristics that provide anti-jamming, low probability of intercept and low probability of detection. This capability requires a new satellite constellation capable of providing these AJ/LPI/LPD capabilities for the small aperture OTM ground terminals. The satellite constellation that provides AJ/LPI/LPD is the future Transformational Satellite constellation. WIN-T Increment 4 will provide these capabilities as the TSAT constellation is brought on line.

Increment 2 is inextricably tied to Increment 3 both contractually and developmentally. The technologies in Increment 2 are early, mature releases of technologies that are threshold requirements in the Increment 3 program. Fundamentally, the Army can't get to Increment 2 without the development of the technologies in Increment 3.

The bigger PM WIN-T

The WIN-T Increments 1 through 4 are normally what individuals are referring to when they say, "WIN-T." However, the Project Management Office WIN-T has a lot more programs and capabilities that bring capability to the warfighter in addition to Increments 1 thru 4. PMO WIN-T includes the Product Management Offices that bring the Army Multi-Channel Satellite Terminals, the Product Management Office for Extremely High Frequency Satellite Systems, and the Product Director for Tactical Networks Architectures and Configurations-Current.

PdM MCST is responsible for the Army's tactical multi-channel satellite ground and commercial terminal programs. MCST specializes in the multi-frequency band (C, Ku, Ka and X Bands) satellite terminals. These terminals provide commanders with assured and reliable communications throughout the world using both commercial and military satellite constellations. The equipment provided by PdM MCST includes: Phoenix Satellite Terminal, Secure Enroute Communications Package-Improved, Global Broadcast System, Lightweight High-Gain X-Band Antenna, Lightweight Multi-Band Satellite Terminal, Large Aperture Multiband Deployable Antennas, and manages the Commercial SATCOM Terminal Program which provides commercial SATCOM to the Army as well as our sister services and other government agencies.

The Product Manager for Extremely High Frequency Satellite Systems is the Army's designated PdM for the High Capacity Communication Capability, a pre-MDAP ACAT I program that will bring protected, high-bandwidth SATCOM capability to the tactical Warfighter via the Transformational Satellite constellation. Additionally, PdM EHFSS provides life cycle management of the Secure, Mobile, Anti-jam, Reliable, Tactical Terminal, the Single-Channel Anti-jam Man-Portable terminal, and any advanced modifications or international partner variants of those systems. PdM EHFSS is currently providing Life Cycle Management to four programs to include fielding and upgrading 325 SMART-T's and its associated communications planning tools for both the SCAMP and SMART-T programs, as well as sustaining 628 SCAMP terminals, and coordinating the pre-Milestone A efforts associated with HC3.

PD TNAC2 is responsible for ensuring compatible architectures among tactical network systems, to ensure interoperability within the greater tactical network and is charged to prevent individual stovepipe or proprietary solutions. PD TNAC2 uses the Current Force Network Working Group and associated sub-working groups, as venues for PdMs, developers, and

others developing tactical network solutions to share their plans and help formulate an open systems architecture that enables communications interoperability. This is done across all PEO C3T programs and to a great extent, all tactical networking programs; PD TNAC2 provides the technical glue for individual products enabling seamless communications.

Operational impacts

I would hope after getting this far in the article that you share my opinion that the PM WIN-T products have an immense operational impact on our Army. It is a unique opportunity, the responsibility for which is reinforced everyday by the dedicated team of core government, government matrix, systems engineering and technical assistance contractors, and our prime industry partners which make up the PMO team.

PMO WIN-T is there:

- From the current force backbone tactical network provided by Increment 1 (and the previous lots/spirals of JNN)
- The contract execution of the CSTP program which enables the procurement of the current strategic satellite backbone in the CENTCOM area of operation using the Deployable Ku Earth Terminal scattered throughout Southwest Asia,
- To the development of the future tactical networks (Increments 2 – 4) and current and future protected satellite networks (SMART-T and HC3),
- To the integration of networking capabilities into an overarching functional network

The future capabilities allow commanders to plan, employ, and mass the network just like we plan, employ, and mass indirect fires. The operational impact of PM WIN-T products are felt everyday in every unit connected to the tactical network.

Communications ATH, communications OTM, bring the network that enables Battle Command, Reach, and Reachback. These capabilities provide the Army the ability to be modular and interoperable. The future capabilities allow commanders to plan, employ, and mass the network just like we plan, employ, and mass indirect fires. The operational impact of PM WIN-T products are felt everyday in every unit connected to the tactical network. It is indeed a privilege to have the opportunity that we in PM WIN-T have in supporting the best Army in the world. Our focus is the warfighters' ability to execute their mission, anywhere in the world.

COL Hoppe is currently the Project Manager, Warfighter Information Network—Tactical, in the Program Executive Office for Command, Control Communications-Tactical, Fort Monmouth, N.J.

Acronym QuickScan

ADM – Acquisition Decision Memorandum
AJ – Anti-Jamming
APB – Acquisition Program Baseline
AT&L – Acquisition Technology and Logistics
ATQH – At-the-Quick-Halt
ATH – At-the-Halt
BOI – Basis Of Issue
CFN WG – Current Force Network Working Group
CI – Configuration Items
COMPOs – Component Code
CPS – Communications Planning Tools
CSTP – Commercial SATCOM Terminal Program
DKET– Deployable Ku Earth Terminal
EHF –Extremely High Frequency
EHFSS – Extremely High Frequency Satellite Systems
EOIP – Everything-Over-Internet-Protocol
ERMP – Enterprise Risk Management Program
FBCT – Future Brigade Combat Team
FCS – Future Combat Systems
GBS – Global Broadcast System
HC3 – High Capacity Communication Capability
HNW – Highband Networking Waveform
IA – Information Assurance
ID – Infantry Division
JNN-N – Joint Network Node-Network
LAMDA – Large Aperture Multiband Deployable Antennas
LHGXA – Lightweight High-Gain X-Band Antenna
LMST – Lightweight Multi-Band Satellite Terminal
LOS – Line-of-Sight
LPD – Low Probability of Detection
LPI – Low Probability of Intercept
LRIP – Low Rate Initial Production
MCST – Multi-Channel Satellite Terminals
MDAP – Major Defense Acquisition Programs
MSE – Mobile Subscriber Equipment
NCW – Network Centric Waveform
NETOPS – Network Operations
OTM – On-the-Move
PdM – Product Management
PdM EHFSS – Product Management Extremely High Frequency Satellite Systems
PdM MCST – Product Management Multi-Channel Satellite Terminals
PD TNAC2 – Product Director Tactical Networks Architectures and Configurations-Current
PEO C3T – Program Executive Office for Command, Control Communications-Tactical
PM – Project Manager
PMO – Project Management Office
PM TRCS – Project Manager, Tactical Radio Communications
PM WIN-T – Project Manager Warfighter Information Network-Tactical
POR – Program of Record
RHN – Regional Hub Nodes
SCAMP – Single-Channel Anti-jam Man-Portable
SECOMP-I – Secure Enroute Communications Package-Improved
SETA – Systems Engineering And Technical Assistance
SMART-T – Secure, Mobile, Anti-jam, Reliable, Tactical Terminal
SNE – Soldier Network Extension
SOTM – SATCOM on-the-Move
SWAP-T – Space/Weight/Power and Thermal
TAC – Tactical
TNAC2 – Tactical Networks Architectures and Configurations-Current
TSAT – Transformational Satellite
USD AT&L – Under Secretary of Defense Acquisition Technology and Logistics
UAS – Unmanned Aerial Systems
WCP – WIN-T Communications Payload
WGS – Wideband Global Satellite
WIN-T – Warfighter Information Network-Tactical

WIN-T to evolve with modularity

By Josh Davidson and James J. Sintic

When it was first conceptualized more than a decade ago, the Warfighter Information Network-Tactical was designed to be an enterprise tactical network built to support each Army-provided capability. It was a network that was to evolve to support groups of Army-provided digital capabilities rather than stand alone systems. This group, or System of Systems, is intended to include systems that communicate as they move in platforms across the battlefield.

As it evolves, WIN-T will allow warfighters to plan and execute their battles, with only a minimum user requirement for operating network software. It was initially intended to support an Army that prepared to fight in a division centric manner. Each network node, at the time, was built to respond to a division's actions. However, present iterations of WIN-T are based on the Army's move to a modular, brigade combat team structure. This will enable satellite-based communications to reach much lower echelons. The equipment itself will also be modular, allowing it to function independently.

The autonomous nature of this network has provided satellite communications to warfighters who need to expediently deploy to the more centralized focus areas they see in Operation Iraqi Freedom and Operation Enduring Freedom. The network has progressed along with the Army's transition from fighting in larger terrains to the present modular form of fighting, which is focused in smaller locales.

Brigade combat teams who might be deployed to Somalia, Iraq, or Afghanistan at one point and redeployed to another location 72 hours later, need a network that allows them to be mobile, agile, and independent. This mindset vastly differs from that of the Cold War, when the military could spend four-to-six months building up to a fight. The satellite communications of WIN-T Increment 1 and each of its subsequent increments will support modularity and WIN-T's future increments will align with the System of Systems concept.

Jim Sintic, now deputy product director of Tactical Network Architectures and Configurations-Current, recently talked about technical aspects of WIN-T and explained how it will support the current and future force. He also talked about how the Current Force Network Integrated Process Team, stood up to examine methods of decreasing redundancies among systems on the network, will progress with future WIN-T Increments.

Josh Davidson: ***Will the current force network IPT that was stood up for the Joint Network Node-Network (JNN-Network, now WIN-T Increment 1) continue with future WIN-T increments?***

Jim Sintic: It's funny, they call it the current force network because it will always be current. However, as future force technologies come forward and are deployed, the current force network working group has the charter… to keep gluing everything together.

The current force network's charter says that all these programs that are looking to develop and field for the very first time have to coordinate with the current force working group to make sure they can interoperate seamlessly with all the other things that are still in the field today. This is so that they have seamless communications. So, (the IPT) will continue to operate and have the same function, except now it is taking future force programs and integrating them into the current force. Not much is going to change there; it is just something new that we need to add to the architecture.

Josh Davidson: ***How has that IPT evolved since it began?***

Jim Sintic: Actually the whole IPT process has evolved immensely. It seems like everybody is taking a follow-up approach to that model (created at the IPT's inception), because now it is something that ASAALT (the Assistant Secretary of the Army for Acquisition, Logistics and Technology office) is looking to adopt as a part of an overarching ASAALT vision behind IPTs. Really, if you look at it, there are three tiers of it. There is the tier 1, which is the PM (project manager) decision making level. That's where (COL William C. Hoppe, PM for WIN-T and COL Cris Boyd, PM Tactical Radio Communications Systems) get together and make decisions. Then there is the tier 2, which is the Program Executive Office entity for engineers. This is where all the engineering leaders, from all the different PMs, get together and talk about synchronizing all the programs, so that we have a single

vision for tactical networks and communications and battle command platforms. Then you have really the working group levels that are underneath that. This is really where most of the work gets done. This is where the engineers take requirements from multiple programs and strategize to create a seamless integration of those programs and platforms into a single network. That is where you see a lot of the engineering work done, a lot of the lab testing done, a lot of white papers written and specifications that are written. All of those types of things are done at the third working group layer. The information flows up and down, so as we do things that the third tier layer, which is the current force working group, we bring that to tier 2. We work with the battle command folks, John Willison's folks, we work with the (navigation) folks, Johnston Williamson, and the other folks and we start figuring out this is what we are bringing to the table. What can you change to work with us better, and what can we change to work with you better from a technical perspective?

Sometimes those have programmatic impacts … So, it is going to continue to evolve in the IPT process because it keeps everybody in sync. If everybody just focused on their thing and didn't look outside the box, then we may have programs that do not interoperate with one another and don't communicate properly when they get to the field. By having the engineers work together in the IPT forum, now you are taking those engineers and you're creating a forum for them to get together and share ideas on their programs and the things they are doing to help create a common vision for all of the programs, not just the one program. So, I think you will see it continue to evolve as we move forward.

Josh Davidson: ***Will the Post-Deployment Software Support and Post-Production Software Support that the CECOM Life Cycle Management Command Software Engineering Center provides continue with the future WIN-T increments?***

Jim Sintic: Absolutely. Engineering is only part of the battle. (There is) the sustainment piece, not just from a hardware perspective of spare parts, logistics, and depots and things like that. Then, there is a software aspect to it, because most of the equipment we have is software driven, even though it sits on a hardware platform. So, having someone like the SEC as a partner with the PM, like the Logistics and Readiness Center and some of the other organizations is critical to the successes because software gets dated really fast.

As you know, just working with the Directorate of Information Management with your computer, you need constant patches, upgrades, updates, security Information Assurance Vulnerability Alert patches, all need to be continuously updated and analyzed all the time. So, you need someone like the SEC to go through and evaluate as software updates become available. They have to do the testing to make sure it is both forward and backward compatible, so that when they deploy the patches, it doesn't break anything or affect anything you are supposed to do operationally.

So, they are going to be a huge part (of our future efforts). Actually, more important than the actual engineering role, up front, only for the fact that the equipment is going to be there for so long. It is their responsibility to take that software to the life cycle of the program. So, it is really important to have that.

Josh Davidson: ***Can you explain in general terms how the components of WIN-T Increment 1 connect to a satellite and maintain communications on the battlefield?***

Jim Sintic: Basically, if you look at the way we do things today, there are many different avenues for how we connect communications, especially from a satellite perspective. Right now, we use commercial satellite communications terminals, we connect to commercial satellite communications networks and we use Ku-band.

In the future, we will migrate to Ka-band (from) a military operated satellite. The first one is supposed to be launched at the end of this year. But, basically it's a lot like the technology you use with your Direct TV or your Hughes.

The big difference on the back end for us, is the fact that we have to make dishes that fit inside a different nomenclature for tactical use. (The dishes are) towed by Humvees and M1115 vehicles and things like that. And the biggest difference behind that is the fact that we use certain communications security material on the back end of those terminals, because everything that goes over the air is all encrypted. (This is) unlike your Hughes or your Direct TV, where it's just commercial and everything is out in the clear, out in the open.

Basically, we use the same technology in terms of: you have to know your latitude and longitude and of the different coordinates to align with the bird. We have spectrum analyzers inside the satellite communications transportable terminals to help do that; to align all the different satellite communications terminals. They all have to operate on different frequencies and things like that.

Josh Davidson: ***What is the difference between the military and commercial satellite systems with regards to ruggedization?***

Jim Sintic: There is a big difference. When we build equipment here, and it's not just satellite communications terminals but everything that we build, there are certain military specification regulations that we have to build equipment to. These give you all the environmental variables that you have to meet. You have to operate in certain conditions and the equipment has to be stored in certain conditions. It has to withstand wind, dust, electromagnetic interference, TEMPEST (Transient Electromag-

netic Pulse Emanation Standard) and High-Altitude Electromagnetic Pulse regulations. You have to go through anti-jam testing. There are a lot of things that we have to do because we have to make our networks more resilient than your normal commercial networks because not only do we have to fight the environment, but we have to fight our adversaries. People who want to jam our satellite connections, people who want to jam our radio connections. People who want to interrupt our communications because everything is about communications warfare. Information dominance is power now.

Josh Davidson: ***How quickly will you lose connectivity when the equipment starts wearing and tearing away? How will that affect the performance of the system?***

Jim Sintic: I don't know if it necessarily degrades the performance of the system. What it does do is, from a logistics standpoint, it makes you have more spare parts. The maintenance part of the programs that we develop, when things start to wear over time, it puts a big burden because everything is always having to go in for service.

Mr. Davidson, Symbolic Systems Inc., is a staff writer supporting the Program Executive Office, Command, Control and Communications-Tactical Chief Knowledge Office. He holds a Bachelor's Degree in journalism/ professional writing from the College of New Jersey (formerly Trenton State College).

Sintic is the Deputy Product Director, Tactical Network Architectures and Configurations – Current, under Program Manager, Warfighter Information Tactical.

He can be reached by e-mail at james.sintic@us.army.mil

Acronym QuickScan

ASAALT – Assistant Secretary of the Army for Acquisition, Logistics, and Technology
CKO – Chief Knowledge Office
DOIM – Directorate of Information Management
FY – fiscal year
HEMP – High Altitude Electromagnetic Pulse
IAVA – Information Vulnerability Alert
IPT – Integrated Process Team
LCMC – CECOM Life Cycle Management Command
LRC – Logistics and Readiness Center
PEO C3T – Program Executive Office, Command, Control and Communications-Tactical
PM – Project Manager
SEC – Software Engineering
TEMPEST – Transient Electromagnetic Pulse Emanation Standard
TNAC2 – Tactical Network Architectures and Configurations-Current
PM-TRCS – Project Manager Tactical Radio Communications Systems
PM – WIN-T – Project Manager Warfighter Information Network-Tactical
WIN-T – Warfighter Information Network-Tactical

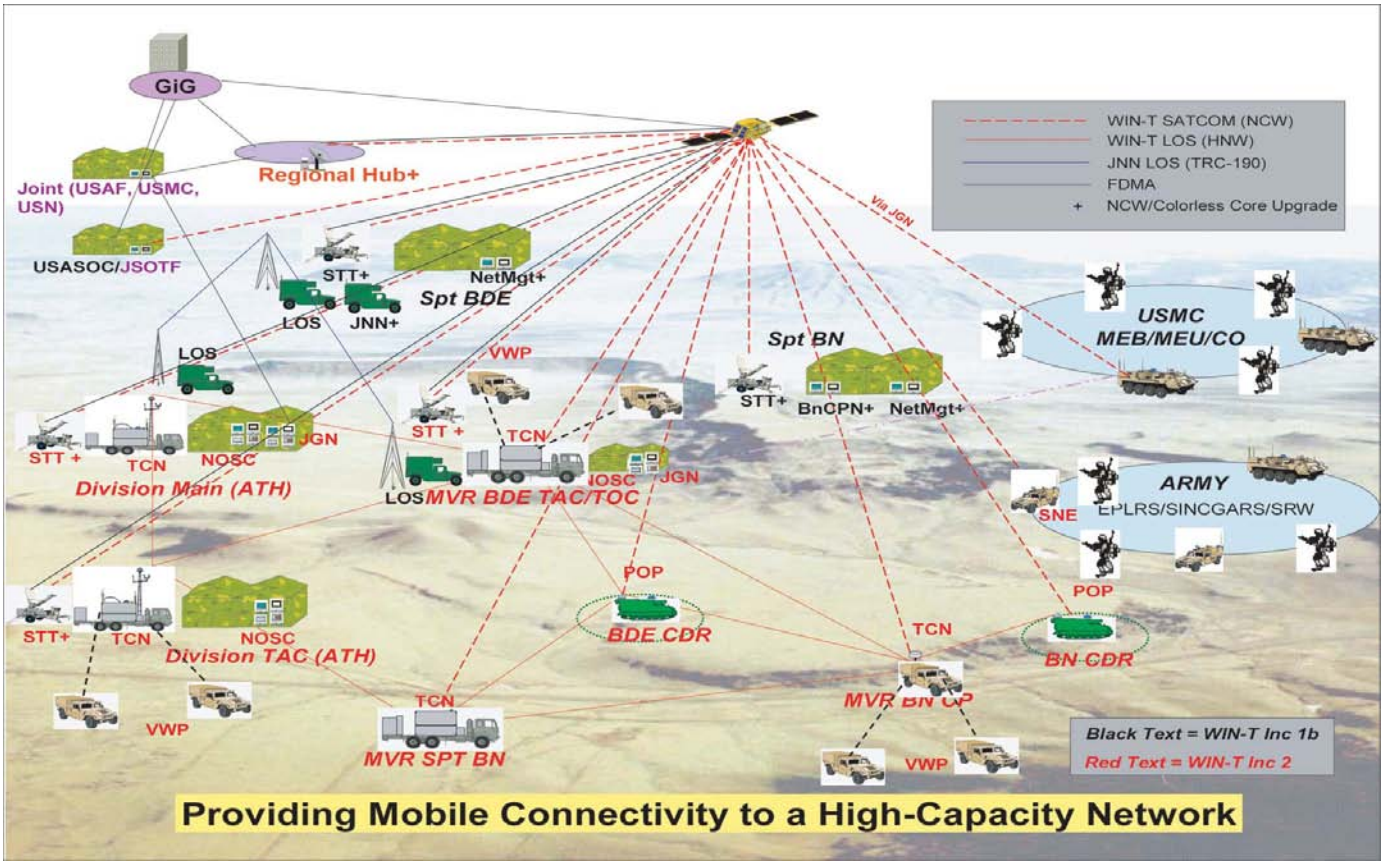


Figure 1. WIN-T Inc 2

Enabling Wideband SATCOM on-the-move communications

By Chris Swenarton, Eugene Levchenko, Lino Gonzalez, Mark Lange, Eugene Pedoto

There are several anticipated operational benefits associated with implementing high capacity, beyond line-of-sight communications on mobile tactical warfighting platforms. These benefits are more commonly referred to as satellite communications on-the-move. These include improvements in situational understanding, lethality, survivability, and overall combat effectiveness.

The Warfighter Information Network – Tactical Increment 2 program is currently implementing solutions to enable this capability using components originally developed under the United States Army's KaSAT Development Program and the Affordable Directional Antenna and Pointing Technologies Army Technology Objective-Demonstration. These components include the MPM-1000 modem, which implements the Network-Centric Waveform, as well as an on-the-move antenna system, which includes a positioner, feed assembly, aperture and an inertial navigation unit. Multiple technical, operational, and statutory issues, however, must be addressed in order to fully realize this vision.

These challenges are discussed herein, as well as the status of their corresponding solutions. A roadmap for implementation of the capability in the field is provided, as well as a forecast for future SOTM technology evolution.

Technical challenges

There are numerous technical challenges related to vehicle platform dynamics, size, weight, and power constraints, varying radio frequency link conditions, and the use of layer three networking protocols, which must be considered in the development of a mobile high capacity beyond line-of-sight communication system. Each of these challenges must be addressed with a cost effective solution in order to comply with WIN-T program objectives.

Vehicle platform dynamics

WIN-T Increment 2 will deploy multiple configuration items using fixed, at-the-halt, and/or satellite communications on-the-move terminals. (See Figure 1. Above.)

Two different types of SOTM terminals will be provided under Increment 2. Both SOTM systems require an antenna positioner, which must reliably and accurately point to a fixed absolute azimuth, elevation, and polarization angle regardless of vehicular motion. This is normally accomplished by feeding a three axis positioner with input from an external Inertial Navigation Unit device. The external commercial-off-the shelf INU devices are relatively expensive and contribute substantially to the overall cost of the SOTM system. Many external INUs were originally developed for fixed wing aircraft applications. Although this approach is acceptable for the Tactical Communication Node and Point of Presence Configuration Items, which are fielded in relatively low densities, it becomes an issue for the Soldier Network Extension CI, which is projected to be fielded in densities exceeding 34 units per BCT.

In order to address this challenge, the U.S. Army Communications-Electronics Research, Development and Engineering Center developed a prototype two-axis positioner with an embedded low cost INU, in lieu of an external commercial off-the-shelf device under the ADAPT ATO-D. This positioner relies on a satellite beacon, along with its internal INU to stay accurately pointed at the satellite.

Prototype antennas were delivered to the CERDEC in the fourth quarter of fiscal year 2008. PM WIN-T, working with MIT/Lincoln Labs, developed a unique testing capability for these prototypes since they required a live satellite beacon, motion table and precise pointing measurement system.

Testing of the prototypes confirmed that the initial ADAPT ATO-D design goals were satisfied. Eventually, 34 SNE Engineering Development Models were subsequently procured under WIN-T Increment 2. See (Figure 2. Above right) Additional testing on the SNE EDMs will be completed in the third quarter of FY 08, to ensure that the low cost positioner is capable of satisfying all FCC/ITU criteria for SOTM platforms, while subjected to the U.S. Army's Perryman and Churchville-B road profiles. The overall pointing accuracy and throughput performance requirements for the SNE CI are less than that of the TCN/PoP SOTM terminals. However, the projected Average Procurement Unit Cost for the SNE is less than 55 percent of that for a standard three axis/external INU implementation.

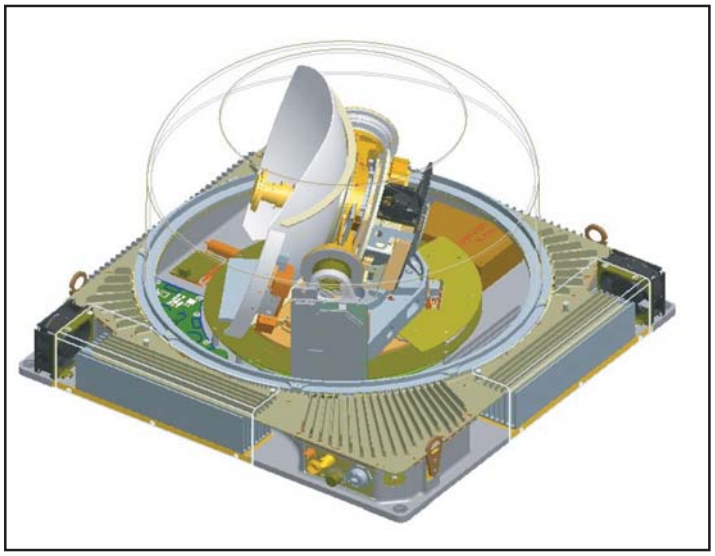


Figure 2.SNE SOTM antenna

Vehicular platform considerations also present an issue with respect to the modem used for SOTM applications. The MPM-1000 modem technology used in WIN-T Increment 2 was originally developed under the Army's KaSAT program. The KaSAT modem configuration was neither affordable nor suitable for use within warfighting platforms. Consequently, PM WIN-T needed to reduce the modem's APUC and ruggedize the system to withstand platform induced shock and vibration, as well as exposure to warfighter environments.

Working with the modem contractor, PM WIN-T identified several candidate cost savings opportunities in the modem design. These included selection of a commercial off-the-shelf-based modem controller, design of a new carrier board for the controller, and replacement of expensive FPGAs with more affordable alternatives.

At the same time, PM WIN-T applied funding to redesign the mechanical structure of the modem to withstand shock and vibration profiles in accordance with MIL-STD-810F. The new modem design will also comply with significantly increased stringent environmental requirements, including exposure to sand, dust, fungus, humidity, electromagnetic interference, and greater operating temperature ranges. Notwithstanding the improvements in the modem design to address the vehicular platform concerns, the overall projected APUC for the modem has decreased by more than 40 percent, as compared to units procured in FY 07.

Size, weight, and power constraints

Size, weight, and power are critical system characteristics for all SOTM systems. WIN-T SOTM systems will be fielded as B-Kits to be integrated into user owned vehicles that have tight SWAP constraints. Integrating SOTM B-Kits into tactical mobile platforms, such as Humvees, Bradleys, Strykers, and Mine Resistant Ambush Protected vehicles is a packaging challenge. The surface area to mount an antenna is minimal and different on each vehicle.

Also, antenna height must be minimized, as well, for Soldier survivability reasons. Considerable development focused on reducing antenna size, weight, and power to enable integration into these types of tactical vehicles. Early vendor

models delivered antennas with 24 inch apertures, which proved too large for mobile tactical vehicles. WIN-T has performed multiple tradeoff studies between throughput performance and antenna size, weight, and power to define the optimal antenna system for each of the mobile vehicle platforms. WIN-T Increment 2 will provide 18 inch aperture antennas for the TCN and PoP CIs and 16.5 inch antenna for the SNE CI.

In support of future WIN-T Increments, PM WIN-T is working closely with the CERDEC to further reduce SWAP requirements for SOTM antennas via sponsorship of the SOTM Active Quasioptical array antenna. This hybrid design combines the benefits from both phase arrays and real aperture technology to provide electronic switchable Ku/Ka-band in a single antenna.

The concept is for the low profile antenna along with the positioner motor and electronics to be enclosed in a 37 x 11 inch pancake radome. The objective weight of the antenna is approximately 100 pounds. At least four prototype antenna units are planned for test in the first quarter of FY 09. It is anticipated that this new antenna design will be ready for production in the first quarter of FY 10 with a target AUPC similar to that of the SNE terminal.

RF link conditions

To address the radio frequency link condition challenges, PM WIN-T developed and matured the Network-Centric Waveform, hosted on the MPM-1000 modem. NCW provides four receiver/demodulation chains and two transmit/modulation chains supporting biphase shift keying and offset quadrature phase key shifting modulation, and half and three-quarter rate Forward Error Correction. NCW supports data rates from 32 kbps to 6.144 Mbps. The maximum user throughput that is achieved depends on the associated SATCOM terminal, as well as the link conditions.

Radio frequency links will suffer blockages and periodic outages due to terrain, tunnels, buildings, vehicular orientation, and weather effects. The SOTM system must be able to expediently acquire the satellite signal, and reacquire it should it be lost due to line-of-sight obstruction/blockage. NCW is designed for fast acquisition and requisition.

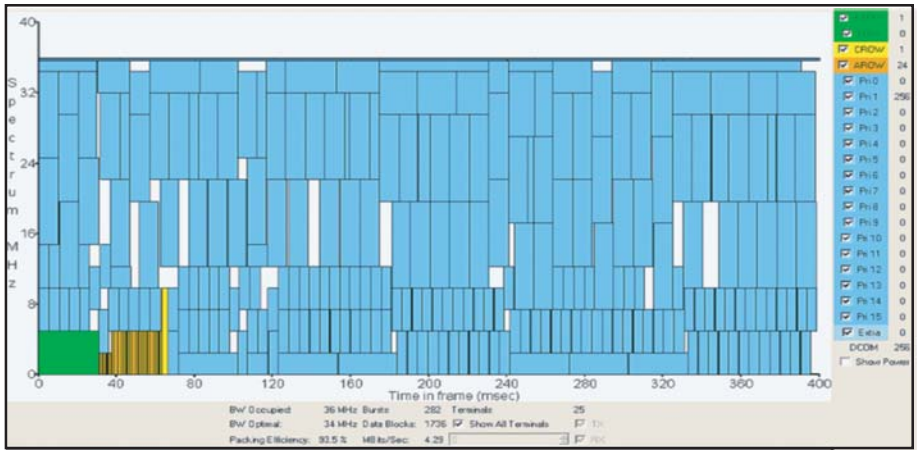


Figure 3. NCW Scheduler Slot Plan

The modem will reacquire bursts within a second for short duration or intermittent blockages. Should the user be in extended blockage duration, such as behind a building or in a tunnel, the SOTM system will automatically reacquire and reconnect with the network within 10 seconds when the vehicle moves out of the obstruction and a clear line-of-sight is established. In addition, PM WIN-T is considering implementation of an automated persistent slot feature within WIN-T Inc 3. This feature will use Return Order Wire statistics to automatically assign and release satellite resources during OTM and intermittent blockage conditions.

The WIN-T SOTM systems will provide dynamic user throughputs nominally at 128 kbps for the SNE and 256kbps for the PoP and TCN CIs. Higher transmit user rates up to 1024 kbps will be achievable but will vary and depend on weather conditions, satellite in use, location in beam footprint, and other factors. NCW employs an advanced network scheduler that maximizes network data throughput under varying atmospheric conditions and terminal population by making optimal use of satellite power and bandwidth. The system adjusts itself dynamically and requires little operator intervention.

The data rate, modulation/coding and power settings are dynamically scheduled for each link/burst in real time based on link conditions and satellite resource constraints. Burst scheduling recurs every 400 milliseconds. This re-scheduling capability is critical, especially in OTM operations, due to the dynamic nature of radio frequency link conditions. A sample frame structure which depicts the scheduler's efficient use of spectrum while supporting multiple apertures is provided in (Figure 3.)

Networking protocol adaptations

A major challenge associated with all satellite communications is long delay times. When adding the software-based scheduling delay of the NCW waveform to the physical propagation delay of a geosynchronous satellite, it is not uncommon to see a one second round-trip time between two terminals. Standard TCP implementations will not take full advantage of available bandwidth under such long delay conditions since the TCP protocol implements a reliable sliding acknowledgement window with a limited maximum window size, and assumes data loss is the result of network congestion. WIN-T SOTM systems will make use of a Space Communications Protocol Standards

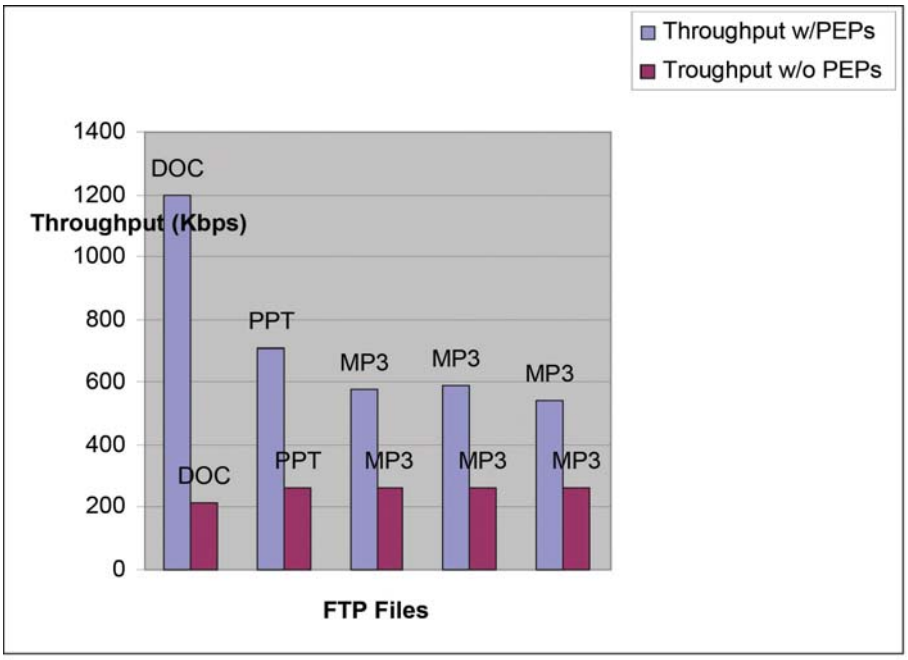


Figure 4. SOTM throughput with and without PEPs

TCP Performance Enhancing Proxy to alleviate many of the problems associated with TCP and long delay times over satellite.

SCPS PEPs act as a transport layer gateway essentially breaking a typical end-to-end TCP session into three separate connections. These are a standard TCP connection between local application and local PEP; a local PEP to remote PEP connection employing a SPCS-based protocol to optimize use of the satellite-based link; and lastly, another standard TCP connection between remote PEP and remote application. The PEPs work transparently through a technique known as spoofing, so no modifications need to be made to the TCP applications. PM WIN-T recently performed testing of various SCPS PEPs over a live NCW network. (Figure 4.) shows results of throughput tests from a large aperture terminal to a SOTM equipped platform, both with and without PEPs, for three types of files normally sent using the TCP protocol.

On average, throughputs increased by a range of two to six times with the PEP devices in line. An International Organization for Standardization standard SCPS-based PEP was chosen by WIN-T Increment 2 over PEPs, which implemented proprietary algorithms so that improved SATCOM TCP throughputs could be achieved in the event NCW communications are required with a non-WIN-T SOTM unit.

NCW further improves interoperability by appearing to an Ethernet/Institute of Electrical and Electronics Engineers 802.3 standard interface as a switched link-layer architecture, analogous to a Virtual Local Area Network partition in a terrestrial link-layer switch. Therefore, IP unicast, multicast, and broadcast packets are forwarded appropriately within the waveform allowing standard protocols such as Open Shortest Path First unicast routing, Protocol Independent Multicast multicast routing, and High Assurance Internet Protocol Encryptor peer discovery to work without the need for complex end-to-end tunnels to be created and maintained between wide area network routers.

Operational challenges

Communication architectures vary among the Army echelons and among different brigade combat teams. Users require reliable but flexible communications network structures to accommodate separate units with different loading traffic profiles. When deploying a SOTM-based solution to enable wideband BLOS communications, operational planning must be addressed. Network size or the number of nodes in a network, expected traffic duty cycle of nodes, number of distinct networks, interconnection between networks, and quality of service must all be considered. The NCW system is highly flexible and can be adapted to many diverse user network scenarios.

Automated devolution

A typical NCW network consists of satellite earth terminals with one terminal operating as the network controller and the other terminals operating as network members. The NC serves as the source for network time synchronization and as the focal point for network control and network resource management. It is also used to establish priority-driven bandwidth-on-demand traffic communications. The NC also provides the heartbeat for the entire network. NCW provides a critical and flexible NC devolution capability to maintain network reliability and survivability. In order to avoid a single point of failure scenario, certain terminals, designated as NC-Capable, are capable of assuming the NC function, via seamless planned and unplanned handover protocols.

Mesh architecture

NCW supports a heterogeneous network of terminal types with varying antenna sizes and power characteristics, ranging from large-aperture strategic terminals to small-aperture tactical mobile terminals. In a fully mesh network configuration setup, NCW always initially tries to establish a peer-to-peer communications between all terminals.

Technically, peer-to-peer communications will reduce the satellite resources required to relay the data to the destination terminal

and will also significantly reduce the delays associated with two-hop communications associated with a hub-based architecture. Operationally, a mesh architecture is crucial for transport of time critical data, but may also be required to support certain types of communications such as duplex voice.

Depending on the frequency band used (Ku-band), mesh communications may not be possible for small terminal to small terminal communications. Small tactical mobile SOTM terminals typically have reduced aperture antennas and may require more power than is available from the satellite to close a one hop link.

In these instances, the NCW Hub-Assist mode will dynamically route packets through the Net Control terminal or alternative NC to reliably maintain communications. The NC and alternate NCs serve as store and forward hubs to assist NMs and route traffic to the destination node when the link cannot be directly closed in a single-hop link.

NCW will not be new to the field when it will be introduced under the WIN-T Increment 2 program in FY 11. Early NCW releases are in use today in the Mounted Battle Command on-the-Move program and a quick reaction program called Triton. The integration, small scale fielding, and operational lessons learned have been invaluable in identifying technical and operational issues early and provide improvements to the system as the WIN-T program moves forward. Periodic technical and field tests continue at the C4ISR OTM Test Bed, Fort Dix, N.J., to mature the system into a high performance and reliable WIN-T communications network.

Statutory challenges

The WIN-T design will capitalize on ubiquitous commercial Ku-band satellites and military Ka-band aboard Wideband Global SATCOM satellites to provide high bandwidth SOTM capabilities. From a regulatory perspective, both Ku and Ka bands present unique challenges to the Army.

Commercial Ku-band

Within the Fix Satellite Service Ku-band, there are approximately 220 geosynchronous satellites listed as operational. This density of satellites makes adjacent satellite interference a very significant issue, especially when using small aperture SOTM terminals. The current criteria established for SOTM by both the FCC (continental United States) and ITU (outside of the continental United States), however, were principally adapted for shipborne applications and do not consider ground mobile environments. PM WIN-T has formally proposed that the regulatory limits be changed from the rigid go/no-go off-axis power spectral density profile to an approach using a statistical model. The statistical model approach would require a very low probability of exceeding the off-axis power spectral density profile caused by momentary pointing errors due to movement of the vehicle or ground mobile platform on which the antenna is mounted. These proposals are currently being evaluated at ITU working groups.

Regardless of changes to the FCC/ITU criteria, dynamic spreading of the radio frequency signal will be required when using Ku-Band. The WIN-T NCW design has implemented seven unique spreading factors which range from 0 to +12 dB and which are computed based on the power required to close the link and the aperture parameters. NCW optimizes the available satellite bandwidth by spreading the signal the minimum amount needed to avoid ASI.

These changes are distributed, every 400 milliseconds, to each node in the network, from the network controller via the Forward Order Wire channel. Each of the SOTM terminals planned for WIN-T Increment 2 will comply with the current criteria established by the FCC and ITU.

Military Ka-band

For military Ka-band, the interference environment is not as severe. The performance criterion for all earth terminals for military Ka-band is codified in MIL-STD-188-164A. Currently, Ka-Band off-axis limits have not been established in MIL-STD-188-164A. However, there is an ITU Radio Regulation that imposes the requirements for coordination between geostationary-satellite networks sharing the same frequency bands.

Currently, the Army is analyzing the ITU Radio Regulation and will propose to the MIL-STD community a maximum permissible off-axis power spectral density from SOTM earth stations. This will promote quasi-free interference satellite operations while maintaining reasonable SOTM spectral efficiency.

Summary

Substantial progress has been realized with respect to addressing the technical, operational and statutory challenges associated with deploying a SOTM based solution to enable BLOS communications on warfighting platforms. The initial widescale deployment of this capability will occur with the WIN-T Increment 2 fieldings of PoP and SNE CIs in FY11. The TCN CI, which will be owned and operated by Signal Corps personnel, will also use the SOTM technology to enable the entire WIN-T WAN to operate on the move. During the course of FY 08 -10, PM WIN-T will continue to mature each of the SOTM components, integrate them into functional B-kit configurations, and subject them to both developmental and operational tests.

In addition, several new advanced NCW features are being considered for implementation. Many of these features are being implemented to take advantage of new WGS capabilities, including variable size bandwidth segments and gain states, not available on many commercial satellites. Other features include improvements related to ease of use and maintain-

ability. Although much work remains to be done, the vision of improved warfighter situational understanding, lethality, survivability, and overall combat effectiveness via high capacity BLOS communications is closer than ever to reality.

Mr. Swenarton is serving as the TMD chief for PM Warfigher Information Network-Tactical.

Mr. Levchenko, P.E., serves as a senior systems engineer for SATCOM on-the-Move development, test and integration for Warfighter Information Network-Tactical Increment 2 and associated Army Team C4ISR programs.

Mr. Gonzalez has provided direct system engineering support to the U.S. Army Program Executive Office; Project Manager, Military Strategic, Tactical and Relay , PM Military Satellite Communications and PM Warfighter Information Network-Tactical for the past 16 years. His area of expertise is in Military satellite communication systems such as MILSTAR, UFO, GBS and GAPFILLER. Before joining the LinQuest Corporation he worked at the Johns Hopkins University Applied Physics Laboratory, Bendix Corporation, and BAE Systems.

Mr. Lange is a systems engineer at Project Manager, Warfighter Information Network-Tactical. He holds an M.E. degree in systems engineering from Stevens Institute of Technology and a B.S. degree in computer science from the New Jersey Institute of Technology.

Mr. Pedoto is an independent consultant supporting the Program Executive Office for Command, Control and Communications-Tactical, Project Manager, Warfighter Information Network-Tactical in the areas of test and evaluation of Satellite Communications terminals and tactical communications, including the development of SATCOM on-the-move terminals. He holds an M.S. degree in management science and a B.S.E.E.

Acronym QuickScan

ADAPT – Affordable Directional Antenna and Pointing Technologies
APUC – Average Procurement Unit Cost
ASI – Adjacent Satellite Interference
ATO-D – Army Technology Objective-Demonstration
BLOS – Beyond Line-of-Sight
BPSK – Biphase Shift Keying
C4ISR – Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CERDEC – Communications-Electronics Research, Development & Engineering Center
CIs – Configuration Items
COTS – Commercial Off-The-Shelf
EDMs – Engineering Development Models
FCC – Federal Communications Commission
FEC – Forward Error Correction
FOW – Forward Order Wire
FSS – Fix Satellite Service
FY – fiscal year
GSO – Geosynchronous
HAIPE – High Assurance Internet Protocol Encryptor
HMMWV – Highly Mobility Multipurpose Wheeled Vehicle
IEEE – Institute of Electrical and Electronics Engineers
INU – Inertial Navigation Unit
ISO – International Organization for Standardization
ITU – International Telecommunications Union
LOS – Line-of-Sight
MBCOTM – Mounted Battle Command on-the-Move
MRAP – Mine Resistant Ambush Protected
NC – Network Controller
NCW – Network Centric Waveform
NM – Network Members
OQPSK – Offset Quadrature Phase Key Shifting
OSPF – Open Shortest Path First
OTM – On-the-Move
PEP – Performance Enhancing Proxy
PIM – Protocol Independent Multicast
PoP – Point-of-Presence
ROW – Return Order Wire
SCPS – Space Communications Protocol Standards
SNE – Soldier Network Extension
SOTM – SATCOM On-the-Move
SWAP – Size, Weight, and Power
TCN – Tactical Communication Node
WAN – Wide Area Network
WGS – Wideband Global SATCOM
WIN-T – Warfighter Information Network Tactical

Satellite communications for company level warfighter

By Richard S. Wexler and Syed R. Ali

One of the lessons learned from Iraq and Afghanistan was the need for a more robust beyond line-of-sight communication capability between the lower Army echelon land warriors, squad leaders, platoon leaders, company commanders and the battalion commanders. These lower echelon units currently rely on radios that are propagation range constrained to the line-of-sight distance between the radios.

The tactical communications radios that currently service the lower echelon Army units are dominated by two LOS Combat Network Radios that include the Enhanced Position Location Reporting System and the Single Channel Ground and Airborne Radio System. The Warfighter Information Network-Tactical Increment 2 program will develop the Soldier Network Extension On-the-Move Satellite Communications, which will augment and enhance the communications limitations of the current LOS CNRs.

The BLOS communications capability of the SNE combined with its ability to communicate on-the-move will help to close the communication gap existing between the various tactical legacy radio networks. This shortfall was identified by a United States Army Training and Doctrine Command study, and the need for a low cost Single Integrated Transport System was suggested. The basic requirements for providing this lower echelon communications solution include:

- ❖ Interface compatibility requirements with future networking systems;
- ❖ Potential for interoperability with higher echelons;
- ❖ Baseband compatibility requirements with existing digitized lower echelon units;
- ❖ Information Assurance/ Encryption Requirements;
- ❖ At-the-Halt/On-the-Move Capabilities.

These requirements formed that basis of the WIN-T SNE.

The network healing process is synonymous with a bridging capability whereas network thickening offers enhanced bandwidth capability between nodes. The SNE will provide both network thickening and healing for the CNR nets that support communications between the company commanders and the battalion's command post as depicted in Figure 1. The majority of the Army Warfighter's communications traffic served by the SNE network includes command and control messages and voice exchanges, as well as situational awareness traffic. The SNE would serve as an access port for extending the range of the legacy CNRs to both heal and thicken these range-limited networks.

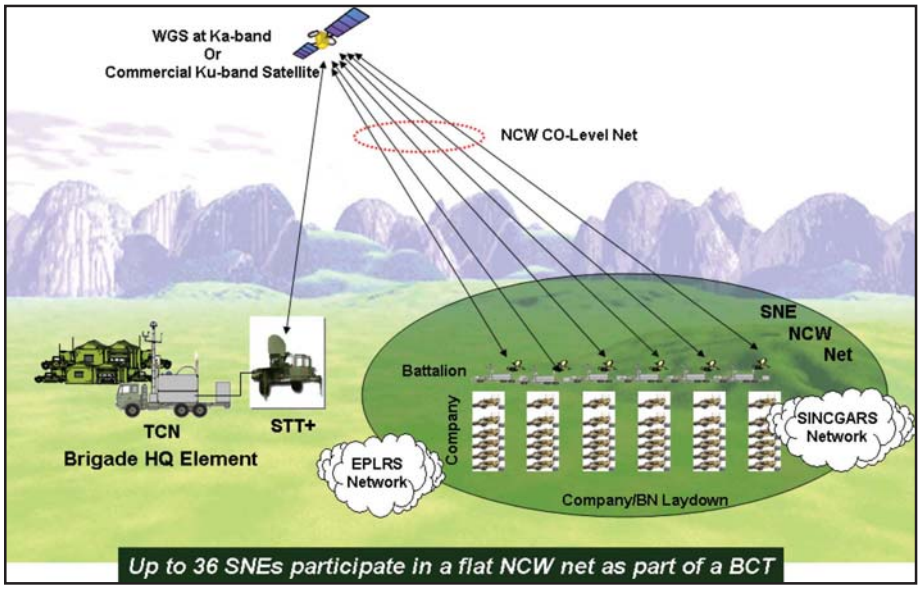


Figure 1. Operational view with NCW SATCOM Net to extend BN/CO-level SINCGARS and EPLRS Combat Net Radio Traffic.

Basic requirements

Some high level SNE requirements are provided below:

- ❖ Operate over both commercial and Department of Defense satellites at Ku and Ka-band, respectively;
- ❖ OTM and ATH 64 to 128 Kbps user data rate capability (clear sky conditions – reduced throughput under rain conditions or severe satellite transponder loading);
- ❖ Support IPv4/6 routed traffic;
- ❖ Transmission will be based on Demand-Assigned Multi-Frequency Time Division Multiple Access WIN-T Network Centric Waveform for SATCOM application;
- ❖ Hub-Assist (Hub-Spoke) and peer-to-peer connectivity;
- ❖ Will support anticipated force structure subnet scheme with likely 36 members per

subnet (Membership count per subnet is still under assessment);
❖ National Security Agency Approved and FIPS 140-2 Accredited TRANSEC (AES 256-bit);
❖ Support secret user enclaves with only "peer" exchanges (i.e., secret-to-secret or unclassified-to-unclassified) of command and control/situational awareness information is supported (single security domain supported);
❖ Full Link Management and Quality-of-Service;
❖ Meet host vehicle shock and vibration profiles.

Besides the requirements for BLOS, other data connectivity requirements are essential for the SNE to function effectively. These include:

❖Digital connectivity both voice and data down to the company-level command post where it can then be extended to the team/squad and platoon leader level;
❖Digital connectivity between dismounted Soldiers and their vehicles;
❖Voice connectivity down to individual dismounted Soldier for real-time communication and for command and control;
❖Retain Combat Network Radio capability.

Figure 2 shows the basic layout of the SNE Terminal.

The SNE SATCOM terminal is proposed to use a commercial NCW modem designated the MPM-1000 and a small aperture platform stabilized antenna. The antenna (anticipated to have a radio frequency equivalent diameter of 16 inches) will include an integrated Solid State Power Amplifier. The antenna will be mounted on a two-axis positioner providing elevation over azimuth satellite tracking. In addition, the design will include polarization tracking for commercial Ku-band operation. Military Ka-band will employ circular polarization. Therefore, there is no need for active polarization tracking. The antenna will be capable of a mechanically-switched Ku-Ka band change.

Laptops will be used to control antenna and modem functions, host a WIN-T thin Network Operations client, and potentially manage QoS. The input to the modem will be encrypted using the High Assurance Internet Protocol Encryptor (HAIPE KG-176). The inputs to the SNE's router will support connections to the SINCGARS Internet controller, the EPLRS and the future Soldier Radio Waveform-based Handheld, Manpack, Small Form Fit radio. This interface will support a dual IPv4/6 stack. The use of a single HAIPE will enable the SNE to operate in a single security domain (such as either secret or unclassified) at any point in time. Support to multiple security domains has been ruled out based on host vehicle size, weight, and power limitations and added cost.

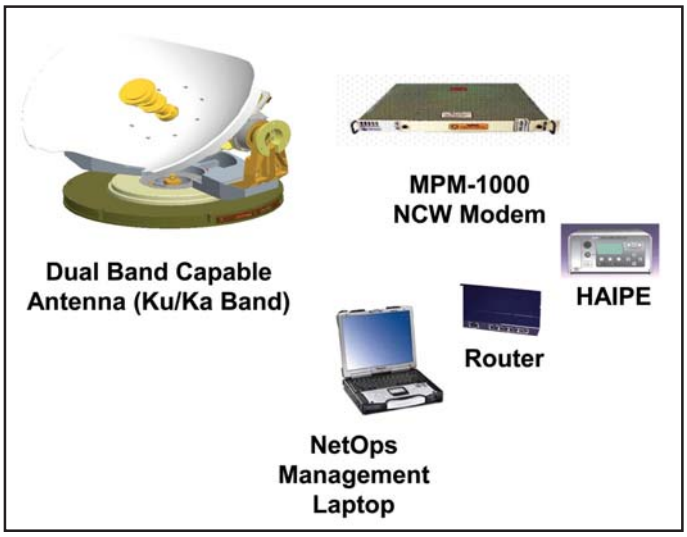


Figure 2. Soldier Network Extension key components

A typical SNE deployment will include up to 36 SNE company-level terminals sharing a NCW-defined subnet. The SNE provides SATCOM links to the battalion Tactical Operation Center or any other battalion level location that provides high-level command and control. Typically, the battalion level commander will have a WIN-T Tactical Communications Node with a co-located Satellite Tactical Terminals upgraded (STT+). These locations in turn will potentially have access to either WIN-T SATCOM terminals or to the Standardized Tactical Entry Point and teleport sites, as a way to access the Global Information Grid to derive the associated services. All necessary types of waveforms including EPLRS, SINCGARS, and SRW will be supported by the company-level commander's vehicle. These vehicles are anticipated to include High Mobility Multipurpose Wheeled Vehicles (Humvees), as well as, other tactical vehicles.

Operational requirements

The basic objective of the SNE is to provide BLOS capability with network thickening and healing for lower echelons in support of combat operations. The following is a list of operational criteria that needs to be considered:

❖ Integration into current vehicles;
❖ Operationally effective in close combat operations;
❖ Suitability in different operational environments;
❖ Minimal Soldier interaction during operation;
❖ Reduction in mission planning time;
❖ Thickening and healing of digital CNR nets;
❖ Improved distribution of situational awareness ;
❖ Improved distribution of command and control messages;

❖ Improved survivability and lethality.

The operational requirements mentioned above will be used as criteria in assessing SNE capability and its communication effectiveness. Other criteria like reliability and maintainability will also be evaluated during the integration and test development phase of the SNE program.

Testing strategy

Although the SNE baseline represents a modification of an existing established design, the SNE will require additional testing before it can be deployed in the combat zone. Extensive testing has been accomplished to date regarding the NCW. The main aspects of testing are:

❖ Tracking performance testing;
❖ Terminal certification to validate compliance with both military-standard 188-164 and applicable Ku-band commercial SATCOM standards (such as Intelligence Satellite Earth Station Standards)
❖ Integration/baseband interoperability testing between different radio networks and the SNE terminal.

It is anticipated that all operational tests will be conducted on Humvees, which is the target host vehicle for the SNE system. A concept of the Humvee-based vehicle configuration is shown in Figure 3. User tests will be performed to verify ATH and OTM capabilities of the SNE to confirm its operational effectiveness. Field testing will be required to verify:

Field testing will be required to verify:

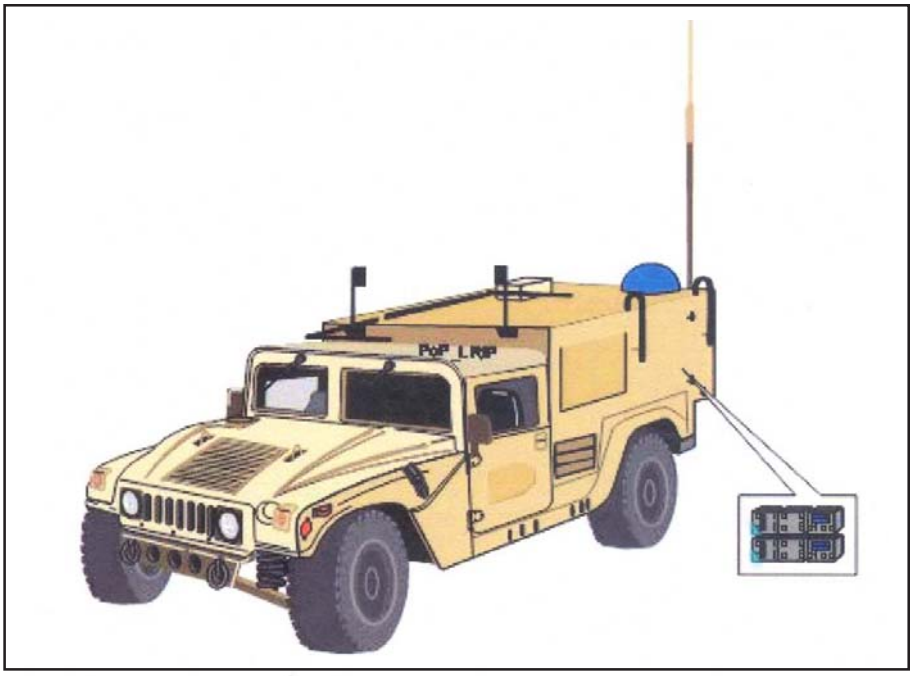


Figure 3. Concept of SNE integrated onto a Humvee. The SNE antenna is mounted below the radome shown in the concept drawing

❖ Communication functionality;
❖ Environmental compatibility;
❖ Electronic effects like EMI, TEMPEST, COSITE;
❖ Fault isolation capability;
❖ Hardware and software performance/functionality.

Conclusion

This article has presented a set of high level concepts and requirements for SNE. Its basic operational, functional and testing requirements were covered to elaborate the challenges that lay ahead in implementing it, and its integration needs with existing radio networks.

The SNE will bring a new range extension capability to the Army, fielded to lower echelons. Once the SNE is tested and deployed in the field, it is envisioned that other services whose needs are similar to Army's may also be interested in deploying SNE in their network. The integration of SNE is a work in progress; and it is anticipated that a user test will be considered in early calendar year 2009.

Mr. Richard Wexler is the satellite communications lead engineer within the MITRE Corporation's Fort Monmouth, N.J., office.

He received a B.S. in electrical engineering in 1975 from the City College of New York and an M.S. in management science in 1980 from Fairleigh Dickinson University.

Mr. Ali is a Senior System Engineer at Project Manager, Warfighter Information Network-Tactical at Fort Monmouth, N.J. He received his BSEE in 1967; an MSEE in 1971; and an advanced degree of DEE in 1982.

Acronym QuickScan

ATH – At-the-Halt
BLOS – Beyond Line-of-Sight
C2 – Command and Control
CNRs – Combat Network Radios
DoD – Department of Defense
EMI – Electromagnetic Imaging
EPLRS – Enhanced Position Location Reporting System
GIG – Global Information Grid
HAIPE – High Assurance Internet Protocol Encryptor
Humvee – High Mobility Multipurpose Wheeled Vehicle
HMS – Handheld, Manpack, Small
HT – Heavy Terminal
IA – Information Assurance
IEEE – Institute of Electrical & Electronics Engineers
IESS – INTELSAT Earth Station Standards
INC – Increment
LOS – Line-of-Sight
MILCOM – Military Communications Conference
MF-TDMA – Multi-Frequency Time Division Multiple Access
NCW – Network Centric Waveform
NETOPS – Network Operations
NSA – National Security Agency
OTM – On-the-Move
QOS – Quality of Service
SA – Situational Awareness
SATCOM – Satellite Communications
SINCGARS – Single Channel Ground and Airborne Radio System
SITS – Single Integrated Transport System
SNE – Soldier Network Extension
SRW – Soldier Radio Waveform
SSPA – Solid State Power Amplifier
STEP – Standardized Tactical Entry Point
STT – Satellite Tactical Terminals
SWAP– Size, Weight and Power
TCN – Tactical Communications Node
TEMPEST – Transient Electromagnetic Pulse Emanation Standard
TRADOC – Training and Doctrine Command
WIN-T – Warfighter Information Network Tactical
UMS – Universal Modem System

HNW – WIN-T Increment 2 LOS solution

By Darren LeBlanc

Since the inception of radio communications, signaleers have relied solely on a fixed infrastructure for any high throughput communications. For operation centers and key leaders in the division, brigade, and battalion, the Warfighter Information Network – Tactical Increment 2 line-of-sight solution brings a significant paradigm shift. No longer does a commander have to manage the risk of degraded communications as his unit moves forward. Terrestrial LOS communications is no longer restricted to a series of point-to-point fixed links. With the fielding of WIN-T Increment 2, these leaders will obtain high throughput links, as part of a mobile backbone communications infrastructure. For the first time, the Soldier will have true on-the-move connectivity.

The crown jewel of this LOS system is the Highband Networking Waveform. HNW is a new breed of radio waveforms that allows for automatic neighbor discovery and automatic frequency reuse. With the help of a "smart" multi-beam antenna technology, the HNW radio can automatically detect any other HNW radios within range and allow a user to pass video, voice, or any type of Internet Protocol traffic to and from the newly found neighbor. Any one radio can automatically, and simultaneously, connect to another radio within the brigade, given a clear path. This functionality lets an HNW network self-form and self-heal when it becomes disjointed or loses a member.

Additionally, HNW is capable of automatic frequency reuse. HNW intelligently determines which links will not cause interference even while OTM. It also allows for reuse of the frequency. Given the Time Division Multiple Access architecture of the waveform, this frequency reuse allows an entire brigade to have high-capacity links on just one 22 Mhz channel.

In October of 2007, WIN-T demonstrated a fully networked, high capacity, on the move LOS communications system at Navy Lakehurst and its neighboring Fort Dix, N.J. A full brigade-sized complement of terrestrial radios were deployed throughout the two New Jersey installations. For the first time, a high throughput, self-forming, self-healing OTM network has been realized for the warfighter.

For more information on WIN-T Increment 2 Radio Systems, e-mail Timothy Rider, of the CECOM Life Cycle Management Command Public Affairs Office, at Timothy.Rider@us.army.mil.

Mr. LeBlanc is an electrical engineer for PM WIN-T, Fort Monmouth, N.J. He is currently the Acting Chief for the WIN-T Space and Terrestrial Communications Directorate Support Branch.

Acronym QuickScan

HNW – Highband Networking Waveform
LCMC – Life Cycle Management Command
LOS – Line-of-Sight
OTM – On-the-Move
S&TCD – Space and Terrestrial Communications Directorate
WIN-T – Warfighter Information Network-Tactical

WIN-T Networking Waveforms Unprecedented Spectrum Efficiency

By Richard Hoffman

Introduction

The Warfighter Information Network – Tactical provides the backbone network for the tactical Army. This robust WIN-T network brings high throughput on-the-move communications to the tactical infrastructure and provides Wide Area Network access to the company echelon, which is lower than ever before. WIN-T provides a multi-tier network, which is comprised of terrestrial, air, and satellite communications links. The limited spectrum that is identified for worldwide military use is congested today.

This congestion will continue to increase over time. In order to meet these new challenges, WIN-T is implementing two networking waveforms to deliver unprecedented spectrum efficiency. The two waveforms support line-of-sight (terrestrial and air tier) and satellite communications.

Line-of-sight waveform

The Highband Networking Waveform is designed to support terrestrial and air based line-of-sight communications, both on-the-move and at-the-halt. This waveform provides the high capacity, long range links, as well as the robust connectivity required of WIN-T WAN backbone communications. HNW includes integrated transmission security that covers both signaling and user traffic. Networks automatically self-form and self-heal with no operator or user interaction, decreasing manpower requirements and allowing HNW functionality to be inserted in vehicles without a signal Soldier presence. The dynamic nature and frequency reuse features of the waveform optimize spectrum efficiency and allow connectivity in a spectrum challenged environment.

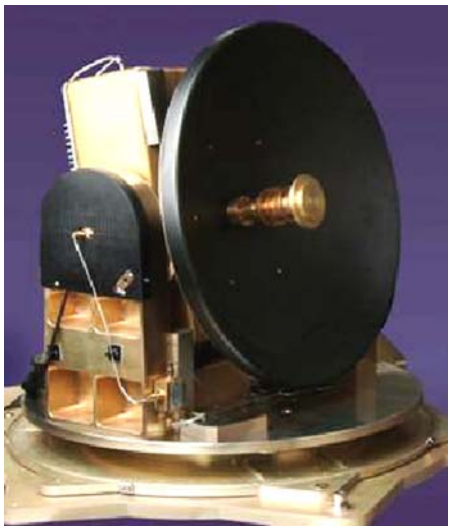
Initial HNW Radio Implementation (Highband Networking Radio)

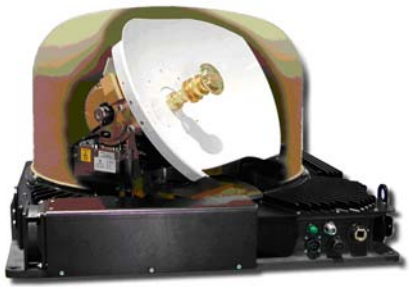
HNW supports WIN-T terrestrial connectivity, as well as connectivity to air platforms. The WIN-T baseline includes HNW in the Extended Range Multi-Purpose Warrior platform and the Future Combat System Firescout. WIN-T implements HNW at C (4.4 to 5 GHz) and Ku (14.5 to 15.35 GHz) frequencies. HNW is a Time Division Duplex Time Division Multiple Access waveform, with all transmit and receive functions including self-forming and self-healing neighbor discovery on one frequency.

This waveform structure allows a tactical deployment to operate the entire LOS network on one frequency assignment, eliminating the need to continually replan frequency assignments as the battlespace changes. This is accomplished with directional electronic antenna technology, which allows HNW to cover the full hemisphere and point in a given direction on a burst by burst basis. This supports the high throughput, long ranges, thick mesh connectivity, demand assigned bandwidth, frequency reuse, and other capabilities described below. Each of these features contribute to HNW's ability to push more bits than ever before through the available frequency spectrum. They also allow it to act as a throughput multiplier on the battlespace.

a. Dynamic Throughput. HNW measures link conditions in real time and provides the highest rate possible, up to 110 Mbps shared (transmit and receive). This is accomplished with dynamic modulation and coding modes, which change based on link conditions and range. Power control is also used to optimize lower probability of intercept/lower probability of detection and frequency reuse.

b. Automated Frequency Reuse. Since the narrow-beams provide isolation in directions other than their beam direction, this permits multiple links to operate on the channel frequency at the same time. This frequency reuse greatly increases the spectrum efficiency of the waveform across the battlespace. Frequency reuse of 15 times for a 40 node network has been modeled. Narrow beams are used on the air





Initial NCW Radio Implementation (MPM-1000 modem plus two different OTM antennas, one for POP and TCN and one for SNE).

platforms as well, maximizing frequency reuse for this tier. This frequency reuse is automated, with no user involvement required and is dynamic to support OTM operation.

c. Demand Assigned User Data. The HNW assigns timeslots based on user demand. More timeslots for that link are assigned when demand increases at a specific node. When demand decreases at a specific node, less timeslots are used for that link, leaving these timeslots to be used by other nodes. This demand assignment feature allows bandwidth sharing across the network, optimizes network throughput, and minimizes spectrum required.

d. Variable Bandwidths. HNW networks can be set up in scarce spectrum environments. It includes selectable channel bandwidths of 3.125, 6.25, 12.5, 25 and 50 MHz. This allows connectivity and throughput for an entire tactical deployment even with limited spectrum availability.

e. Self-forming and Self-healing Network. The HNW supports mobile ad hoc networking by automatically discovering and tracking moving nodes. The HNW differs from many ad hoc networking waveforms in that it is designed to operate with an antenna that supports narrow beam directional functionality. To support this form of ad hoc networking, the HNW includes a Time Division Duplex TDMA protocol that schedules access to the communications channel. The TDD TDMA not only controls the time at which a link between nodes has access to the communications channel, but also controls the direction over which that link operates. This allows mesh connectivity to many other nodes simultaneously and supports a robust network. A robust network allows user bits to travel to the intended network location using the least number of links. This minimizes spectrum use.

SATCOM waveform

The Network-Centric Waveform provides OTM and ATH satellite communications between users in a full-mesh multi-frequency time-division multiple access network. The NCW SATCOM link provides range extension for the WIN-T WAN backbone network through the use of various MILSATCOM and commercial transponded satellites. The WIN-T NCW network leverages C/X/Ku/Ka bands ATH and Ku/Ka bands on-the-move. NCW includes integrated transmission security that covers both signaling and user traffic.

NCW uses a network scheduler. This automatically calculates optimum connectivity between all network member terminals in a mixed network supporting both OTM and ATH communications. NCW supports mesh connectivity between users while OTM, and does not require a large aperture hub for operation. Any terminal can act as network controller, and devolution to alternate controllers is automatic. NCW includes very powerful, dynamic features to maximize satellite transponder resources. The features contributing to the efficiency of NCW are described below.

a. Dynamic Throughput. Member terminals measure performance in real time and provide this measure back to the network controller. This information is used to determine the modulation and coding mode the terminal will use. This provides automated dynamic throughput adjustment based on link conditions, allowing the use of the available link margin to support additional throughput. This means that the link continues to work at reduced throughput when traditional satellite communications links would break.

b. Demand Assigned. The TDMA structure of the waveform is used to assign timeslots to terminals. Only a limited number of timeslots are assigned to a specific terminal, when little or no throughput is required. This leaves timeslots available for other terminals.

When additional throughput is required, additional timeslots are assigned. This allows for the sharing of transponder resources across the network, which optimizes throughput and minimizes the number of satellite transponders that are required for a given deployment. Scheduled virtual connections also provide data to the intended node, minimizing double hops experienced in legacy networks and

further minimizing satellite transponder use.

c. Heterogeneous Networks. NCW schedules connectivity in a mixed network of at-the-halt and on-the-move terminals. For small aperture OTM terminals, spread spectrum is implemented in order to reduce off-axis power spectral density. This is required to minimize adjacent satellite interference. Support is provided for both spread and non-spread communications in the same network. Blockage mitigation on-the-move is supported.

d. Robust Network Controller. No hub terminal is required and any terminal can act as network controller. If the primary controller fails, control of the network immediately moves to a previously identified alternate network controller. This occurs automatically without loss of communications. Peer to peer OTM communications is supported when link capabilities exist and automatically devolves to hub assist when required.

Summary

WIN-T delivers some incredible new capabilities to the tactical Army. At the top of that list is a completely OTM communications infrastructure. This high capacity mobile backbone will be fielded to more Army echelons than previously fielded communications infrastructure systems. With the scope of that fielding, come new challenges in our spectrum constrained environment. To overcome these challenges, WIN-T is implementing two new networking waveforms. WIN-T networking waveforms will allow more user data to be pushed over available satellite transponders and spectrum. The dynamic, ad-hoc nature of these waveforms, along with features such as demand assigned allocation of resources, effectively multiplies available spectrum. These technologies were previously demonstrated in the WIN-T Developmental Test/Operational Test in November 2005, as well as in the Increment 2 Engineering Field Test in October 2007. The WIN-T Increment 2 program will field the initial HNW and NCW technologies to the tactical Army. The WIN-T Increment 3 program will provide the full HNW and NCW capability that will meet the needs of the tactical Army within the constraints of available spectrum well into the future.

Mr. Hoffmann is a member of the Communications Electronics Research, Development and Engineering Center Space and Terrestrial Directorate who is embedded at Project Manager, Warfighter Information Network-Tactical as the WIN-T Increment Two and Three Transmission Team Lead. He holds a BSEE from Rutgers University and MSEE from Rutgers Graduate School.

Acronym QuickScan

ATH – At-the-Halt
CERDEC – Communications Electronics Research, Development and Engineering Center
DT/OT – Developmental Test/Operational Test
ERMP – Extended Range Multi-Purpose
FCS – Future Combat System
HNW – Highband Networking Radio
LOS – Line-of-Sight
LPI/LDP – Lower Probability of Intercept/Lower Probability of Detection
MANET – Mobile Ad hoc Networking
MF – Multi-Frequency
NCW – Network Centric Waveform
OTM – On-the-Move
SATCOM – Satellite Communications
PM WIN-T – Project Manager, Warfighter Information Network-Tactical
S&TD – Space and Terrestrial Directorate
TDD – Time Division Duplex
TDMA – Time Division Multiple Access
TRANSEC – Transmission Security
WAN – Wide Area Network
WIN-T – Warfighter Information Network-Tactical

WIN-T Air Tier

- providing BLOS coverage for ground forces

By Denee Lake

The Warfighter Information Network-Tactical Increment 3, currently scheduled for fielding fiscal year 2015, will introduce an air tier that will provide constant communications to forces as they conduct full spectrum operations.

This air tier will be integral to Increment 3's architecture as it will provide a relay extension capability that will heal the terrestrial network and reduce the requirements on the overburdened satellite tier. It will also provide beyond line-of-sight coverage to nodes on the ground.

The airborne platform will act as an advantaged node, providing a greater coverage footprint and connecting smaller groups of nodes on the ground. This will provide connectivity to ground nodes in previously unreachable areas. Additionally, smaller clusters of High-band Networking Waveform enabled units will be connectable without the latency and bandwidth restrictions of the satellite tier.

The Firescout and the Extended Range Multi-Purpose unmanned aerial vehicles will provide this beyond line-of-sight coverage to ground forces. The FireScout flies at an altitude of 15,000 feet and will have an expected coverage of almost 40 km. The ER/MP flies at 25,000 feet with coverage of more than 85 km. Other Department of Defense programs, like Aerial Common

Sensor, have shown an interest in using the WIN-T Communications Payload for direct dissemination of platform data, as well.

Additionally, WIN-T is examining the potential to deploy the WCP on a high altitude platform. These platforms can fly to altitudes in excess of 60,000 feet, to provide greater coverage with minimal effects from weather.

In Increment 3, WIN-T will deliver the first Internet Protocol-based network node in the sky. Using multi-beam directional antennas coupled with the WIN-T High-band Networking Waveform, the airborne layer will provide continuous robust network connectivity to the ground nodes and allow for on-the-move communication in locations previously unreachable.

For more information on the WIN-T Communications Payload, please e-mail Timothy Rider, of the CECOM Life Cycle Management Command Public Affairs Office, at Timothy.Rider@us.army.mil.

Denee Lake is the Project Lead for the Air Tier in PM WIN-T.

Acronym QuickScan

BLOS – Beyond Line-of-Sight
CLCMC – CECOM Life Cycle Management Command
ER/MP – Extended Range Multi-Purpose
HNW – High-band Networking Waveform
LCMC – Life Cycle Management Command
WCP – WIN-T Communications Payload
WIN-T – Warfighter Information Network-Tactical

Users examine WIN-T Inc 1's challenges, successes, lessons learned

By LTC Rodney Mentzer and Josh Davidson

WIN-T Increment 1…Enabling Army Transformation Today

After switching to WIN-T Increment 1 from its predecessor, the Mobile Subscriber Equipment Network, "our pipe size increased drastically," said. SFC David Heil, 1/34 Brigade Combat Team.

"Where before, we were having problems just getting files across the network and getting simple things moved from point 'A' to point 'B' for coordination, now we're getting a live feed," he said.

WIN-T Increment 1, formerly called the Joint Network Node-Network, provides battalion-level and above warfighters with the ability to connect to the Army's digitized systems, voice, data, and video via satellite Internet connection.

The story behind WIN-T Increment 1 began with the launches of 2001's Operation Enduring Freedom in Afghanistan and 2003's Operation Iraqi Freedom. The system was developed as an immediate response to the need for a beyond line-of-sight communications pipe. The need for that type of capability surfaced when GEN William S. Wallace led the Army in a run for Baghdad, Iraq. Wallace recognized that the pace of the war outran the coalition forces' ability to communicate, which revealed a gaping hole in the way they fought.

As the 3rd Infantry Division was deployed to Iraq to support OIF, the need for an evolution of Mobile Subscribe Equipment, the 20-year-old existing LOS satellite communications network, became evident.

LOS communications limit the warfighter's communications to areas they can see.

WIN-T Increment 1 is assigned to Project Manager Warfighter Information Network-Tactical of the Army's Program Executive Office for Command, Control, and Communications Tactical. What follows in this article is a summarization of discussions which took place at the first annual WIN-T Increment 1 users conference held at Fort Monmouth, N.J., last fall.

Evolution to WIN-T Increment 1

BG Nick Justice, the PEO for C3T, began the conference by thanking the users for their role in WIN-T Increment 1's progress since the Army's first rotation into Iraq.

"They asked me to talk about how we got to where we are today…I can do that with one word: you," Justice told the users.

During WIN-T Increment 1's inception, staff from various Army organizations such as Training and Doctrine Command and the Signal Center laid down a new infrastructure for communications Army wide, Justice said.

"We broke the old infrastructure and put a new infrastructure in place… We have done a tremendous job to collectively change our Army," he said.

BG Jeffrey Smith Jr., commander for 5th Signal Command in Germany, was "absolutely right," when he said, "The road for WIN-T is through JNN," Justice added.

"If anybody in here asks the

question, 'When is WIN-T coming,' the answer is we fielded it to almost 50 percent of the total Army," Justice said.

WIN-T Increment 1 Product Manager LTC Rodney Mentzer said that his office is required to field WIN-T Increment 1 to each of the 199 Army units that contain Signal Soldiers. Of those, 93 units will have the system by this summer, he said.

"I am very confident that we will field our entire force before 2012," he said.

The lot 10 version of the system was put on contract last September and it contains a Ka-Band capable Frequency Division Multiple Access modem. Lot 11 (the rest of the Army) is expected to be placed on contract by the end of this summer, Mentzer said.

The system's tactical hub is fielded at the division level. The Joint Network Node and WIN-T Increment 1 dish shelter are fielded to brigades, while the transit cases and dish are fielded to battalions.

WIN-T Increment 1 is completely funded and money is allocated to support the transfer of partial WIN-T technical insertions into the current network, Mentzer said.

WIN-T Increment 1 is made up of nearly 85 percent commercial-off-the-shelf equipment. Therefore, during repairs, damaged parts are switched out and fixed separately, while new ones are sent to the unit.

Mentzer's briefing also pointed out these benefits of WIN-T Increment 1:

- ♦ It allows for independent mobility of command posts and centers unconstrained by LOS radio ranges;
- ♦ It incorporates industry standards for network operations;
- ♦ It supports modularity by allowing a BCT to have self-sustaining reach back communications. Modularity is a major restructuring of the entire Army, involving the creation of BCTs that will have a common design and will increase the pool of units available for deployment.
- ♦ It connects the warfighter to the Global Information Grid;
- ♦ It provides Defense Information Systems Network connectivity down to the battalion level;
- ♦ It allows for satellite communications, terrestrial termination and autonomous brigade operations.

WIN-T Increment 1 officially became a program of record on June 5. The first WIN-T portion towards satellite communications will be released in Increment 2 and Future Combat Systems/WIN-T will be Increment 3. Increment 4 will mark the release of the High Capacity Communications Capability. Fielding of the Mobile Subscriber Equipment is expected to cease by 2009.

Though it was originally expected to be fielded in 2013 or 2014, training for the first WIN-T unit is expected to take place by 2009.

The users' opinion

Heil used the conference to establish contact with experts in subjects such as new WIN-T Incre-

ment 1 spirals, along with the required training and release dates for present and future spirals.

"I looked at this conference to help project that for me and then to have a voice for us to present what happened to us in theater and what happened with our training, so we can help improve the systems to make it better for the fellow Soldiers who are going to get the upgraded spirals and for the future WIN-T program," he said.

Michael Valdez, the JNN Fielding Manager who led the efforts to organize the conference, said that he has received very positive feedback on the conference and requests to be invited next year.

"I have already started initial planning due to the overwhelming success of this year's event," he said.

Heil said that the digital systems tied to WIN-T Increment 1 allowed his commander to make quicker decisions than he had ever seen on the battlefield.

During the exercises, the commander of Heil's unit, used Army Battle Command Systems 6.4's capabilities to follow separate insurgents as they would pass mortar shells to and from one another. The unit would circle around one of the insurgents with an Unmanned Aerial Vehicle, the Raven unmanned aerial system or squad level devices. That information was fed into ABCS 6.4 capabilities.

"We would take those tracks and he would follow him in," Heil said. "We'd send in teams, cordon off the area or we would bomb that area at that point."

During training Heil, who served as the Brigade Automations Non-Commissioned Officer-in-Charge, used a full range of digital systems including the Common Ground Station, All Source Analysis System, Digital Topographic Support System, the Advanced Field Artillery Tactical Data System and Maneuver Control Systems-Light.

MCS digitally distributes tactical information on the battlefield, allowing a commander to readily access and display current situation reports, intelligence and contact reports that assess enemy strength and movement, as well as the status of friendly forces.

Though it was originally expected to be fielded in 2013 or 2014, training for the first WIN-T unit is expected to take place by 2009.

ASAS automates the processing and analysis of intelligence data from all sources. A commander uses AFATDS to plan and execute fires during each phase of action including deliberate attacks or defensive operations.

CGS is a tactical data processing and evaluation center that links multiple air and ground sensors. DTSS provides digital maps and updates to commanders and weapons platforms in support of mission planning and execution.

During the unit's Joint National Training Center rotation, ABCS 6.4 allowed it to obtain live UAV feeds that were fed from the common ground station into AFATDS, Heil said. This allowed for directional fire support precisely on the target, Heil said.

Soldiers from the 1st Brigade Combat Team/Fourth Infantry Division preparing for their deployment to Iraq at the National Training Center, Fort Irwin, Calif., spoke highly of WIN-T Increment 1.

The system allows battalions to communicate and their commanders to connect to the systems that allow them to digitally plan the battle using topographical maps, said SPC Richard Campbell, a JNN-Network operator.

It allows units to deploy to and communicate with any location in the world, he said.

SSG Michael Irizarry, the unit's Ku-trailer operator, said the system was very reliable during the training process.

"To operate the system is fairly easy," he said. "There are basic steps to follow. Anyone can really be trained to operate it within a few weeks."

The KU system, he said, can be set up in about 30 minutes.

"The KU system, with its capabilities, has given a lot broader range of communications than the other systems have before," he said. "So, it has helped quickly establish communications within the training environment."

Technologically, the Army's satellite based networks, such as WIN-T Increment 1, has moved the Army to an even playing field with industry, said 1LT Brian Wilkins, a Systems Engineer with Florida's 146th Expeditionary Signal Battalion.

"As a whole, industry is using the same exact stuff," he said. "It's just, we put it into a box and we send it to the field."

Internet-based communications technology also allows for more modular equipment, where components can be removed and replaced with other peripheral pieces, Wilkins said.

Issues with newer systems can be resolved with a simple phone call. When a problem arises with older systems, Soldiers might need to sift through old documentation before taking steps to resolve it. Locating documentation for systems made in the 1970s is not an easy task, Wilkins said.

The transition to WIN-T has generated excitement in the Army community, he said.

"We can get away from this antiquated stuff," Wilkins said. "People feel relevant in the world, when they don't feel like they are using stuff that they are never going to deploy with."

WIN-T Increment 1 was a first place winner of an Institute for Defense and Government Advancement 2006 Network Centric Warfare Award under the category of Best Contributions to the Development of NCW Theory. Additionally, it was recognized as one of the Top Tech-

nological Innovations of the Year in the government/non-profit Category World Wide in the Computerworld Honors Program of 2006.

LTC Mentzer received an appointment to the United States Military Academy at West Point, N.Y., and graduated as a field artilleryman in 1988. He holds a Master of Science degree in Kinesiology from Indiana University, and a Master of Arts degree in procurement and acquisition Management from Webster University, in St. Louis, Mo.

He is a graduate of the Command and General Staff College at Fort Leavenworth, the Materiel Acquisition Managers Course at Fort Lee, Va., the Army Master Fitness Trainer Course at West Point, N.Y., and the Field Artillery Advanced and Basic Courses at Fort Sill, Okla.

Mr. Davidson, Symbolic Systems Inc., is a staff writer supporting the Program Executive Office, Command, Control and Communications-Tactical Chief Knowledge Office. He has interviewed numerous Soldiers, including GEN David Petraeus and GEN Benjamin S. Griffin, about a vast range of Army Team C4ISR systems. He holds a Bachelors Degree in journalism/professional writing from the College of New Jersey (formerly Trenton State College). He previously worked as a municipal beat reporter for the Ocean County Observer, a daily newspaper owned by Gannett Newspapers Inc. He has also written investigative and feature articles for many other publications.

The system allows battalions to communicate and their commanders to connect to the systems that allow them to digitally plan the battle using topographical maps, said SPC Richard Campbell, a JNN-Network operator.

Acronym QuickScan

AFATDS – Advanced Field Artillery Tactical Data System
ASAS – All Source Analysis System
BCT – Brigade Combat Team
CGS – Common Ground Station
COTS – Commercial-off-the-Shelf
DISN – Defense Information Systems Network
DTSS – Digital Topographic Support System
ESB – Expeditionary Signal Battalion
FDMA – Frequency Division Multiple Access
HC3 – High Capacity Communications Capability
IDGA – Institute for Defense and Government Advancement
JNN-N – Joint Network Node-Network
JNTC – Joint National Training Center
MCS – Maneuver Control Systems
MSE – Mobile Subscriber Equipment
NCW – Network Centric Warfare
OIF – Operation Iraqi Freedom
PM WIN-T – Project Manager, Warfighter Information Network-Tactical
PEO C3T – Program Executive Office Command, Control and Communications Tactical
TRADOC – Training and Doctrine Command
UAV – Unmanned Aerial Vehicle

New Equipment Training Inc 2 to build on Inc 1

By Timothy Rider

Monte Crippen, the New Equipment Training planner for WIN-T Increment 1 leaves little doubt as to whether he thinks Soldiers should dedicate themselves to NET when new equipment and training arrives at their doorstep.

"This is brand new, state-of-the-art communications," Crippen said. "It is their go-to-war communications backbone network, and it's complicated. If the units don't know how to operate it, they can't communicate. The commands need to realize they need to completely dedicate themselves to this training."

Crippen has been planning NET for units since the initial delivery of the Joint Network Node-Network to the 3rd Infantry Division between summer and fall of 2004. That JNN-Network is now part of the WIN-T program does not change the basic process that continues with Increment 1 and through follow-on updates and increments: When the new equipment arrives, NET follows soon thereafter. Then, crew drills and battle staff exercise and finally a complete inventory and turnover to the unit.

In order to achieve readiness, Project Manager WIN-T provides full service to help a unit through the steps of new equipment arrival and training.

In the preliminary steps, Project Manager WIN-T schedules a meeting.

"We physically go to the unit and explain how it's going to happen," Crippen said. "While we're there, we do a site survey of the facilities to help establish a plan for the use of space needed to hold classes, store, set up, and test the new equipment."

The next step is receipt, initial set up, and equipment testing.

"The contractor has to have the equipment in place, so the Soldiers have the equipment to train on and then use," Crippen said.

In a typical brigade, 75 students take NET classes for WIN-T Increment 1. In an expeditionary signal battalion, that number of students is approximately 150 Soldiers.

"During classes, the units pretty much stand down," said Crippen, who referred to WIN-T NET as a "high impact" event.

The Signal Center at Fort Gordon, Ga., approves the training program, selects teachers for NET and assesses the available military occupational specialties that will serve as "feeder MOSs" – those existing MOSs that have been identified to receive the updated training, Crippen said.

Increment 1 NET courses

For WIN-T Increment 1, courses will continue until 2009 when Mobile Subscriber Equipment retires, according to Crippen. Typically, six to eight classes are in session, sometimes simultaneously, during a 12-week period. Classes typically hold 16-20 Soldiers. Class schedules are aligned, so personnel can complete one class and then take other courses. For example, Basic Information Technology Networking class students may also attend the Battalion Command Post Node course.

Although there are now three different versions of the WIN-T Increment 1 shelter, Soldiers train on a version that comprises all three versions, according to Crippen.

WIN-T Increment 1 NET is summarized below:

- A 50-day JNN/Single Shelter Switch Shelter Operator Class is targeted for 25F/25N Soldiers. Upon completion, 25N Soldiers may also attend the five-day JNN Shelter Troubleshooting course, which is targeted to 250N, 948B 25W Soldiers.
- The five-day Basic Networking Course and a 10-day BCPN is targeted for 25B Soldiers who will be the BCPN primary operator/maintainers.
- The 10-day Ku Satellite Communications Transportable Terminal Course is targeted for 25S/25Q Soldiers and the five-day Master Reference Terminal Course is targeted for 25S Soldiers.
- The 43-day Network Management Course, 12-day Information Assurance Course and 10-day Depot Purchased Equipment Maintenance Planning Module Course is provided to officers and key personnel from a number of target MOS who will be the unit's network planners, managers and information assurance specialists.
- As part of Increment 1, NET is also provided on transmission systems that have recently been enhanced with increased capabilities, including the 20-day Tropospheric Scatter Radio Operator-Maintainer course, a five-day High Capacity Line-of-Sight Operator Maintainer Course and a three-day HCLOS ELM Unit Maintainer Course.
- One-day courses on generators and environmental control unit maintenance

Although the JNN/SSS Shelter Operator Course material is now taught as part of Advanced Individual Training to new 25 N Soldiers, "we do recommend that those new Soldiers receive the NET training, because it's the actual equipment they will use, and we

support an exercise," Crippen said. "It gives the Soldiers more exposure to realistic conditions."

"Soldiers have been adapting well," Crippen said. "It's a well liked system. It brings the Internet to the foxhole, and for the battalions who receive it, it's the first time they've had the capabilities."

Increment 2 NET approach

Increment 2 NET is based on training task analysis and is currently in the midst of development. "Increment 2 will be building on the foundation we've already established with Increment 1 NET," said Crippen.

The training plan for Increment 2 NET focuses on an Operator-Maintainer and a Network Operations Training Model. As such, NET incorporates six different O-M courses and a single NETOPS course to train all the configuration items that comprise the Increment 2 network. Additionally, there is a "leveler" course to bring students up to a consistent baseline before the start of NET. Dwight Hill, the Increment 2 training manager, referred to this leveler training as a risk mitigation technique to address a newly established resident capability and the dynamics of commercial off-the-shelf products and the realism of troop rotation. He further emphasized the crew drills and system battle staff exercises that are unique to Increment 2 NET and integral to Soldier success. The crew drills and battle staff exercises will provide a collective opportunity for all students to employ the WIN-T network and apply newly acquired skills. The first Interactive Media Instruction Simulation for the Tactical Communication Node is part of the initial training products delivery and will be evaluated as part of the Increment 2 training strategy.

Besides signal MOSs, Increment 2 NET includes a General Purpose User course targeted for Soldier Network Extension, point-of-presence, and Vehicle Wireless Package operation. A user support course for 25U, 25B, and 254A Soldiers to supplement GPU operators is estimated at two weeks. Increment 2 also features the one-day staff overview training.

The Increment 2 Training team has already convened three successful training conferences to engage key stakeholders and additional conferences are planned as development continues.

Estimated length for WIN-T Increment 2 NET is summarized below:

- Nodal System O-M Course: six weeks
- Joint Gateway Node Operator-Maintainer Course: four and one-half weeks
- Transmission Operator-Maintainer Course: seven days
- GPU Course: one week
- User Support Course: two weeks
- Staff Overview Training Course: two days
- NETOPS: eight weeks
- Crew Drills/Battle Staff Exercise: two weeks "All students participate"

The Limited User Test for Increment 2 will evaluate the training approach and set the stage for future training endeavors.

Mr. Rider served as a Soldier/photojournalist with the Army for more than seven years before he became the Fort Monmouth Media Relations officer in January 2001. He has a bachelor's degree from Excelsior College, which is located in Albany, N.Y.

Acronym QuickScan

BCPN – Battalion Command Post Node
DPEM – Depot Purchased Equipment Maintenance
GPU – General Purpose User
HCLOS – High Capacity Line-of-Sight
IMI – Interactive Media Instruction
JNN-N – Joint Network Node-Network
MOS – Military Occupational Specialties
NET – New Equipment Training
NETOPS – Network Operations
O-M – Operator-Maintainer
PoP – Point-of-Presence
SNE – Soldier Network Extension
SSS – Single Shelter Switch
TCN – Tactical Communication Node
TROPO – Tropospheric Scatter Radio
VWP – Vehicle Wireless Package
WIN-T – Warfighter Information Network-Tactical

PD TNAC2 ensures interoperability among separate systems

By Jennifer Zbozny and Josh Davidson

Simply put, when systems do not interoperate, Soldiers can't perform their missions. They can't make phone calls, send e-mails or access the systems that provide capabilities such as situational awareness, battlefield collaboration or sending calls for fire. Internet and network connectivity, much like what is experienced each day in the average office environment, is lost. However, loss of connectivity on the battlefield brings potentially deadly consequences.

This is one reason why Product Director, Tactical Network Architectures and Configurations-Current, led by Jennifer Zbozny and Jim Sintic, performs the network integrator role and as such partakes in numerous efforts to ensure that essential interoperability exists among separate systems. Product Managers are chartered with developing specific systems, and PD TNAC2 integrates those systems into a greater functional network.

As Product Managers design their systems, we work with them to ensure the equipment they purchase will interoperate with the other products with which they need to communicate. We develop the technical network architectures and interconnect diagrams that lay out the methods for systems to use to connect to and communicate with one another. And, we develop the configurations or technical glue that connects the systems together and enables them to talk.

Many of the systems presently fielded in theater are developed by numerous separate Product Managers and contractors. While focused on building their own systems, developers many times do not have the proper information from other complementary systems that allow the separate systems to interoperate on the network. PD TNAC2 examines the compatibility of the network's many systems and ensures that interoperability. Warfighters should not have to worry about individual systems or charters. They want complete system-of-systems capabilities that allow them to accomplish their missions easily and rapidly. A system-of-systems is a set or arrangement of systems that are related or connected to provide multiple capabilities to a singular end user.

Warfighters should not have to worry about individual systems or charters. They want complete system-of-systems capabilities that allow them to accomplish their missions easily and rapidly.

Warfighters also want as much commonality as possible between products that provide similar capabilities. For example, routers are part of many network systems. It is far easier for end users when the routers across different systems are the same. This reduces learning curve, training burden, and sustainment and logistics tails, while maximizing interoperability. PD TNAC2 ensures commonality across systems to the maximum possible extent by working with product managers during the component selection phase. PD TNAC2 recently was selected as the PEO C3T lead for the Network Equipment Management Review Board, who will be chartered to provide an approved list of network components to product managers, review their component selections, and ensure commonality across the board to the maximum possible extent.

Commonality from one system to the next benefits both the taxpayer and warfighter by reducing training burdens and costs, sustainment expenses and sparing, and increasing interoperability. In the past, Soldiers had to integrate their systems alone with little support or guidance, as systems were often delivered in a piecemeal fashion without being integrated with other systems into a greater overall network. PD TNAC2 now performs that integration function by developing the configurations and interconnect diagrams warfighters need to make their equipment interoperate. While training is still necessary for the users to understand system integration, so they can modify systems to support different missions, they do not have to perform the entire function alone.

PD TNAC2 is led and staffed by government employees and Systems Engineering and Technical Assistance contractors, and provides a critical service at a fraction of the cost that a development contractor group would charge.

PD TNAC2 performs extensive testing to ensure that the network systems interoperate and support the applications warfighters rely on to perform their missions. PD TNAC2 owns and operates a current force network lab where integration-related tasks are accomplished. Our products ensure developmental continuity for successful execution of current force programs.

PD TNAC2 holds bi-weekly Current Force Network Working Group meetings, which involve technical staffs from the Program

Executive Office for Command, Control and Communications-Tactical; PM Defense Communications and Army Transmission Systems; Central Technical Support Facility; Chief Information Office/G6; Battle Command Battle Lab, Signal Center, at Fort Gordon, Ga.; General Dynamics Command, Control, Communications, and Computers Systems; Northrop Grumman Mission Systems; DataPath, Inc.; MITRE; CISCO; and other government and industry organizations.

These meetings provide a forum for product managers to brief product specific plans, technical insertions, and modifications. The core CFN WG personnel from PD TNAC2 then ensure that no negative impacts exist on interfaces or the greater network architecture and operations.

Led by Matthew Iannelli, the CFN WG provides a technical forum to coordinate development of interoperable network solutions across numerous product managers and contractors. It establishes a consensus of universal systems of systems solutions, as opposed to individual stovepipe or proprietary network solutions.

Sub working groups exist within the CFN WG. They are designed to focus more intensely on specific network areas, perform research and investigation of available solutions to Warfighter requirements and provide feedback to the CFN WG as necessary. The groups are a wireless working group, led by Jason Weag; Information Assurance architecture working group, led by Kathy Fishman; telephony working group, led by Jeff Dunn; a routing working group led by Dave Buleza; and multicast working group, led by Matthew Williams. These sub-working groups are stood up and stood down as needed.

PD TNAC2 was recently established as a product group to ensure horizontal integration across current network products, including Warfighter Information Network-Tactical Increments. Numerous accomplishments have since been achieved, which include:

As WIN-T's architecture expands with its future Increments, PD TNAC2 will work closely with staff from all of the WIN-T Increments to allow the network architecture to evolve while maintaining interoperability.

❖ Developed common transit cases to provide routing and user access capabilities for Joint Network Node/WINT Inc-1, Single Shelter Switch, Base-Band Node, Command Post Platform and other products. This reduced the number of different types of cases in the field dramatically. The cases will be leveraged by WIN-T Increment 2. They were placed on the Common Hardware/Software contract to allow anyone, including warfighters, to purchase them as needed.

❖ Performed extensive testing on voice solutions to integrate the voice architecture and allow interoperability between radios, Voice over Internet Protocol phones, intercom systems, etc. Recommended a solution based on the test results to PEO C3T; it was accepted, and the plan is to execute it.

❖ Perform regression testing of new CISCO Internetwork Operating Systems for use on the Army's tactical network.

❖ Evaluated WAN acceleration and optimization technologies for the tactical Army. Recommended solutions for specific products and they are being executed.

❖ Developed a standard wireless Wide Area Network solution based on 802.16 radios that was fielded to Stryker Brigade Combat Team Five in support of an operational needs statement and is currently in theater.

❖ Developed and implemented multicast architecture in support of a number of the Army's digitized battlefield systems.

❖ Performed bandwidth analyses and test support for the Command Post of the Future, TIGRNET and All Source Analysis System-Light.

❖ Developed network specifications for WIN-T Increment 1 and ensured backwards compatibility with previously built equipment.

PD TNAC2 also works very closely with the United States Marine Corps to ensure interoperability across the entire network used by ground forces.

We will provide the same support with WIN-T Increments 2 and 3 as we presently offer on today's network. In the cases where configurations are automated by the future WIN-T increments, we will support configuration policy development. We will work to ensure a cohesive working network across the WIN-T Increments and between WIN-T increments and other systems in the field.

As WIN-T's architecture expands with its future Increments, PD TNAC2 will work closely with staff from all of the WIN-T Increments to allow the network architecture to evolve while maintaining interoperability. To further this effort, PD TNAC2 is presently purchasing WIN-T Increment 2 equipment for our lab to enable testing of the architectures, equipment, and interoperability.

When systems don't interoperate in the office, reports are late and progress towards accomplishing daily tasks slows to a halt. On the battlefield, the consequences can be much more severe, and might place the lives of our nation's Soldiers in danger. Our team is committed to ensuring interoperability is maintained across the network enabling our warfighters to complete their missions with confidence and the assurance that they can rely on the

network they use.

PD TNAC2 is assigned to Project Manager, WIN-T of the PEO C3T.

Ms. Zbozny graduated from the University of Florida in 1991 with a Bachelor of Science in industrial and systems engineering, and from Monmouth College in 1993 with a Master of Science in software engineering. She is Product Director, Tactical Network Architectures and Configurations – Current, under Program Manager, Warfighter Information Tactical.

Mr. Davidson, Symbolic Systems Inc., is a staff writer supporting the Program Executive Office, Command, Control and Communications-Tactical Chief Knowledge Office. He holds a bachelor's degree in journalism/professional writing from the College of New Jersey (formerly Trenton State College).

Acronym QuickScan

ASAS-L – All Source Analysis System-Light
BBN – Base-Band Node
BCBL – Battle Command Battle Laboratory
C4ISR – Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance
CFN WG – Current Force Network Working Group
CHS – Common Hardware/ Software
CIO – Chief Information Office
CPP – Command Post Platform
CTSF – Central Technical Support Facility
DCATS – Defense Communications and Army Transmission Systems
GDC4S – General Dynamics Command, Control, Communications, and Computers Systems
IA – Information Assurance
IOS – Internetwork Operating Systems
JNN – Joint Network Node
NGMS – Northrop Grumman Mission Systems
PD – Product Director
PD TNAC2 – Product Director, Tactical Network Architectures and Configurations-Current
PEO C3T – Program Executive Office Command, Control, and Communications Tactical
SBCT-5 – Stryker Brigade Combat Team Five
SETA – Systems Engineering and Technical Assistance
SSS – Single Shelter Switch
TNAC2 – Tactical Network Architectures and Configurations-Current
U.S. – United States
WAN – Wide Area Network
WIN-T – Warfighter Information Network-Tactical

WIN-T from a logistics perspective

By Diane Concepcion

The Army's decision to consolidate the four Warfighter Information Network-Tactical increments into a single Project Management Office has allowed WIN-T's Readiness Management Division to provide integrated and overarching management to each.

The division is lead by Diane Concepcion, chief of RMD. In the division is Caroline McCarthy, Increment 1 Logistics Manager; Patty Cushion, Satellite Transportable Terminal Logistics Manager; Will Sharman, NetOps Logistics Manager; Patty Hammarberg, Increment 2 and 3 Logistics Team Chief; and Tom McGrath, Increment 2 Logistics Manager. The group is now working together to synchronize the WIN-T supportability effort. These logisticians, along with the functional experts on the increment teams now work collocated under one division.

Formerly known as Product Manager, Joint Network Node, WIN-T Increment 1 transitioned into Project Manager, WIN-T when the organization was restructured in June 2007. During that time period, WIN-T Increment 1, which previously existed in PM Tactical Radio Communications Systems, became a program of record. A Lot 10 contract was awarded in August 2007.

Now, PdM WIN-T Increment 1 will be required to go back and validate the sparing and supportability so quickly put in place. Deliveries such as the Failure Mode Effects and Criticality Analysis report, Level of Repair Analysis,

Maintenance Engineering Evaluation and other data will feed into a Performance Based Logistics review of the established support strategy. Every aspect will be examined including New Equipment Training. The Official Training Task Analysis, which was not completed during the expedient five month development cycle performed during initial Increment 1 fieldings, is now on contract. By November of 2008, update and review of the Increment 1 logistics tail will be completed, which will culminate in a Logistics Demonstration performed as part of the upcoming 2009 Operational Assessment.

Traditionally, an RMD serves as the functional manager of logistics, training and fielding for PMO products. This role will remain critical as Increment 2 builds upon the Increment 1 Supportability Strategy. As a result, Increment 2 can now leverage the positive and negative lessons learned from the support team which has lived those lessons first hand.

On the contract of Increment 2, a program of record in the System Development and Demonstration phase, are each of the logistics products intended for a proposed supportability strategy. The strategy will be tested through a logistics demonstration in the Increment 1a OA. Logistics support for Increment 2 will include Army mandated Two Level Maintenance, electronic and print training materials, embedded training, and the first Increment Two simulation (for the TCN), logistics analysis/Computerized Optimization Model for Predicting and Analyzing Support Structures and Core Depot Analysis to meet title 10 requirements. Performance-based studies for the non-core workload will be performed as a best value analysis to determine the operational feasibility and suitability of a Performance-based Logistics strategy for Low Rate Initial Production. Increment 1's Regional Support Center infrastructure will also support Increment Two. Using Increment 1 support solutions will minimize schedule and performance risk.

This logistics strategy can be traced back to 2004, when the lead engineers of Project Manager, Tactical Radio Communications Systems spent the winter joined with various groups throughout the Army in an entity known as "Task Force Networks."

This logistics strategy can be traced back to 2004, when the lead engineers of Project Manager, Tactical Radio Communications Systems spent the winter joined with various groups throughout the Army in an entity known as "Task Force Networks." These groups came together to address issues put forth in the V Corps white paper entitled "OEF/OIF Communications Lessons Learned" and to create the solution that would meet the Operational Needs Statement, which indicated that the Mobile Subscribe Equipment network just wasn't cutting it in the fight. By March 2004, a contract was awarded for the Joint Network Node-Network, which is now known as WIN-T Increment 1. Fielding of that system to the 3rd Infantry Division began five months later on Aug. 9.

The solution was to replace the line-of-sight MSE, with a joint voice, video, data communications network that was satellite-based. PM TRCS had previously developed and fielded non-program of record equipment; but never to the magnitude of the JNN-Network. In five month's time, a relatively simple concept was put in place to provide logistics support for a highly complex system.

The supportability concept for the JNN-Network included using Common Hardware Systems equipment such as routers, servers, laptops and transit cases. These made up a majority of the system's components. CHS, a product line within PM TRCS, provides computer-based equipment with a life of contract (five year) warranty. The beauty of CHS is that regionally-based support centers are in place to accept turn-in of these warranted items.

During this time, JNN-Network support also included a robust sparing scheme and Contractor Field Service Representatives from both General Dynamics and Data Path Industries. General Dynamics is the manufacturer of this commercial off-the-shelf system. DPI manufactures the Satellite Transportable Terminal, a key component of WIN-T Increment 1, which provides high bandwidth, beyond line-of-sight satellite communications at-the-quick-halt.

In the short five month development window, technical manuals and training courses were developed. The fielding to 3ID became known as Spiral 1. As time went on and additional spirals of JNN-N were fielded, PM TRCS instituted a process of continuous improvement to the expediently developed support strategy. Sparing was adjusted based on usage. New Equipment Training courses were improved after each iteration, based on feedback from the students during training and OEF/OIF operations.

As this took place, the General Dynamics MSE Resident School at the Signal School, Fort Gordon, Ga., received funding to procure initial JNN-Network equipment. The school also received funding to begin development of simulations to be utilized as part of the curriculum that would eventually transition with the transformation of the MSE school to the JNN-Network school.

The foundation of support provided during the expedient

initial fielding of WIN-T Increment 1 was accomplished with only a small portion of the analysis traditionally performed with a Program of Record. This analysis must meet regulatory and statutory stipulations required to meet milestones for production or fielding decisions. The calculation of which spares were needed was done manually, based on the criticality of those items to the operation of the shelter, Satellite Transportable Trailer or other major component.

With the usage of CHS items, common to many other systems in the Army inventory, the reliability and prediction of failure became an exercise in educated guessing. Overall, the sparing levels at division, brigade, sustainment depot or RSC levels have been validated through real time usage data and remain relatively the same after three years. The items which caused the biggest problem with the JNN-Network were some standard Army inventory items, harvested from a gaining unit's Mobile Subscriber Equipment; the older Environmental Control Units and generators. Significant problems surfaced with these items after they were used for 20 years with MSE. They also were taking a substantial beating in theater. PM TRCS and later PM WIN-T worked with Project Manager, Mobile Electric Power, the Department of Defense's supplier of power generation products and the CECOM Logistics Readiness Center to quickly repair, reset or replace the failing ECUs and generators.

In addition to RESET, the WIN-T JNN Branch of the Logistics and Readiness Center's Communications Directorate, (under branch chief Allen Hardison) provides maintenance engineering, provisioning, technical writing, and logistics support to PM WIN-T.

The big cost driver in JNN-Network support was the large number of Contractor Field Service Representatives deployed with the system to mitigate the rapid introduction of this highly complex communications system designed to adapt to the needs of Army Transformation supporting modularity and mobility.

The big cost driver in JNN-Network support was the large amount of Contractor Field Service Representatives deployed with the system to mitigate the rapid introduction of this highly complex communications system designed to adapt to the needs of Army Transformation supporting modularity and mobility.

Initially, significant numbers of CFSRs were supplied per division. The cost of the CFSRs was compounded by the challenge of hiring sufficient numbers of qualified CFSRs willing to deploy. Fielding occurred at an astounding speed and major divisions were often fielded simultaneously. At one point, in the spring and summer of 2005, PM TRCS was fielding the JNN-Network to the 101st Airborne, 10th Mountain Division, and 4th Infantry Division simultaneously. CFSRs and NET teams were in short supply, but each fielded spiral ultimately received the required training and CFSRs. It was well recognized that action needed to be taken.

By late 2006, alternatives were being examined closely that could reduce the cost, as well as dependency on CFSRs. Product Manager JNN worked with General Dynamics to devise a concept of regionalizing CFSRs, and to provide the CFSRs at the right time and when they were most needed. Now, CFSRs are allocated in regionally based pools. They deploy with the unit providing much of the initial support needed during network set up or falling in on an established network. After this initial period, all but few CFSRs can return to the CONUS pool and be available at the RSCs for on call requirements.

Logistics Assistance Representatives from the Readiness Directorate of CECOM Life Cycle Management Command were provided seats in all JNN-Network NET events, and since 2004 the great majority of the government's complement of Switch and Long Haul LARs have been trained. This is a key organic fall back for the contractor provided CFSRs. As part of NET, which is instructed by Increment 1 contractors, Michael Benson's team from the Readiness Directorate, Information Technology Field Services Branch developed and taught various courses such as Advanced Cisco Routing, WIN-T Networking and Information Assurance. With varying skill levels of the Soldiers, Basic Networking is also taught to ensure that students attending NET all start on the same page. The resident school at Fort Gordon continued to procure training suites and build simulations. The military occupational specialty 25N10 (nodal network systems operator-maintainer) was established for the JNN operator/maintainer and the first class graduated on Feb. 28, 2006.

Despite the expedient initial fielding of Increment 1, each of the required elements are now on contract to bring it through Full Materiel release. Increment 2, working in concert with the Increment 1 logistics team, will capitalize on every aspect of its predecessor's history.

Ms. Concepcion has worked in the Team C4ISR community at Fort Monmouth, N.J., for 29 years. She is chief of the Readiness Management Division for Project Manager, Warfighter Information Network-Tactical.

Acronym QuickScan

3ID – 3rd Infantry Division
CFSR – Contractor Field Service Representative
CHS – Common Hardware Systems
COMPASS – Computerized Optimization Model for Predicting and Analyzing Support Structures
COTS – Commercial off-the-Shelf
DPI – Data Path Industries
ECU – Environmental Control Units
FMECA – Failure Mode Effects & Criticality Analysis
JNN-N – Joint Network Node-Network
LAR – Logistics Assistance Representative
LCMC – Life Cycle Management Command
LORA – Level Of Repair Analysis
LRIP – Low Rate Initial Production
MEE – Maintenance Engineering Evaluation
MSE – Mobile Subscribe Equipment
NET – New Equipment Training
OA – Operational Assessment
PM – Project Manager
RMD – Readiness Management Division
RSCs – Regionally-Based Support Centers
SDD – System Development and Demonstration
STT – Satellite Transportable Terminal
TRCS – Tactical Radio Communications Systems
WIN-T – Warfighter Information Network Tactical

WIN-T Inc 1

By Herbert Cort

Introduction

Warfighter Information Network-Tactical Increment 1 is an Acquisition Category ID program, which is designated for Office of the Secretary of Defense Test and Evaluation oversight. WIN-T Increment 1 is composed of two sub-elements, WIN-T Increment 1a and WIN-T Increment 1b, which are technical insertions of WIN-T technology. WIN-T Increment 1a will enhance the currently fielded Joint Network Node-Network to extend networking at-the-halt with Ka military satellite communications capability down to the battalion level. WIN-T Increment 1b will enhance networking at-the-halt with Network-Centric Waveform and Colorless Core Capability to improve efficiency and encryption to divisions, brigades, and battalions.

WIN-T Increment 1b technical insertions add NCW modem and Colorless Core routing and information assurance architecture to allow compatibility with WIN-T Increment 2. The NCW equipped modem provides interoperability with current and developing on-the-move platforms and increased data throughput. WIN-T colorless core routing and Information Assurance architecture employs encryptions which are compliant with the High Assurance Internet Protocol Interoperability Specification to provide type 1 protection of data. WIN-T Increment 1a uses a black core architecture where the unclassified backbone has direct connectivity to the Non-secure Internet Protocol Router Network. WIN-T Increment 1b and 2 use a colorless core architecture. WIN-T Increment 1b provides a compatible colorless core capability to WIN-T Increment 1a. The Multi-frequency - Time Division Multiple Access capability of WIN-T Increment 1a is provided by the Linkway modems. In WIN-T Increments 1b and 2 this capability is provided by the NCW modem to all WIN-T locations so there will be one-hop connectivity from the command posts to the Increment 2 fielded assets. This enhanced networking capability enables more efficient wideband communications and supports the distribution of intelligence, surveillance, and reconnaissance information via voice, data, and video to tactical operation centers at the halt which significantly improves unit coordination and synchronization.

Test and evaluation modeling and simulation

WIN-T Increment 1 is part of a program to certify instrumentation tools to enhance the Data Collection, Reduction and Analysis Certification Program. The purpose of this program is to identify best-of-breed tools/metrics/processes for future test and evaluation events. The team assisting in this process includes representation from Director Operational Test and Evaluation, Training and Doctrine Command Capability Manager Networks and Services, U.S. Army Test and Evaluation Command, Research Development and Engineering Command Communications Electronics Research Development and Engineering Center Lab technicians, Program Managers and is coordinated by ATEC and the Program Executive Office Command, Control and Communicational Tactical. The demonstration/evaluation event was hosted at the RDECOM CERDEC JNN-Network Laboratory located at Fort Monmouth, N.J., in September 2007 with each vendor having the opportunity to demonstrate his instrumentation product. Modeling and simulation were used to provide a representative network based upon the WIN-T Increment 1 requirements. Network General's

Test Strategy

Network Intelligence Suite instrumentation tools were chosen by the RDECOM CERDEC, PEO C3T and ATEC in December 2007. ATEC is planning to conduct a Network General Network Intelligence Suite instrumentation certification event using a WIN-T Increment 1a test network located at General Dynamics, Taunton, Mass., in September 2008. This verification event is being conducted to certify the Network General Network Intelligence Suite instrumentation tools to be used by the U.S. Army Operational Test Command during the WIN-T Increment 1a Initial Operational Test and Evaluation event to be conducted in October 2008.

Post Milestone C/Low Rate Initial Production WIN-T Increment 1a Production Verification Testing

A post-Milestone C Decision was provided in an Office of the Secretary of Defense Acquisition Decision Memorandum, dated June 5, 2007. The post-Milestone C Decision directed a Low Rate Initial Production designated for test and evaluation to support Production Verification Testing and operational test events. The equipment procured under a LRIP will support the following events: PVT – contractor conducted, PVT – government conducted, operational testing and fielding requirements. The LRIP quantities are as follows: two Hubs, 63 JNN Shelters and 271 Battalion Command Post Nodes.

The PVT will verify compliance of the WIN-T Increment 1a system to the contractual product specifications. PVT is performed one time using a sample from the LRIP quantities and consists of the following test and evaluation requirements:

- Safety
- Temperature (low and high)
- Humidity
- Rain
- Sand and dust
- Weight, center of gravity
- Helicopter sling load
- CH-47 flight test
- Vibration (Munson Road, secure cargo)
- Shock (rail impact, transit drop)
- Electromagnetic Interference
- Transient Electromagnetic Pulse Emanation Standard
- High Altitude Electromagnetic Pulse
- Logistics demonstration
- Functional network "over-the-air" Ku-band satellite
- Army Interoperability Certification
- Joint Interoperability Certification
- Information assurance
- Chemical Biological and Radiological Nuclear Analysis

These test and evaluation requirements will be validated either through test and/or analysis.

PVT for WIN-T Increment 1a is being conducted from January 2008 through March 2009. PVT for WIN-T Increment 1b is to be determined.

WIN-T Increment 1 Operational Test events:

WIN-T Increment 1a Initial Operation Test and Evaluation

The WIN-T Increment 1a IOT&E is scheduled to occur in October 2008. The objective of the IOT is to demonstrate operational effectiveness, operational suitability, and survivability in support of a full rate production decision. This test event will ensure that the WIN-T Increment 1a will provide the current force warfighter with a state-of-the-art communications backbone that will enable them to exchange voice, video, and data information throughout the division, brigade combat team, and battalion levels of command. The WIN-T Increment 1a will provide the warfighter with reliable services and information exchanges that provide the warfighter with the means to control battlefield tempo by getting information to the right place at the right time. This will be an instrumented test event conducted by the U.S. Army Operational Test Command on a non-interfering basis during the 5/2 Infantry Division/Stryker Brigade Combat Team-7 Mission Readiness Exercise.

The projected test architecture will consist of Corps Response cell, Division Headquarters (one maneuver brigade with supporting battalion) with a mix of currently fielded and new production systems; it is a theater and below system. It is anticipated that the test unit will be I Corps, 1st Cavalry Division, and the 5/2 Infantry Division SBCT-7. The unit will receive Lot 10 equipment as its first fielding of WIN-T Increment 1a equipment. The IOT&E event will be conducted with tactical and operational realism using trained Soldiers-operators using the new Lot 10 WIN-T Increment 1a systems.

Blue and Red teams from the 1st Information Operational Command will implement non-destructive Information Assurance vulnerability and penetration testing.

The test scenario will consist of the events essential for WIN-T to operate as a theater and below system (i.e. network) in a Full Spectrum Operational environment.

The WIN-T Increment 1a will provide the warfighter with reliable services and information exchanges that provide the warfighter with the means to control battlefield tempo by getting information to the right place at the right time.

The results of the WIN-T Increment 1a PVT and WIN-T Increment 1a IOT will be summarized in the ATEC System Evaluation Report in support of a Materiel Release of WIN-T Increment 1a by the Milestone Decision Authority.

The results of the WIN-T Increment 1a IOT&E will be summarized in the DOT&E Beyond-LRIP Report to be submitted in support of the Full Rate Production Milestone Decision Review. The FRP Milestone Decision Review for WIN-T Increment 1a is projected to occur in June 2009.

WIN-T Increment 1b Limited User Test

The WIN-T Increment 1b Limited User Test is scheduled to occur in March 2009. The primary objective of the WIN-T Increment 1b Operational Test and Evaluation program is to ensure the new capabilities added to the Increment 1 network are operationally effective, operationally suitable and survivable. The new capabilities will be assessed during the Increment 1b LUT and validated during the Increment 1b Operational Test. The below test strategy describes Increment 1b test events as if they are stand alone events. It is planned that WIN-T Increment 1b test events will be conducted in conjunction with WIN-T Increment 2 test events to save personnel and resources.

The new Increment 1b capabilities are the Network-Centric Waveform and the Colorless Core Capability. The Network-Centric Waveform permits direct satellite connectivity between nodes within the network and eliminates the need for multiple satellite links between Increment 1 and Increment 2 nodes. The Colorless Core Capability adds another layer of security causing a change to the network throughput. NCW and Colorless Core are inherent to Increment 2 design.

The WIN-T Increment 1b test program has been tailored to focus on these new capabilities and will use relevant data from WIN-T Increment 2 testing. WIN-T Increment 1b and Increment 2 will be fielded together and their OT events are expected to be concurrent to reduce test resources.

The objective of Increment 1b and Increment 2 LUT is to assess the new capabilities in an operationally realistic environment. ATEC will use this LUT and all relevant data to prepare an assessment and support a WIN-T Increment 2 Milestone C decision and validate NCW and Colorless Core insertion into Increment 1b.

This event will assess the effectiveness, suitability, and survivability of WIN-T Increment 1b technology insertion in conjunction with WIN-T Increment 2 LUT. The LUT will run from the start of New Equipment Training through the units Mission Readiness Exercise or Combat Training Center Rotation. The LUT test unit has yet to be determined by U.S. Army Forces Command. It is planned that test events during the LUT include backwards compatibility with previously fielded WIN-T Increment 1a systems.

WIN-T Increment 1b OT

The WIN-T Increment 1b OT is scheduled to occur in May 2010. The objective of the OT is to gain a full

materiel release of WIN-T Increment 1b system technical insertion. The WIN-Increment 1b enhanced networking at-the-halt NCW and colorless core capability will be evaluated concurrently during WIN-T Increment 2 OT event planned for May 2010.

The objective of the WIN-T Increment 1b OT is to assess the operational effectiveness, operational suitability and survivability of the WIN-T Increment 1b system with the new capabilities that improve network throughput and provide interoperability with the WIN-T Increment 2 network. ATEC will use the WIN-T Increment 1b OT and all relevant data to prepare their assessment that will support the Materiel Release by the MDA.

The objective of the WIN-T Increment 1b OT is to assess the operational effectiveness, operational suitability and survivability of the WIN-T Increment 1b system with the new capabilities that improve network throughput and provide interoperability with the WIN-T Increment 2 network.

Summary

WIN-T Increment 1 is composed of two sub-elements, WIN-T Increment 1a and WIN-T Increment 1b, which are technical insertions of WIN-T technology. WIN-T Increment 1a will enhance the currently fielded Joint Network Node Network to extend networking at-the-halt with Ka-band military satellite communications.

WIN-T Increment 1b is a NCW and Colorless Core technical insertion to WIN-T Increment 1a that will allow it to communicate with the next increment of WIN-T, WIN-T Increment 2.

Mr. Cort is currently assigned to Project Manager, Warfighter Information Network-Tactical at Fort Monmouth, N.J. He is the test engineer for Product Manager, WIN-T Increment 1. He received a Bachelor of Science degree in industrial engineering from the State University of New York at Buffalo in 1985. He graduated from the Army Logistics Management Center School of Engineering and Logistics Quality and Reliability Engineering program in 1986.

Acronym QuickScan

AIC – Army Interoperability Certification
ATEC – U.S. Army Test and Evaluation Command
BnCPN – Battalion Command Post Node
CBRN – Chemical Biological and Radiological Nuclear
CERDEC – Communications Electronics Research Development and Engineering Center
CTC – Combat Training Center
DCR&A – Data Collection, Reduction, and Analysis
DOT&E – Director Operational Test and Evaluation
EMI – Electro Magnetic Interference
FORSCOM – U.S. Army Forces Command
FRP – Full Rate Production
FSO – Full Spectrum Operational
HAEMP – High Altitude Electromagnetic Pulse
HAIPIS – High Assurance Internet Protocol Interoperability Specification
IA – Information Assurance
IOT&E – Initial Operational Test and Evaluation
JNN-N – Joint Network Node-Network
LRIP – Low Rate Initial Production
LUT – Limited User Test
MDA – Milestone Decision Authority
MF – Multi-frequency
MRX – Mission Readiness Exercise
NCW – Network Centric Waveform
NET – New Equipment Training
NIPRNET – Non-Secure Internet Protocol Router Network
OSD – Office of the Secretary of Defense
OT – Operational Test
OTC – U.S. Army Operational Test Command
OTM – On-the-Move
PEO C3T – Program Executive Office Command, Control and Communicational Tactical
RDECOM – Research Development and Engineering Command
TCM NS – Training and Doctrine Command Capability Manager Networks and Services
TDMA – Time Division Multiple Access
TEMPEST – Transient Electromagnetic Pulse Emanation Standard
WIN-T – Warfighter Information Network-Tactical

WIN-T Increment 2 Test Strategy

By Kenneth Hutchinson

Implemented by Project Manager, Warfighter Information Network-Tactical Increment 2, the "build-a-little, test-a-little" test strategy uses networks of increasing scale to identify developmental issues early on and address them before they magnify.

This testing method was used in October 2007, when PM WIN-T successfully executed a 15 Node Engineering Field Test at the FortDix/Navy Lakehurst, N.J., contiguous base.

When a problem is discovered, a failure review and corrective action system is used to evaluate the criticality of the problem and ensure that corrective actions resolve the issue. Correcting the issue might involve installing a software fix or patch, hardware modifications or a change in operating procedures.

The test at Fort Dix/Navy Lakehurst consisted of 15 Highband Network Radio radios and eight Net Centric Waveform modems. It was performed in a highly mobile environment over cross country terrain. A C-23 Sherpa was fitted with an HNR radio and antenna to demonstrate objective airborne relaying capabilities. This was the largest HNR network demonstrated to date, and showed the network's ability to perform dynamic routing on-the-move. Network management demonstrated its capability to plan, monitor, and manage a mobile network of this magnitude.

This test demonstrated technologies identified as critical to the development of the WIN-T Increment 2 system. These technologies included:

1. **Capabilities of the HNR and NCW;**
2. **The ability to monitor and manage the network both at the radio and remotely;**
3. **Demonstrating the Radio Management Interface;**
4. **Showing the ability to plan the network;**
5. **Demonstrating that the network is dynamic and can route around blockages;**
6. **Demonstrating that the network can hand off between terrestrial and satellite communications;**
7. **Demonstrating both unicast and multicast capabilities.**

A multi-disciplined team consisting of PM WIN-T, Communications-Electronics Research, Development and Engineering Center Space and Terrestrial Communications Directorate, PM C4ISR On-the-Move, TCM Networks and Systems and General Dynamics planned and executed the event over a two-week period.

Modeling and simulation have been developed to simulate live traffic over a representative WIN-T network over geographically dispersed regions. M&S will be used throughout the WIN-T Increment 2 program to:

- ❖ Assess technical performance;
- ❖ Reduce system design, development, and fielding times;
- ❖ Assess logistics support, training, human factors, and fielding concepts;
- ❖ Reduce total ownership costs and to perform cost/performance tradeoffs;
- ❖ Assess and mitigate technical risks; and to aid in threat assessment and mission area analysis.
- ❖ M&S will also be used to support the system performance evaluation.

The future test strategy in

volves a series of test events of increasing complexity to demonstrate system capabilities and support critical program milestones. These tests will demonstrate key performance parameters, critical operational issues and criteria, as well as, the continued maturation of critical WIN-T technologies. The "build-a-little, test-a-little" strategy will mitigate program risk and ensure successful completion of program milestones.

A number of key WIN-T test events will be held in the future. They include:

❖ **Developmental Test (November 2008)** - This test will deploy a representative slice at both division and brigade areas down to the company level. It will provide a robust, on-the-move network sending representative voice, video and data traffic.

Performance requirements that will be evaluated in DT include: Interoperability, Network Management, NETOPS, Information Dissemination, Mobile Throughput, Self Healing, Self Networking, and Manpower and Personnel Integration. These requirements will be evaluated in a representative doctrinal laydown and include mobility, network loading, relaying (ground, and space) and interfaces.

Performance against Information Assurance threats will also be evaluated during DT.

❖ **30 Node Engineering Field Test (December 2008) –** This event is a continuation of PM WIN-T's "build-a-little, test-a-little" development strategy. It will be conducted at the same location as the Developmental Test and will provide PM WIN-T an opportunity to demonstrate emerging WIN-T technologies at an increased scale. This event will demonstrate a larger network deployed over a significantly larger geographical area. By providing increased operational realism, PM WIN-T will be able to demonstrate increased technology maturity.

❖ **Limited User Test (March 2009).** The LUT provides the first opportunity to evaluate the WIN-T Increment 2 system under operational conditions. The WIN-T network will be deployed in accordance with existing doctrine.

The test scenario will include a division complement and two brigade slices, one of which will be a WIN-T Increment 1b brigade. The operational tester will collect instrumented and manual data (performance; reliability, availability, maintainability and MANPRINT).

The actual scope and execution of the test will be derived from scenarios and excursions provided by its user, the U.S. Army Signal Center, Fort Gordon, Ga. The test will be designed in such a way that it enables the test team to collect data on WIN-T's ability to support split based operations, reach back, at-the-halt and on-the-move communications, network security, and voice, video, and data traffic.

Interoperability testing will be conducted to evaluate the interface with Army Current Force/Interim Networks. These test events will be used to provide data in support of a Milestone C decision to allow WIN-T Increment 2 to proceed into the Low Rate Initial Production Phase.

After the Milestone C Decision and production contract award, a comprehensive test program based upon government approved test plans and procedures will be conducted.

These tests will include:

❖ **Production Qualification Test (October 2009 to January 2010)** - This will verify specification compliance and uncover deficiencies at the system level, to ensure that technical risks have been minimized. This testing will be conducted at the contractor's facility and will demonstrate that the WIN-T Increment 2 system meets contractually specified requirements.

❖ **PQT-G (March 2010)** - Similar to the Developmental Test event conducted in the System Design and Development phase, PQT-G will demonstrate the WIN-T Increment 2 network's ability to perform KPP and enhanced critical technology maturity. The network will be deployed over geographically dispersed locations and provide an opportunity to evaluate production representative hardware and software in user provided tactical vehicles.

❖ **Initial Operational Test (July 2010)** - The IOT provides an opportunity to evaluate WIN-T Increment 2 using objective Soldiers in a relevant operational environment. It will use a division slice and install a WIN-T presence at the brigade level to include an Increment 1b and sufficient subordinate battalions to load the network. Actual WIN-T items to support the division and brigade elements will be operated by Soldiers from a designated test unit. WIN-T will support split-based operation over representative distances and implement reach back, provide both stationary, and on-the-move communications, network access at all security levels, support video teleconferencing and network access to local voice subscribers. Deployments and scenarios will involve both static and mobile elements operating in accordance with preplanned missions to include highly mobile offensive operations. Static ground and space relays will be used as required to enhance the area of coverage.

These test events will be used to provide data to support a System Evaluation Report for the WIN-T full rate production decision and subsequent fielding of the system.

Summary:
The WIN-T Increment 2 program implements a robust test strategy to provide critical information in support of key program milestones. It uses a series of "build-a little, test-a little" events of increasing complexity and scope to identify potential design problems early on and mitigate program risks.

Mr. Hutchinson is the lead test engineer for the Warfighter Information Network-Tactical Increment 2 and 3 program within Project Manager, WIN-T, Fort Monmouth, N.J. He has more than 30 years experience in testing complex communications and command and control systems.

In his current position, he develops testing strategies and serves as the principle point-of-contact for test related issues.

Acronym QuickScan

CERDEC – Communications-Electronics Research, Development and Engineering Center
COIC – Critical Operational Issues and Criteria
HNR – Highband Network Radio
IA – Information Assurance
IOT – Initial Operational Test
KPP – Key Performance Parameters
LRIP – Low Rate Initial Production
LUT – Limited User Test
M&S – Modeling and Simulation
MANPRINT – Manpower and Personnel Integration
NCW – Net Centric Waveform
NETOPS – Network Operations
OTM – On-the-Move
PM – Project Manager
PQT – Production Qualification Test
S&TCD – Space and Terrestrial Communications Directorate
SDD – System Design and Development
TCM – TRADOC Capabilities Manager
WIN-T – Warfighter Information Network-Tactical

Army ready with next generation of network operations

By Greg Wagner

The Army will be testing and fielding various increments of their flagship WIN-T program over the next 12-to-24 months; for WIN-T Increments 2 and beyond, this includes an integrated Network Operations capability. This capability represents the next generation in NetOps and, perhaps more significantly, a fundamental paradigm shift in how NetOps is accomplished tactically. This paradigm shift is largely driven by how the requirements for the WIN-T Increment 2 and beyond network were written.

Rather than write specific operational requirements against classic network components (e.g., transmission, switching, network management), the TRADOC Capabilities Manager Network & Services wrote a series of network-level, performance-based requirements. This "requirements" paradigm shift resulted in an operational description of how the whole *network* must perform, and what the whole *network* must do, rather than a recitation of operational requirements against specific, isolated subsystems.

These performance-based requirements are contained in the WIN-T Capabilities Description Document and the related WIN-T Increment 2 Capabilities Production Document. The CDD and CPD also include five Key Performance Parameters, which describe "must-have" capabilities, without which the system would not meet mission critical functions. One of these KPPs directly relates to NetOps (network management in particular), and two other KPPs indirectly involve NetOps.

The specification of holistic, performance-based network requirements, coupled with three of the five KPPs involving NetOps directly or indirectly, requires a NetOps materiel solution that is *integrated*. WIN-T Increment 2 is fielding such a NetOps solution. The term "integrated" can mean many things; in the context of WIN-T Increment 2, *integrated* NetOps means integrated with respect to the overall network, and integrated with respect to work flow.

WIN-T Increment 2 NetOps is *integrated* with the larger network in the sense that all aspects of the NetOps agents and technologies are located throughout the network and interact with other network components to make the automated, near-real-time monitoring and response decisions required to meet the network-level performance metrics set forth in the CDD and CPD. These decisions must be made in concert with decisions made in other network subsystems such as routing and switching, admission control, and transmission to yield a predictable and guaranteed speed of service for different types of traffic (voice, video, data) and different traffic importance (critical, routine, etc.) so as to meet the commander's priorities for information flow. These sorts of decisions cannot be made by stand alone packages residing in a central location.

WIN-T NetOps is *integrated* with respect to work flow in the sense that all aspects of the NetOps process, from planning through administration to monitoring and response, are accomplished by a single framework containing all requisite data and functions, and

done in an integrated, harmonious fashion. Changes to the settings or behaviors of an information assurance component, for example, can be addressed in the larger context of the overall network, and implications or changes to the other parts of the network can be made without tedious data re-entry by an operator. In addition, the operator has a single, intuitive user interface for all aspects of the NetOps process, to include spectrum management. This simplifies new equipment training, sustainment training, and resident training for the operators and trainers alike.

The WIN-T Increment 2 network is a mobile, ad-hoc network. As such, it creates some interesting NetOps challenges, that themselves represent a second paradigm shift from classical network operations thinking.

In a mobile, ad-hoc network, the up/down status of an individual link is secondary to the *connectivity* of nodes. As the various network elements move as a function of the flow of battle, it is natural for any number of links to be "down," but the important question is whether the various network elements, and the battle command systems they connect, can pass data with the requisite speeds of service. This requires a fundamental shift in user perspective, from a link-based, static view of the network to a connectivity-based, dynamic view of the network. TCM N&S is working with PM WIN-T and the user community to address user interface and training associated with this paradigm shift.

With a mobile, ad-hoc network operating in a multi-tier transmission environment (terrestrial air, space), it is important to be able to predict *a priori* how the network will behave spatially and temporally as an operation or exercise progresses. This prediction needs to account for geographical features, the variations in traffic volume offered to the network as a function of battle phase and unit position, and spectral interference and its attending bandwidth effects, both within the network and between the network and the background environment. All this must be accomplished in a time frame that is relevant tactically. With this information, a network operator can see where, both in space and time, the network fails to meet commanders' delivery priorities, and can then allocate or reallocate resources from the terrestrial, air, or space layer to meet the commander's operational needs.

The WIN-T Increment 2 network is a mobile, ad-hoc network. As such, it creates some interesting NetOps challenges, that themselves represent a second paradigm shift from classical network operations thinking.

U.S. Army Training and Doctrine Command has mandated that the WIN-T program follow net-centric principles, and has prescribed the Net-Centric KPP for the program. The WIN-T NetOps system is built upon net-centric principles and follows the Network-Centric Operations and Warfare reference model and Network-Centric Enterprise Services guidance. The software is designed around a service-oriented concept, with functions or tasks represented by services. This enhances the ability to "expose" or export services to other NetOps solutions (e.g., Future Combat Systems Network Management Systems)or conversely import or subscribe to externally provided services (e.g., Joint Tactical Radio Systems Wideband Networking Waveform management services, Theater Network Operations and Securities Center trouble ticketing services).

Based upon guidance from the Army and Department of Defense, WIN-T NetOps is being built in an incremental fashion, following the incremental development of the network. Increment 1 will involve the deployment of stand-alone government off-the-shelf and commercial off-the-shelf-based products for network operations akin to those being used for the JNN network. Increment 2 introduces the WIN-T net-centric NetOps architecture, introduces capabilities required for effective management and control of a mobile-ad-hoc network, and begins the integration of the stand-alone COTS and GOTS products. Increment 3 refines the mobile, ad-hoc functions, provides additional capability for the planning and management of battle command applications and services, and continues the integration of the GOTS and COTS solutions. Increment 4 completes the NetOps development with refinements of previous functions and completes replacement of COTS and GOTS stand-alone packages.

WIN-T provides an integrated NetOps solution as part of an overall network design that meets the performance based operational requirements set forth by the Army. This integration provides a unified NetOps approach that is harmonized with other critical network elements to provide positive control of a mobile, ad-hoc network, and a simultaneous providing of the required bandwidth and speed of service to the commander, the command staff, and their respective battle command applications.

Editor's Note: Paul Wein contributed to this report.

Mr. Wagner is a systems engineer in the Network Operations area of the Project Manager, Warfighter Information Network-Tactical office. He received a B.S. in electrical engineering in 1979 from West Virginia University, and masters in engineering administration in 1988 from George Washington University, an M.S. in electrical engineering in 1992 from The Johns Hopkins University, and a Ph.D in Information Systems in 2003 from Kennedy Western University.

Acronym QuickScan

AFCEA – Armed Forces Communications and Electronics Association
CDD – Capabilities Description Document
COTS – Commercial off-the-Shelf
CPD – Capabilities Production Document
DoD – Department of Defense
FCS – Future Combat System
GOTS – Government off-the-Shelf
ICWG – Interface Communications Working Group
IEEE – Institute of Electrical & Electronics Engineers
JNN-N – Joint Network Node-Network
JTRS – Joint Tactical Radio Systems
KPPs – Key Performance Parameters
NCOW – Network Centric Operations and Warfare
NCES – Network Centric Enterprise Services
NetOps – Network Operations
NMS – Network Management Systems
TCM N&S – TRADOC Capabilities Manager Network & Services
TNOSC – Theater Network Operations and Securities Center
TRADOC – Training And Doctrine Command
WIN-T – Warfighter Information Network-Tactical
WNW – Wideband Networking Waveform

DiD strategy ensures security across WIN-T

By Deryk Gannon

Ensuring tactical information reaches the right people at the right time is essential to the Warfighter's safety and mission-related needs.

Project Manager, Warfighter Information Network-Tactical will implement a Defense in-Depth strategy to ensure the integrity of this information. The initial and focal DiD strategy for WIN-T is to segregate and limit users' access to the wide area network and network infrastructure by using a Global Information Grid Colorless Core. This colorless core will ensure all user traffic is High Assurance Internet Protocol Encryptor encrypted, as it transits through the WIN-T backbone. Defense in Depth is a coordination of multiple security layers, such as perimeter, enclave, and host levels; alert correlation and countermeasures used in response to cyber threats and to provide protection of information across an enterprise network.

The WIN-T strategy will also implement DiD fundamentals such as perimeter protection suite, enclave, and host-based protection. These protection mechanisms are a culmination of Army approved information assurance commercial off-the-shelf hardware and software, which provide firewall, anti-virus detection/blocking software, intrusion detection, software malicious mobile code detection and access control.

This strategy will include extending the Department of Defense Public Key Infrastructure to the Warfighter and Battlefield Command applications. WIN-T will leverage the DoD PKI to provide stronger user/device authentication and negate the need for users' passwords. WIN-T 802.1X will be used in conjunction with the DoD PKI to enforce network access and auditing. Each of these information assurance mechanisms and devices will be managed, monitored, and configured by the WIN-T Network Operations and Security Center, which will provide a single correlated IA Common Operation Picture and network InfoCon status.

WIN-T transmission systems will implement National Security Agency transmission security techniques to protect over the air broadcast.

This strategy of limiting the users' direct access enterprise services is intended to reduce or limit the insider threat to the overall WIN-T network. This strategy is built into the program from the start and provides a strong manageable and upgradable system to protect all aspects of the WIN-T network.

Mr. Gannon is a senior information assurance and security engineer for Net-Centric Technology supporting Project Manager, Warfighter Information Network-Tactical at Fort Monmouth, N.J.

Acronym QuickScan

BC – Battle Command
COP – Common Operational Picture
DiD – Defense in Depth
HAIPE – High Assurance Internet Protocol Encryptor
IA – Information Assurance
PKI – Public Key Infrastructure
PM – Project Manager
PPS – Perimeter Protection Suite
WIN-T – Warfighter Information Network Tactical

Battle Command Battle Lab

at Fort Gordon – a rich heritage of support to WIN –T

By Dale A. White

The Capability Development Integration Development Experimentation Division, formerly known as the Battle Command Battle Lab (Gordon), has a long and proud history of providing support to the WIN-T program. Established in 1992, the BCBL(G) mission is to conduct experiments and technical assessments on emerging concepts and technologies focused on improving the "means" of battle command. BCBL(G) provides an unbiased look at technology and serves as the "honest broker" for both the acquisition and user communities. BCBL(G) experimentation dating back to the late 1990s has provided valuable insights regarding communications concepts and technologies and has produced prototypes that have directly transitioned to the fighting force.

Early experimentation

In 1997, a general officer memorandum approved the formation of a distributed testbed between the BCBL(G) and the CECOM Research and Development Command Space and Terrestrial Communications Development as part of a collaborative effort to provide risk mitigation for Program Manager Warfighter Information Network (the original name of WIN-T). The WIN Proof-of-Concept testbed provided a robust experimentation environment that evaluated emerging technologies and integrated those technologies into working prototypes. As a result, two WIN POC nodes were developed, one mounted on a Humvee and another in transit cases. Both nodes provided voice and Internet Protocol data over an asynchronous transfer mode wide area network backbone. In 1999, BCBL(G) deployed the WIN POC node to Fort Polk, La., on its first tactical mission to support of the 28th Combat Support Hospital JRTC rotation.

A 2048 kbps satellite link back to the BCBL(G) provided Non-secure IP Router Network and Defense Switched Network services to the hospital staff. More than 3,500 phone calls were made in a 20 day period. The WIN POC nodes participated in several other key events, most notably the Joint Contingency Force Advanced Warfighting Experiment and Millennium Challenge '00. The architecture became the basis for the six brigade subscriber nodes built by the CERDEC which were fielded to the first three Stryker Brigades.

28th CSH JRTC rotation supported by BCBL(G) WIN POC node, September 1999.

PRT network fielding and training to 125th Sig Bn, Bagram AF, Afghanistan, April 2004.

In 2001, the BCBL(G) began experimentation with a beyond line-of-sight satellite communications modem waveform known as Multi-frequency Time Division Multiple-access Demand Assigned Multiple Access. Working with the Joint Forces Command Joint Battle Center (now called JSIC) in Suffolk, Va., the experimentation quickly showed how an "everything-over ATM" architecture could be effectively and efficiently range-extended using a bandwidth on demand SATCOM access methodology. The waveform was showcased in several key events culminating with Millennium Challenge '02. Joint Forces Command sponsored the BCBL(G) to develop and train a six-node pilot fielding which was then transitioned to U.S. Transportation Command in early 2003.

Technology insertion to OIF/OEF

In mid-2003, the BCBL(G) received a query from the PEO C3T – Program Executive Office Command Control Communications Tactical

Special Projects Office regarding the technical maturity of the MF-TDMA waveform and its possible implementation for the 3/2 Infantry Division (1st Stryker Brigade Combat Team) who were deploying to Operation Iraqi Freedom in late 2003. A significant capability gap existed regarding the ability to adequately provide C2 down to battalion level over non-contiguous battlespace using 3/2ID's organic data radios (Near Term Digital Radio). The BCBL(G) teamed with the Special Projects Office, CERDEC, and PM WIN-T to procure and train a 13 node network in time for 3/2ID's reception, staging, onward integration in Kuwait. The team accompanied the brigade to Camp Udairi, Kuwait, where they performed final network integration and additional training on the objective satellite. The architecture, dubbed Internal Ku-band Satellite System by 3/2ID, provided broadband bandwidth on demand access down to battalion level. It featured a virtual dual hub-spoke topology and operating on just two RF carriers on the satellite. The fielding was so successful that it is still in use today and is on its 5th RIP/TOA.

Immediately following the IKSS fielding, the SPO received a request from the CJ6 for CJTF-76 (Operation Enduring Freedom) citing a similar beyond line-of-sight requirement to provide multimedia services in three security classifications to 16 Afghanistan Provinces to support the Provincial Reconstruction Teams. The SPO team was again assembled and provided equipment and training at Bagram Airfield for the 125th Sig Bn, 25th ID who would operate and maintain the PRT sites. The PRT network has since expanded to 25 sites and, like the IKSS network, is still online today.

WIN-T Inc 1 fielding support

At the time that the IKSS and PRT fieldings were occurring, PM TRCS was developing an architecture for the next generation of tactical switching to replace Mobile Subscriber Equipment and enhance the capabilities of the BSN. Ultimately named JNN, the architecture leveraged the successes of the two pilot fieldings and incorporated the MF-TDMA technology as the core waveform that would allow JNN-equipped brigades and divisions to communicate BLOS. The integration of MF-TDMA into JNN has played a crucial role in the success of the Army's Modular Force transformation. Because the waveform expertise was resident at the BCBL(G), the PM asked the BCBL(G) to assist in the fielding of the 3ID in August 2004. The BCBL(G) established and still operates the WIN-T Inc 1 fielding hub which provides TDMA Master Reference Terminal services,

cut sheets, transmission plans, overall SATCOM subject matter expertise, national tier 2 architecture, and New Equipment Training augmentation for all fielding events. Beginning in 2008, the Inc 1 fielding hub will also support Inc 1 reset events.

NSC-T establishment

In fiscal year 2005, the BCBL(G) identified a sustainment training shortfall for WIN-T Inc 1 equipped units which included the lack of bandwidth and a training support facility for post-fielding training. In addition, a facility was needed to provide TDMA hub support and GIG services for the continued Inc 1 fielding, resetting units, and units without organic TacHubs. On Feb. 2, 2006, BG Jeffrey W. Foley, as the CIO/G6 Architecture, Operations, Network and Space director, approved the concept of the Network Service Center-Training and provided funding for its establishment at BCBL(G). The NSC-T came online on May 15, 2006, and reached Final Operation Capability on Dec. 1, 2006. It emulates the role of either the Tactical Hub or the Fixed Regional Hub Node and supports sustainment/pre-deployment training for JNN-equipped, JNN-compatible, and Marine Corps Support Wide Area Network units in Continental United States/Hawaii/Alaska on a 24x7x365 basis. Supported training includes home station training events, Combat Training Center rotations, Signal Center resident training, and Capstone exercises. Training units connect to the NSC-T over one of two satellites and access Non-secure Internet Protocol Router Network, Secure Internet Protocol Router Network, and Defense Switched Network from the Global Information Grid. To date, the NSC-T has performed over 300 training missions and currently averages 20 missions per month.

In addition to the core training hub mission, the NSC-T also plays pivotal roles in experimentation and prototyping of new technology/waveforms; tactic, technique and Procedure; Detailed Technical Procedure development; and support to the SIGCEN resident schoolhouse. The NSC-T is slated to be a key participant in the upcoming WIN-T Inc 1b/Inc 2 Limited Users Test.

The NSC-T supports sustainment training for WIN-T Inc 1 equipped units in CONUS, Hawaii, and Alaska.

Modeling and simulation support

Since 2005, the BCBL(G) Modeling and Simulation Branch has supported PM WIN-T with Information Exchange Requirements and model-ready network traffic databases for input to the General Dynamics WIN-T model developed in the OPNET modeling environment. The traffic supports all phases of the acquisition life cycle and is based on approved operational requirements products. The Information Exchange Requirement and traffic databases reflect voice, video, and data IERs, with emphasis in FY08 on improved collaboration exchanges, NetOps, applications data, and voice for legacy and FCS networks. The PM WIN-T modeling and simulation multi-year program is scheduled to continue through 2011.

Ongoing experimentation/assessments

The BCBL(G) continues to conduct experiments and technology assessments that are relevant to the WIN-T program and warfighter capability gaps. This year, the BCBL(G) conducted the Medical Command-over-Joint Network Node experiment which assessed the ability of WIN-T Inc 1 to support Army Medical Department's Information Exchange Requirements at the combat support hospital and medical company. The BCBL(G) recently completed an assessment of the Linkway S2 TDMA satellite modem which is the follow-on product for the current Linkway 2100 modem used in Inc 1. An assessment of the L3 MPM-1000 Network-Centric Waveform modem which is scheduled to be inserted into the Inc 1b architecture is planned. Previous experiments include an MBCOTM experiment (FY06) which investigated and validated emerging on-the-move antenna and modem technologies. The Battle Lab also completed the TS/SCI-over-JNN experiment (FY07) which evaluated the technical feasibility of a JNN-equipped BCT to

support the Intel community by providing connectivity for tactical SCIFs. In addition, BCBL(G) is investigating and assessing pertinent WIN-T-related technologies including 802.11, 802.16, Combat Net Radio-over-IP, tactical cellular networks and Secure Mobile Environment Portable Electronic Devices.

The BCBL(G) also supports the Special Operations and Joint communities in addressing current capability gaps. In FY07 the BCBL(G) assessed a U.S. Army, Special Operations Command iDirect-based network and optimized the network performance of their remote Super High Frequency "fly-away" packages to meet their command and control requirements. Early in FY08 the BCBL(G) evaluated a commercially available ruggedized deployable cellular communications system that could operate with National Security Agency approved Type 1 secured cellular devices to meet a current U.S. Marine Corps C2 capability gap in theater.

Mr. White retired from active duty with more than 21 years of service. He has been a Department of the Army civilian at the Fort Gordon Battle Lab since 1995 and is currently the NSC-T technical director.

Acronym QuickScan

AMEDD – Army Medical Department
AONS – Architecture, Operations, Networks, and Space
ATM – Asynchronous Transfer Mode
BCBL(G) – Battle Command Battle Lab (Gordon)
BSN – Brigade Subscriber Node
CDID – Capability Development Integration Directorate
CERDEC – CECOM Research and Development Command
CSH – Combat Support Hospital
CTC – Combat Training Center
DSN – Defense Switched Network
DTP – Detailed Technical Procedure
FCS – Future Combat System
FY – fiscal year

Theater Tactical Sig Bde concept now a reality

By 2LT Jon Reiss, CPT Joseph Kachmar, and MAJ Rob Fago

The 11th Theater Tactical Signal Brigade from Fort Huachuca, Ariz., deployed in October 2007 as the first non-organic signal brigade to support a deployed corps headquarters. The 11th initially supported the III Corps from Fort Hood, Texas, who was executing the mission of the Multi-National Corps-Iraq. In February 2008, XVIII Airborne Corps from Fort Bragg, N.C., replaced III Corps. Dubbed "Task Force Thunderbird", the 11th Signal Brigade headquarters combined with the 44th Expeditionary Signal Battalion from Manheim, Germany, and the 63rd ESB from Fort Gordon, Ga., to provide critical communications support for the MNC-I commander and corps operations in Iraq.

The TTSB and its subordinate ESBs are part of the Army's transformational signal support construct to the warfighters. The TTSB mission is to provide battle command, funding, manning, logistics and administrative support, as well as training and readiness oversight for the ESBs. The brigade headquarters also provides augmentation to the corps G6 for NetOps and engineering when the corps is functioning as a Joint Task Force.

The Corps G6 and the TTSB commander have different but complementing missions; both are important and neither can fail. They draw from the corps' mission and commanders' intent. "If everyone is heading in the same direction, it does not matter who drives the train" comments COL John Hildebrand, the TF Thunderbird commander.

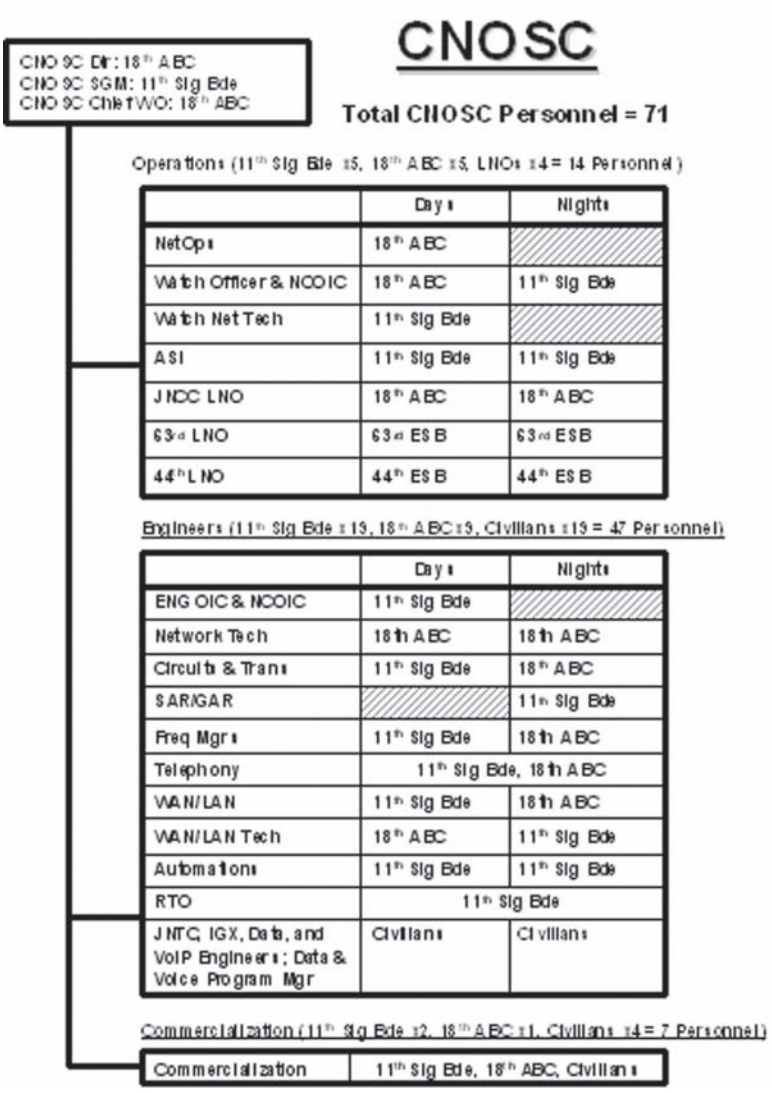
The TTSB commander focuses on training, personnel, and equipment readiness of the ESBs' modular Joint Network Transport Capability teams. The TTSB staff is masters of employing and maneuvering ESBs across the battle space, but are primary subject matter experts on the technical aspects of JNTC and various other ESB assemblages. Because the ESBs are fielded with the same JNTC equipment as the brigade combat teams, the staff is often called upon to assist fellow communicators within the divisional battle space. The TTSB commander has a full multi-disciplined staff, so he is able to conduct mission planning, synchronize movements of forces, conduct reliefs in place, schedule reset of equipment, and move equipment around the battle space. Using additional non-JNTC equipment specifically fielded to the ESB, like the AN/TSC-156B (Phoenix), the staff is able to enhance the services greatly provided to battlefield commanders and can extend the network to an increased number of customers. These are just a few of the missions that the corps G6 is not manned or equipped to complete.

CNOSC -- XVIII Airborne Corps G6 and TF Thunderbird S3 Engineering Section

The corps G6 and his staff's primary focus remains on ensuring the corps commander can communicate with his staff, division commanders, and BCT commanders. As a staff section, they assist in all aspects of corps and division staff planning and the orders process with an emphasis on identifying emerging communications require

ments. The G6 directs the TTSB to provide communications support across the corps battle space from the BCT level and below to division or corps separate units. Finally, the corps G6, with support from the TTSB NetOps section, conducts NetOps of the tactical network via the Corps Network Operations and Security Center.

During OIF 07-09, the 11th TTSB and the 18th Airborne Corps worked very closely to execute missions in the CNOSC; each organization contributing its strengths. Task Force Thunderbird contributed its engineering section and 18th Airborne Corps G6 contributed the director, senior network technician, operations officer, and watch officers. "This close relationship was not an accident. We worked very closely with COL Hildebrand and developed a relationship before we ever deployed," stated COL Campbell Cantelou, the 18th Airborne Corps G6. "We sent our CNOSC Director, LTC Kurt Schosek, with them when they deployed three months ahead of us." Schosek and the 18th Airborne Corps Senior Network Technician, CW4 Curtis Newkirk deployed as part of Task Force Thunderbird and assumed leadership positions in the CNOSC. "We had a short handed crew before the 18th Airborne Corps arrived to fill out the gaps in the CNOSC. Thunderbirds really pulled together and completed the CNOSC mission," said CW4 Curtis Newkirk, "When our Soldiers arrived three months later we had the complete team we needed for extended operations."



"We knew that the first three months were going to be tough, we had lieutenants and Sergeants First Class doing jobs normally filled by senior captains," according to MAJ Glenn Robertson, the Task Force Thunderbird Network Engineer Officer. Even before the 18th Airborne Corps arrived, Soldiers from both organizations had worked together to prepare for their assignments using the MNC-I portal. Hildebrand and Cantelou agreed, "Most of the leaders in both of our organizations are veterans and have been in Iraq before. Personalities mean a lot – the G6 and the Signal commander need to be in synch." Supporting the corps and division commanders is too important of a mission to let personal agendas or pet projects get in the way. Another important aspect that both leaders agree upon is the setting of priorities. The G6 sets the corps' network priorities, one of which is a responsive NetOps that clearly understands the impacts of network modifications on the BCTs and their warfighting operations.

Both the Task Force Thunderbird commander and the corps G6 work for the corps commander making them equally responsible and accountable for corps' network. "NetOpsand the assets that support the corps network must be responsive to the corps commander," stated Schosek. "Once you take the accountability piece out of the hands of signal officers who work for the corps commander, NetOps becomes disjointed and ineffective." The CNOSC with its TTSB engineering section and the corps G6 operations section bring the experience and depth to provide a CNOSC capable of directing the entire corps network. This combined effort and relationship with liaison representatives from coalition and subordinate divisions can direct all communications efforts in the ITO. There is no need to create an ad hoc pick-up team of experts via Joint Manning Document requests. Only Soldiers and government representatives accountable and responsible to the corps commander should be involved in the conduct of NetOps for the corps tactical network. The teamwork of the corps G6 and the TTSB provide the right balance of both network monitoring and brigade level command to the ESBs.

Some proposed that the G6 could direct the employment of ESBs

IGFC M6 visiting Baghdad Signal University.

without a brigade headquarters. It is safe to say these individuals do not clearly understand the benefits a signal brigade brings to the fight. The two ESBs in Iraq are currently providing JNTC teams to three divisions, the Marine Expeditionary Force, and several corps separate brigades. The corps assigns these teams in different proportions from complete companies to individual CPN teams. Often these teams are assigned for temporary missions that last only a few months. After the mission is complete, the team returns, its personnel and equipment are reset, and it is prepared for a new mission. At any given time, Task Force Thunderbird has multiple teams traveling to new locations, returning from completed missions, and others training in preparation of future requirements. A TTSB is designed to battle command multiple ESBs and complete these personnel, logistics, and operational readiness related missions; the corps G6 is not. While the corps G6 is focused on corps / division level operations, the Signal brigade staff is focused on asset management and operational readiness of ESBs. ESBs benefit from the processes, staff expertise, and technical support provided by the TTSB that can only be acquired by continuous training and readiness oversight.

Part of the technical expertise Task Force Thunderbird brought to Iraq was network optimization. The Task Force Thunderbird engineering section led the CNOSC's efforts to improve an already mature network. Quickly identifying an opportunity to decrease the power needed for satellite terminals, the Task Force installed the larger 16' Lightweight High-Gain X-band Antenna. The immediate impact was a reduced strain on the tactical signal network. Another network optimization effort included removing all older AN-TRC 190 radio systems, which possessed only 2 MB of throughput, from the corps tactical network and replacing them with newer versions with four times the throughput. In some cases, the CNOSC helped identify locations that would benefit from the receipt of an even more capable 16 MB radio system. They identified locations that were near bandwidth saturation and developed multiple solutions to alleviate network congestion. The CNOSC engineering section also championed the use of Quality of Service statements for high priority services, ensuring mission critical information arrived at its destination above all other traffic. These successful network optimization efforts were the result of close coordination between the CNOSC engineering section and the various division engineering sections. This coordination has led to increased communications capabilities and a much better understanding of the tactical network and processes necessary to develop future engineering solutions.

One additional skill set that the TTSB brings to the corps fight is specialized signal training. Task Force Thunderbird re-established the Baghdad Signal University, which had been set up and run by the previous Corps Signal Brigades during their rotations. BSU provides all US and Coalition Military, as well as DoD Civilians in theater, an opportunity to receive training on Basic and Advanced Networking, and Fiber Optic Installation. At the request of the corps and division G6s, Task Force Thunderbird added Very Small Aperture Terminal training to the curriculum and will also start training antenna installation and safety. These two courses represent the continuous dialog between all signal organizations and a successful effort to remain current in tactical communications. Task Force Thunderbird worked closely with the Iraqi Ground Forces Command G6, MAJ Debbie Bowker, and developed training for the Iraqi Ground Forces Command Soldiers. Courses were translated into Arabic and BSU developed an aggressive program of study that matched the abilities of the IGFC Soldiers. MAJ Bowker of the IGFC said "TF Thunderbird's Baghdad Signal University, has developed a strategic partnership with the Iraqi Ground

Forces Command to provide classroom and hands-on training for Iraqi soldiers." She went on to say "BSU instructors have been instrumental in providing train-the-trainer instruction and have allowed IGFC G6 Soldiers who completed the Basic Networking Course to serve as an Assistant Instructor and then Primary Instructor for subsequent classes. The IGFC G6 Soldiers are truly grateful for this tremendous training opportunity and this knowledge is paying huge dividends in the professional skills required to support the network."

During their first five months BSU has trained over 17 Iraqi soldiers and have also assisted them as they design their own networking school.

Task Force Thunderbird successfully supported the MNC-I and fully complemented the 18th Airborne Corps G6 Staff during OIF 07-09. The TTSB was the right unit to complement the corps G6. Leaders of both organizations understood the importance of the "one team, one fight" concept. Two separate units came together and built one cohesive organization. Quoting COL Hildebrand's favorite Reaganism, "Wonderful things happen when you don't worry about who gets the credit." Because of that mentality, the corps commander, along with his subsequent division and brigade commanders, were able to focus on the fight; not having to worry about communications or be concerned with the TTSB replacement of habitual Corps Signal Brigades.

Editor's note: The 18th Airborne Corps G6 is part of Multi-National Corps-Iraq and as such are a "C6" staff. We used G6 staff throughout the article for clarity of purpose in this article.

2LT Reiss is the Task Force Thunderbird Current Operations Officer.

CPT Joseph Kachmar is the CNOSC Watch Officer for night shift. Prior to this deployment, Kachmar served as platoon leader and company XO for 269th Signal Company at Fort Huachuca.

MAJ Rob Fago is the Task Force Thunderbird S3. Prior to this assignment Fago served in division, corps, and Theater Signal Battalions as a platoon leader, company commander and S3 respectively.

Acronym QuickScan

BCT – Brigade Combat Team
BSU – Baghdad Signal University
CFLCC – Coalition Forces Land Component Command
CNOSC – Corps Network Operations Security Center
CPN – Command Post Node
DoD – Department of Defense
EECP – Early Entry Command Post
ESB – Expeditionary Signal Battalion
IGFC – Iraqi Ground Forces Command
ITO – Iraqi Theater of Operations
JNTC – Joint Network Transport Capability
MNC-I – Multi-National Corps-Iraq
NETOPS – Network Operations
OIF – Operation Iraqi Freedom
QoS – Quality of Service
TF – Task Force
TTSB – Theater Tactical Signal Brigade
VSAT – Very Small Aperture Terminal

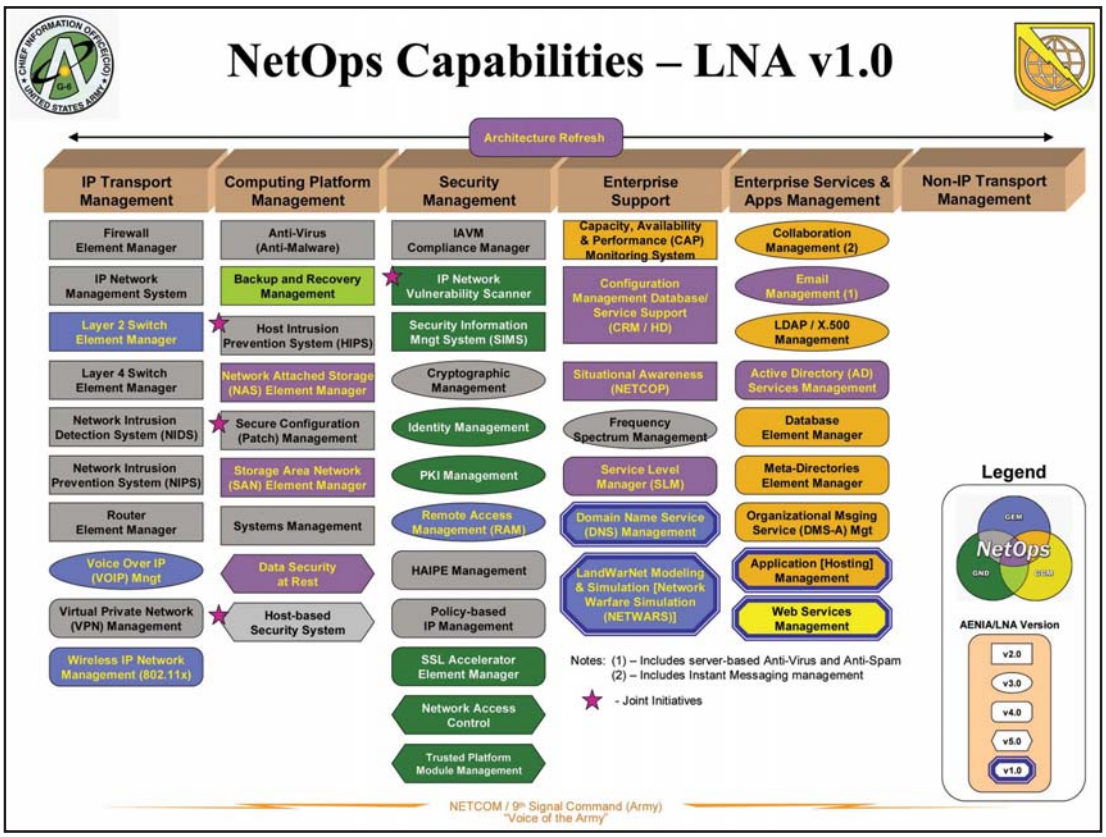
Army LandWarNet NetOps Architecture

By Malcom Cannon

If you were going to build your dream home, how do you think it would turn out if you had no plan and just told your 30 contractors to do what they thought best? You would end up with some type of structure, but it wouldn't be a functional home. The Army's LandWarNet is much more complex than a house and like any complicated endeavor without some type of central vision and plan it would degenerate into chaos. The Army LandWarNet NetOps Architecture is the top-to-bottom enterprise vision for the Network Operations (Global Information Grid Enterprise Management, GIG Network Defense, and GIG Content Management) portion of the LWN.

NETCOM develops the LNA, an integration architecture, under the oversight of Chief Information Officer/G-6. The LNA is one of five architectures which are collectively known as the Army Knowledge Enterprise Architecture. These five architectures also comprise the Enterprise Information Environment Mission Area Architecture, which underpins the Business, Warfighter, and Intelligence Mission Area Architectures. The LNA is not only based on Department of Defense, Joint and Army guidance, but also on industry best practices derived from the Information Technology Infrastructure Library.

There are many different frameworks which can be used to develop architectures, and the DoD decided it would be beneficial to standardize on a single method. The DoD Chief Information Officer



LandWarNet NetOps Architecture

signed a memo in 2004 stating that all DoD architectures would use the DoD Architecture Framework. If you have never looked at DoDAF products you might think they are just diagrams of the computer systems. In fact, the systems are just one of four different views within DoDAF. This framework also includes operational organizations and activities, which are tied to the systems views. This provides an integrated, overarching view of the entire operating environment. It also goes down to the data exchange and roles/responsibilities level of detail. This dovetails with the DoD Net-Centric Data Strategy. The LNA is also compliant with DoDAF.

Now that we have given a little background, you are probably wondering just what is in the LNA? The LNA contains more than 40 different NetOps capabilities (ability to perform some NetOps function), such as Host Intrusion Prevention System, which are grouped into five categories or "bins". These five bins are IP Transport Management, Computing Platform Management, Security Management, Enterprise Support, Enterprise Services and Applications Management, and Non-IP Transport Management.

These 47 capabilities don't exist in isolation. Like the DoDAF views they are all inter-related, and that is what is captured within the architecture. You may be thinking, this is all well and good, but so what. What is the value of the architecture to me?

The LWN supports a multiplicity of users, across all Army echelons from operating forces up to the interface to the Joint Community. Depending on where you are, you may have a different view of the LWN and how it supports your mission. For instance, many programs of record deliver or are reliant on LWN for their connection, computing, and/or NetOps capabilities. Depending on how a POR is designed it may interface and/or draw services from a Theater NetOps and Security Center or another network operations center in the Army. Instead of starting research from scratch, the LNA provides extensive requirements for NetOps capabilities/activities and how to interface to the TNOSC/NOC. The POR may not need all forty-seven capabilities contained in the LNA, but there is a high probability it will use many of them. The LNA team has put thousands of hours of research into how these capabilities should be used, and this effort can be leveraged by any organization that has to implement NetOps capabilities. Their research and products are coordinated with the Signal Center and the operational community. The U.S. Air Force absorbed the LNA into their NetOps architecture using it to cut their time to production. The LNA structure was used to develop the DISA NetOps Architecture and is used as the basis for the Joint Enterprise NetOps Architecture.

Redundant, duplicative systems, at various Army echelons, run counter to Army objectives. Using the LNA across the Army keeps us all moving in the same direction to achieving Army Campaign Plan objectives that drive global synchronization. Before implementing any new NetOps capabilities, the LNA should be reviewed to see if the requirements for implementing that capability already exist. The LNA review is actually part of the formal networthiness certification process.

I haven't gone into Clinger-Cohen and all the mandates to use architecture, because I think the common sense reasons probably resonate more strongly with the reader. Rest assured we are mandated to have an architecture, but I think the bottom line is it just makes

sense to have a plan. If you haven't looked at the blueprint for the NetOps portion of the LandWarNet, I highly encourage you to review the LandWarNet NetOps Architecture. It might just save you some time and money, and more importantly integrate your initiative or organization into Army NetOps.

Mr. Cannon works for Enterprise Systems Technology Activity at Fort Huachuca, Ariz., as the government lead for Architecture and Data Strategy. He holds a masters in information systems from Nova Southeastern University.

Acronym QuickScan

AKEA – Army Knowledge Enterprise Architecture
DISA – Defense Information Systems Agency
DoDAF – DoD Architecture Framework
DoD – Department of Defense
GIG – Global Information Grid
ITIL® – Information Technology Infrastructure Library
JENA – Joint Enterprise NetOps Architecture
LNA – LandWarNet NetOps Architecture
LWN – LandWarNet
NOC – Network Operations Center
POR – Program of Record
TNOSC – Theater Network Operations and Security Center

Regional Hub Node connects
Expeditionary Force to Enterprise

By Charlie Fulford

The requirement for the Regional Hub Node was recognized following the first fielding of the Joint Network Nodes and senior leader visits to Operation Iraqi Freedom/Operation Enduring Freedom. The first Tactical Hub Nodes fielded to the divisions were mounted on commercial five-ton vehicles. These vehicles were difficult to maneuver across desert terrain and required heavy airlift for deployment. The Army Chief Information Officer/G6 challenged the Signal Regiment to build a better solution.

Today, as part of the Warfighter Information Network – Tactical Increment 1 fielding of JNN, the division THNs are mounted on Family Medium Tactical Vehicles improving maneuverability in support of all terrain operations. Additionally, to alleviate the need for the division's THN to deploy in support of small scaled operations and remain at operational base in support of division's main force, the Headquarters Department of the Army G3 validated the requirement for five RHNs. The five RHN will be built and located in South West Asia, Europe, Western Pacific, and two in the Continental United States.

The RHN brings three times the capability of the Tactical Hub Node to the combatant command in support of training and joint expeditionary operations. The capability of three division tactical hub nodes is placed in a fixed facility located at sanctuary or near DISN Gateways (STEP/Teleport). This allows the RHN to connect and transport the common Defense Information Systems Network services to divisions, separates, and Expeditionary Signal Battalions composed of over 30 JNN and 150 command post nodes. The Marine's JNNs will also be supported by the Fixed Regional Hub Node.

Each of the 10 Active Component Divisions have been fielded one Tactical Hub Node. The FRHN

Figure 1

Figure 2

Figure 3. A Radome of a Regional Hub Node

allows Division Brigade Combat Teams, Separates, and Expeditionary Signal Battalions, as well as other services to connect upon arrival in theater or in support of CONUS training and Homeland Defense. Additionally, the RHN provides failover by backing up the THN and providing continuity of operations with other RHNs. The RHN provides increased capability to combatant commanders and joint expeditionary forces.

Program Manager Defense Communications and Army Transmission Systems has the lead for the RHN project implementation and Network Enterprise Technology Command will operate and maintain all five sites. The installation of two RHN is near completion at Camp Arifjan, Kuwait, and Landstuhl, Germany. They are recognizable by the three huge golf ball-like shelters housing the three antennas for the terminals. The communications equipment is housed in a normal Defense Satellite Communications System environmentally controlled building. The RHN is capable of transporting numerous commercial satellite links in support of expeditionary operations. Serving as the connect and transport component of the Network Service Center, the RHN moves critical battle command information (data, voice, and video) from the Army Service Component Command and major headquarters across the joint battle space and down to the maneuver battalions. This capability, coupled with the recent fielding of the JNN and CPN to units deploying to OEF/OIF, provides tremendous data, voice, and video capability for the first time down to the battalion level. The RHN, like the division THN, is a key combat enabler; providing critical battle command information to commanders allowing them situational awareness and common operational picture for decisive engagement of the enemy.

The RHN provides increased capability to combatant commanders and joint expeditionary forces.

Future plans are to implement the NSC concept using the RHN as the transport and connect piece allowing expeditionary forces to pull services from the Area Processing Centers located in CONUS and Outside Continental United States. The APC will host critical battle command applications and network services allowing en-route, upon arrival, and operations access. The Army Theater Network Operations Service Centers in each theater and CONUS will manage the Army's network (LandWarNet) that transports these services. The benefits to both operational base and expeditionary forces are huge. They can pull services from sanctuary eliminating the need to set up large Tactical Operations Centers with large server farms hosting these applications. Placing these battle command applications and network services at the APC allows maneuver elements to have the same services on the move or at-the-quick-halt. This NSC concept will be rehearsed for the first time with the full complement of equipment (RHN, APC, and TNOSC) in the March 2008 timeframe. In the near future, the RHN will have a global presence in support of combatant commanders and the joint expeditionary forces. The RHN is one of the many programs being worked at headquarters, NETCOM 9th ASC to bring the latest enterprise network technology to the joint expeditionary forces.

Mr. Fulford is the senior information systems manager, NETCOM, G3 Plans. He is team leader of the Strategic and Tactical Systems Team, G3 Plans, NETCOM 9th ASC.

Acronym QuickScan

APC – Area Processing Centers
BCT – Brigade Combat Teams
CIO – Chief Information Officer
COCOM – Combatant Command
CONUS – Continental United States
CPN – Command Post Nodes
DCATS – Defense Communications and Army Transmission Systems
DISN – Defense Information Systems Network
ESB – Expeditionary Signal Battalions
EUR – Europe
FMTV – Family Medium Tactical Vehicles
FRHN – Fixed Regional Hub Node
JNN – Joint Network Nodes
NETCOM – Network Enterprise Technology Command
NSC – Network Service Center
OCONUS – Outside the Continental United States
PM – Program Manager
RHN – Regional Hub Node
SWA – South West Asia
THN – Tactical Hub Node
TOC – Tactical Operations Centers
TNOSC – Theater Network Operations Service Centers
WIN-T – Warfighter Information Network-Tactical
W-PAC – Western Pacific

NSCs enable Expeditionary information

"In modern conflict, information has become as important as lethal action in determining the outcome of operations."
FM 3-0, Operations, Feb 2008

By Geoffrey Wells

It's all about information

The newly published FM 3-0, *Operations*, describes combat power as "…the total means of destructive, constructive, and information capabilities that a military unit/formation can apply at a given time." The manual notes that the warfighting functions comprising combat power—movement and maneuver, intelligence, fires, sustainment, command and control, and protection—are "multiplied by leadership and complemented by information." The graphic in the manual, shown below, reinforces the fact that information is essential to the successful execution of all warfighting functions, giving commanders the ability to understand, visualize, describe, and direct warfighting activities, and make informed decisions that effectively apply combat power.

To generate combat power, commanders of expeditionary Army units must have access to global information resources and the ability to quickly and securely exchange large amounts of information with modular forces located around the world. This capability must be available through all phases of an operation to enable planning and coordination with assigned forces that may be widely dispersed, to facilitate distributed training and rehearsal, and to enhance common operational awareness. The capability must extend across the full expanse of the enterprise, from the deployed force to the generating force, so commanders have access to information resources beyond the limits of their immediate area of operation. Properly configured,

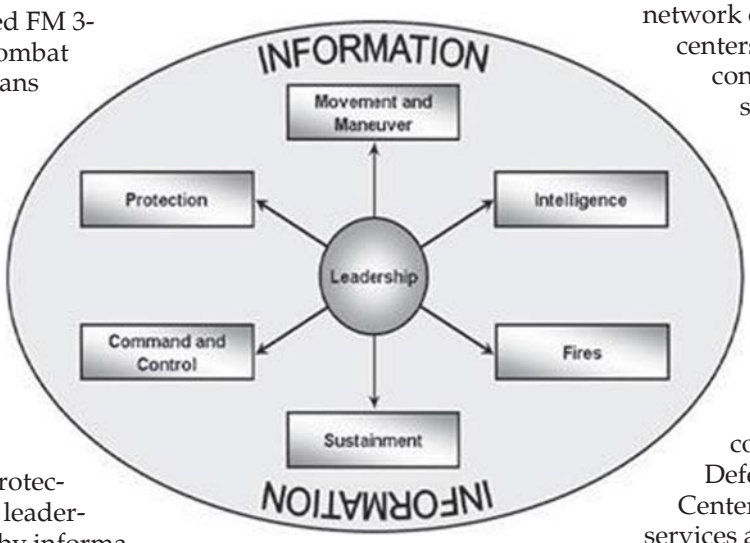


Figure 1

such a capability can give expeditionary forces the ability to deploy rapidly, immediately enter the fight, dynamically change task organization, and maintain command and control as forces maneuver and command posts relocate. Creating that capability—making information "expeditionary"—is the challenge addressed in the Signal Center's Network Service Center concept.

What a Network Service Center is… and isn't

Although it sounds like a place, a Network Service Center is really a combination of capabilities that connect warfighters to an array of network services. The basic capabilities—transport, information services, and network operations—can be found at almost every echelon of the Army and in many forms; however, the Network Service Center concept focuses on capabilities that connect warfighters to global network services at the regional level.

Regional NSCs merge the capabilities of regional hub nodes, area processing centers, and theater network operations and security centers to integrate and precondition theater network services. RHNs are satellite earth terminals that have the capacity of three tactical hub nodes. RHNs collocate with Defense Information Systems Network gateway sites to provide the expeditionary force points of entry into the global network. APCs, commonly located with Defense Enterprise Computing Centers, provide information services and can host battle command and other applications to support the deployed force. TNOSCs serve as the NSCs' management component, coordinating and synchronizing the provisioning of network resources, protecting the network, and staging information to meet the needs of the operational commander.

Strategically positioned around the world, regional NSC's will establish an "always on" backbone network that will allow expeditionary warfighters to quickly transition from garrison to combat operations. See Figure 2.

Connecting the deployed force

In operation, NSCs will enable units to deploy rapidly without having to pre-position an organic hub node. Network services will be available as soon as units establish a

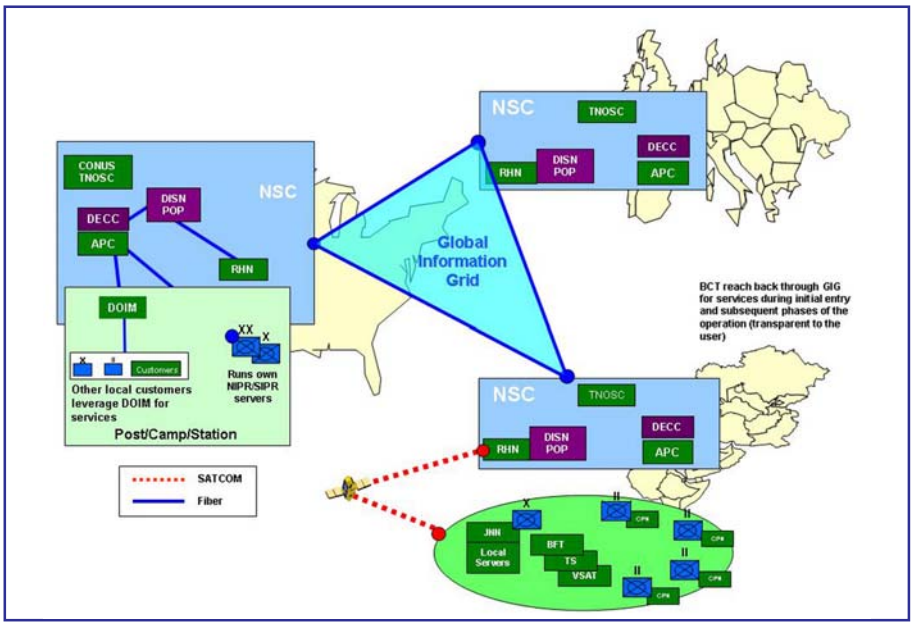


Figure 2.

link to an RHN. APCs will provide fixed platforms in sanctuary locations at which user servers and applications can be hosted. This arrangement will allow the pre-positioning of battle command and common user services to give warfighters immediate access to needed services. When available, servers at these facilities can be pre-loaded with battle command applications, standard operating systems, patches, and security configurations required by operational units.

Units arriving in theater will be able to obtain network services without employing an organic hub node. RHNs and APCs will support continuity of operation during those times when a supported unit's organic hub node is not operational. Using NSC capabilities, units will be able to gain access quickly to network services as they maneuver and relocate command posts. NSC facilities will also serve as a vital backup capability in the event a unit's organic hub node fails. In cases where operational requirements exceed the capacity of a unit's organic hub node, an RHN hub node can accommodate the overflow.

As the network is extended, TNOSCs will oversee technical management of the network, coordinate the provisioning of services, and provide the governance security oversight required to give the warfighter a high level of service availability.

Bringing the concept to reality

Portions of the NSC construct exist today and others are coming on line as funds become available.

Regional hub nodes are ready to go into full service in Kuwait and Germany. Additional hubs are slated for construction at east and west coast locations in the United States, and a fifth hub will be built in the Pacific region. A sixth hub, for training, located at Fort Gordon, has been in operation for more than a year. In addition to supporting operator training at the Signal School, the training hub provides network services to units training at sites as far away as Alaska and Hawaii, demonstrating to commanders that they can quickly gain reliable network services without deploying their own hub.

APCs have also begun to appear in the United States and in some overseas sites. More APCs will be built as funds become available. APC services, to include capabilities directly aimed at supporting deployed operational units, will continue to be explored. At the same time, upgrades to TNOSC capabilities will be incorporated to improve the ability to manage network operations across an enterprise that connects operational and generating force activities.

In recent briefings, GEN George Casey, Chief of Staff of the Army, has emphasized the critical importance of information in executing the Army's mission, and has expressed his intent to expedite the regional NSC effort. With support of the Army's leadership, regional NSCs will soon be providing the expeditionary Army a much needed capability to move information as quickly as it can deploy forces.

COL (Ret.) Wells is the author of the Network Service Center-Regional concept. A former Training and Doctrine Command Systems manager for the Mobile Subscriber Equipment system, Wells works for Janus Research Group, Inc. supporting the Concepts Section of the Signal Center's Capabilities Development and Integration Directorate.

Acronym QuickScan

APC – Area Processing Centers
COOP – Continuity of Operation
DECC – Defense Enterprise Computing Center
DISN – Defense Information Systems Network
NETOPS – Network Operations
NSC – Network Service Center
RHN – Regional Hub Node
TNOSC – Theater Network Operations and Security Center

Requirements for ESB recognized following OIF

By Billy Johnson

The requirement for the Expeditionary Signal Battalion was recognized following the initial phases of Operation Iraqi Freedom which illustrated outdated Mobile Subscriber Equipment switching and line-of-sight systems employed that did not meet the data throughput requirements of supported units.

The ESB was also created to address shortcomings in Integrated Theater Signal Battalion capabilities by providing an integrated network architecture that supports expeditionary functional brigades and battalions at army level, including those Army-level units task-organized to support corps and division operations. Network Enterprise Technology Command/9th Signal Command Army fielded five battalions to the ITSB structure. These battalions were capable of supporting up to 15 command posts. The highly modularized ESB structure served as an organizational platform into which Warfighter Information Network- Tactical capabilities can be introduced with minimal adjustment.

The ESB incorporates Joint Network Transport Capability-Spiral capabilities such as the Joint Network Node and Command Post Node along with an upgraded Single Shelter Switch that provides the needed data capacity at all levels to support up to 30 CPs with 36 satellite points-of-presence.

Recently, the WIN-T program became a Program of Record. The Program of Record absorbed the JNN program and fielding WIN-T Increment 1began.

PM WIN-T has the lead for the ESB fielding and training of the 23 ESB's scheduled to be fielded, 12 Active and 11 Reserve/Guard. The 63rd Signal Battalion was approved and funded as the Army's first ESB as part of Lot-8 JNN fielding and is currently deployed supporting Global War on Terrorism.

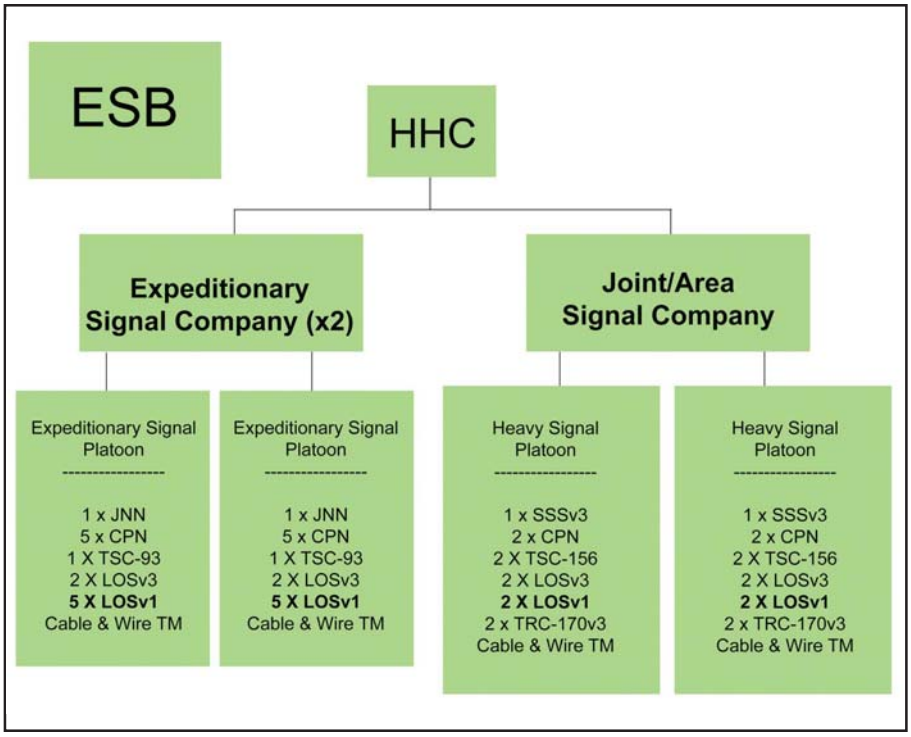
Joint Network Node equipment

The approval was a result of CIO/G6, Headquarters Department of the Army G3, NCR, and NETCOM establishing requirements and attaining funding to accelerate the fielding of JNN to support OIF rotations. ESBs support the pooling concept by providing JNN/CPN to units that do not have organic signal (division/brigade combat teams). Lot-9 JNN fieldings provided JNN equipment for five active Army Signal Battalions and one Army National Guard Battalion to convert to an ESB during FY07/08: 44th Sig Bn, 40th Sig Bn, 50th Sig Bn, 72nd Sig Bn, 51st Sig Bn, and 146th Sig Bn. To date, the active battalions listed have finished fieldings and the 146th Sig Bn began February 2008.

The current rotation has three ESBs (63rd, 44th, and 40th Sig Bns) providing communications support. WIN-T Increment 1 fieldings support four active Army Signal Battalions and three RC/ARNG ESB units. After WIN-T Inc1 fieldings, two active and eight Reserve/Guard remain to be fielded.

Technical capabilities of the switching and data services: Switches provide automatic switching service for analog and digital voice, data, and video services at all echelons of a theater-wide network. The switches support garrison-quality data services, which include but are not limited to: Secure Internet Protocol Router and Non-secure Internet Protocol Router network service, secure and non-secure desktop video teleconference, Defense Red Switch Network ("red phone"), direct Defense Switched Network connection, access for the Joint Worldwide Intelligence Communications System, additional long local and tactical phone extensions, and connectivity for other special circuits as required.

In addition, switches support management of digital groups, trunks, and circuits, and provide a means to monitor and control associated communication assets.



Expeditionary Signal Battalion structure organizational diagram

Switches used by the ESB include the AN/TTC-56V3 Single Shelter Switch , the AN/TTC-59 Joint Network Node, and the OM-87/T Command Post Node.

As depicted in the organizational diagram (page 65) the ESB consists of a battalion headquarters and headquarters company, two identical Expeditionary Signal Companies, and a Joint/Area Signal Company.

The ESB is designed to afford network planners flexibility in configuring resources to meet user requirements precisely. In keeping with modularity principles, ESB and ESB companies, platoons, and teams may be tailored and task organized so that only the precise package of capabilities needed to satisfy a given mission is deployed. In the same manner, companies, platoons, or teams may be added to an ESB to meet the demands of a particular mission.

The mission provides network services to the following organizations from Phase 0 through Phase IV of an operation: Joint Task Force headquarters, Coalition/Joint Force Land Component Command headquarters, ASCC/Army Operational Command Post, Army-level major subordinate command headquarters, functional brigades and their subordinate battalions, including battalions tasked to support division-level organizations, support brigades that have not been resourced with an organic Network Support Company, Army-level digital liaison teams, Ad hoc command posts, Forward operating bases and base/CP clusters, other United States armed services and Department of Defense agencies, and other governmental and non-governmental organizations.

Mr. Johnson is a team member of the Strategic and Tactical Systems Team, G3 Plans, NETCOM 9th SC (A). The team oversees modernization of both strategic and tactical communications systems in support of theater signal operations.

Acronym QuickScan

ASCC – Army Operational Command Post
CP – Command Post
CPN – Command Post Node
DRSN – Defense Red Switch Network
DSN – Defense Switched Network
FOB – Forward Operating Base
ESB – Expeditionary Signal Battalion
FY – Fiscal Year
GWOT – Global War on Terrorism
HHC – Headquarters and Headquarters Company
ITSB – Integrated Theater Signal Battalion
JFLCC – Joint Force Land Component Command
JNTC-S – Joint Network Transport Capability - Spiral
JNN – Joint Network Node
JTF – Joint Task Force
JWICS – Joint Worldwide Intelligence Communications System
LOS – Line-of-Sight
MSC – Major Subordinate Command
MSE – Mobile Subscriber Equipment
NCR –National Capital Region
NETCOM –Network Enterprise Technology Command
NIPR – Non-secure Internet Protocol Router
OIF – Operation Iraqi Freedom
SIPR – Secure Internet Protocol Router
SSS – Single Shelter Switch
VTC – Video teleconference
WIN-T – Warfighter Information Network - Tactical

WIN–T Personnel Requirements

By MAJ Alprentice "Al" Smith and John Plotts

In the current operational environment, the Signal Regiment enables the warfighting function *command and control* by installing, operating, and maintaining Army communications networks and information services. Command and control of Army and Joint forces will require a seamless communications network that is robust and capable of supporting full spectrum operations. The military occupational specialty structure and the training provided to our Soldiers is the critical factor in providing this indispensible capability.

Many of the readers of this article will remember Mobile Subscriber Equipment. It was a communications system that provided many years of good service, but Operation Iraqi Freedom proved that our combat forces needed much more capability not the least of which is command and control on-the-move or C2OTM. In an unprecedented acquisition, the Army purchased what we then called JNN – Joint Network Node – which provided a satellite based at-the-quick-halt capability and moved the Army closer to C2OTM.

In an amazing display of agility, the Army was able to design, purchase, and field our first JNN in about six months. In fact, we fielded the equipment so fast that we received Headquarters Department of the Army approval for a new MOS (25N) to install, operate, and maintain this equipment after it was fielded.

New Equipment Training picked up the slack initially and now we have a steady stream of 25N Soldiers generated by our Advanced Individual Training courses at Fort Gordon. As many of you know, this transition created an imbalance in the inventory of Soldiers in certain MOSs that is only now starting to rebalance.

Command and control of Army and Joint forces will require a seamless communications network that is robust and capable of supporting full spectrum operations. The military occupational specialty structure and the training provided to our Soldiers is the critical factor in providing this indispensible capability.

Today, JNN is part of the WIN-T program called WIN-T Increment 1. The WIN-T program goes well beyond JNN and brings many more capabilities to the force. Although JNN was just the first glimpse of what WIN-T would look like, we designed the 25N not only for JNN, but so that this MOS could evolve along with the evolution of the WIN-T program. WIN-T is a high-speed and high capacity backbone communications network. It will be focused on moving information in a manner that supports commanders, staffs, functional units, and capabilities-based formations – all mobile, agile, lethal, sustainable, and deployable. C2OTM will be fully realized in later increments of WIN-T. If this sounds like some tremendous capability, it is, but WIN-T will not meet the needs of the commander without well-trained Soldiers and leaders of the Signal Regiment.

As the Signal Regiment continues to develop the hardware and equipment required to employ the various increments of the WIN-T program, the Regiment, through the Office Chief of Signal, is also determining the personnel requirements. These requirements are being analyzed in terms of the five Regimental core competencies that were published in an earlier article, Summer 2007 edition of the *Army Communicator*, and our initial focus is on the three competencies that comprise the critical components of network operations. Signal Soldiers must be able to execute Enterprise Systems Management, or said another way, to install, operate, and maintain WIN-T systems.

Our people also need to be competent in Information Dissemination Management and Content Staging. This competency goes to the heart of how we technically enable having the right information available at the right time and at the right place. And finally, our Soldiers must be able to exercise the core competency of Information Assurance and Computer Network Defense or in layman's terms, protect our networks.

As you can imagine, there is a definitive process we must use to identify personnel requirements for emerging technologies. OCOS is working closely with the materiel developers, trainers, and Program Managers in the review of developmental task analysis reports and draft training materials for WIN-T configuration items to determine skill sets and knowledge requirements. This analysis is then cross-walked to existing officer areas of concentrations and warrant and enlisted MOSs to develop the personnel structure. Since many of

the desired WIN-T capabilities are still under development, and in some cases still only conceptual, identification of WIN-T personnel requirements is somewhat constrained due to unknown tasks and requirements. In these instances we must make projections based upon "best-guess" scenarios. As the actual equipment is produced and progresses through the testing phase appropriate adjustments to the personnel structure will occur.

With this in mind, we are developing a Military Occupational Classification and Structure change proposal that, if approved, will realign our Signal warrant officer specialties with the three NetOps core competencies, synchronize their technical development and expertise with WIN-T requirements, and help lead the way in evolving cyberspace operations. As we move through this process, you will see more articles on these pages that will keep you informed.

There is no question of the tremendous increase in capability that WIN-T will bring to the fight. The Signal Regiment is confident that as we first determine and then adjust our training tasks, we will be able to leverage the officer, warrant, and enlisted specialties to provide viable personnel solutions. Our mission is to ensure that the commanders at all echelons continue to receive the world's finest Signaleers to provide the world's finest communications support upon which the Warfighter depends.

MAJ Smith is currently assigned as the Senior Officer Career Program Manager, Officer Division, Office Chief of Signal, Fort Gordon, Ga. He holds an undergraduate degree in Information Systems Management and a master's degree in Computer Systems Management. He is also a graduate of the FA53 Information Systems Manager's course and the Army Force Management course.

Mr. Plotts of Engineering Solutions & Products, Inc. is a retired Army master sergeant providing contractor support to the Office Chief of Signal, Enlisted Division.

Acronym QuickScan

AOC – areas of concentrations
JNN – Joint Network Node
MOS – military occupational specialties
OCOS – Office Chief of Signal
OTM – On-the-Move
WIN-T – Warfighter Information Network-Tactical

LandWarNet

Update from LandWarNet e-University for the Signal Regiment

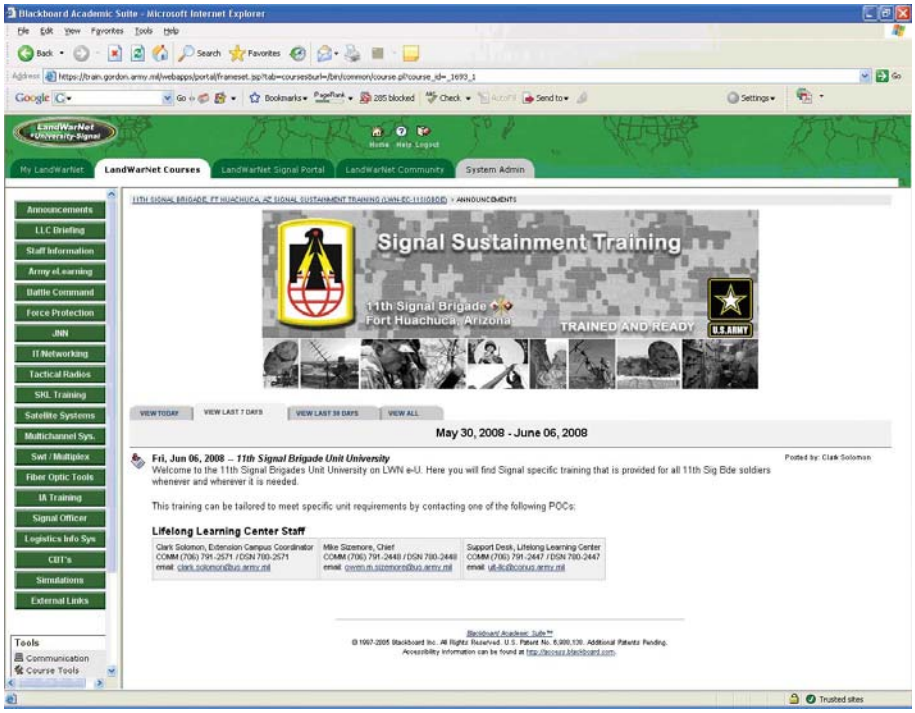
By LandWarNet staff

Introduction

Soldier and Civilian readiness needs necessitate the availability of training on-demand. Distributed Learning leverages technologies into training to achieve the following benefits to meet those demands:

- **Improved readiness**
- **Continuous training throughout the Soldier or Civilians career**
- **Closing the gap between training and operating environments**
- **Facilitating more responsive development and distribution of critical training**
- **Reducing Soldiers' time away from unit/home**
- **Leveraging training efficiencies through multimedia and immersive training products**
- **Avoiding significant training cost**
- **Standardizing Reserve Component and Active Component training**
- **Placing publications and reference materials in digital form for quick use**
- **Easy access to online professional education opportunities**
- **Quicker and wider dissemination of updated training materials**
- **More realistic simulations**

The Signal Center's Lifelong Learning Center is converging the many facets of dL via products, resources, and services available through the LandWarNet eU and LandWarNet eU Signal web portals. The dL available via the web portals leverages Army and Signal specific training materials to benefit and address the training needs of the entire Signal Regiment. Additionally, the training products offered are designed to make the job of unit training representatives less labor intensive by providing access to a "Unit University " program and wide-variety of personal computer-based equipment simulators.



11th Signal Brigade's Unit University website.

LWNeU Unit Universities offer customized training for units' specific training requirements

One of the main functions of LandWarNet e-University is to work directly with unit training staffs to identify training requirements and deliver training resources for mission, pre-deployment, equipment, and sustainment support. Whether it's Signal military occupational specialty-specific training, common user Signal and Information Technology training, or Battle Command training – LandWarNet e-U has a wealth of training resources available and stored in one convenient area.

Examples of included training in our unit universities are the *JNN Electronic Quick Reference Guide*; SKL (Simple Key Loader) Web-based training; Phoenix (AN/TSC-156A) simulation; and links to Command Posts of the Future, Army Battle Command Systems and Force XXI Battle Command, Brigade and Below Blue Force Tracking training.

We are also actively supporting Army Directors of Information Management and their staffs by providing a platform where each DOIM can access a variety of training resources to support their missions. Current DOIM training examples include: Cisco Certified Network Associate training, Voice over Internet Protocol training, and links to Spectrum Management, Power Steering, and Lean Six Sigma training.

What is a Unit University?

A Unit University is a customizable website used to provide commanders, training staffs and Soldiers with access to the most up-to-date training and training products for their unit missions. Unit Universities provide direct access to Training and Doctrine Command approved military occupational specialty training, downloadable training products (Computer Based Trainings, Simulators, Interactive Multimedia Instruction products), and current links to other available training sites.

What kind of training is available?

Unit Universities provide your training staff and Soldiers with direct access to the same course training materials, presentations, and documents used in the Signal Center's resident school training environment. Also available to your Unit University is the LWNeU-Signal knowledge repository, which is a current collection of over 600 downloadable products organized in 47 separate learning areas including 32 high-end simulators, 100 Computer-Based Training products, signal technical and professional documents, presentations, and manuals. The LWNeU-Signal knowledge repository also provides the Regiment with an upload capability for Soldiers to upload local unit developed training content to share across the Regiment.

Examples of training content that can immediately be loaded onto a Unit University range from typical 25B tasks in Information Technology and networking to installing, operating and maintaining WIN-T Increment 1. In addition to the training content developed by Fort Gordon, the LLC staff can link your Unit University directly to the most current sources of training for Army Battle Command Systems, All Source Analysis System, Battle Command Support Sustainment System and Command Post of the Future, as well as, Logistics Information Systems that include Movement Tracking System, Property Book Unit Supply-Enhanced, Standard Army Ammunition System-Modernization, and Standard Army Maintenance System-Enhanced.

U.S. Army SSG George Adams, left, and SPC Brenton Steckel, both from Alpha Company, 1st Bn, 5th Infantry Regiment, monitor the FBCB2 and Remote Weapons Systems. LandWarNet e-University offers in depth FBCB2 training simulations to help improve combat readiness and interoperability.

Who's using the LandWarNet Portals and Unit Universities?

Currently, there are more than 90 units with 4,000 registered users receiving Signal training via their own customized Unit University. Unit University sizes range from brigades to squads. In total, over 8,500 users access the LandWarNet-e-University training portals each month for training.

Recent Unit University additions to the LWN-eU Extension Campus include: XVIII Airborne Corps, 11th Signal Brigade, 316th Sustainment Command (Exp), 4th Infantry Division, 295th Signal Network Support Company, 501st Sustainment Brigade (Korea), 3rd Infantry Division G-6 (Iraq), C Company 1st BCT 10th Mountain Division, and the 7th Signal Company Radio Telephone Operators Academy, Life Sustainment Area Adder, Iraq. Unit Universities can deliver training that cannot be obtained locally to forces in ARFORGEN reset, sustainment, or deployed in Theaters of Operation.

Individual Soldiers with a valid Army Knowledge Online account can access their Unit University anywhere they can connect to the Internet.

Can you add locally created unit training to your Unit University?

Yes, many units also use their Unit Universities to host unit created training, information briefs and command briefs.

How long does it take to build a Unit University Page for my unit?

Your Unit University can be fully loaded with training and operational within three days.

Five reasons why your unit needs a Unit University:

1. Availability: The training is available to your unit and Soldiers regardless of their location. Soldiers can train at home station, in a theater of operations, at their residence, or anywhere there is access to the internet.

2. Training Cost Reduction: No need to spend manpower or funds to stand up and manage a separate IT training system for your

unit – there are no unit costs for LWNeU Unit Universities.

3. Reduction in Training Planning Time: Fort Gordon LLC Staff locates, organizes and loads your unit's requested training content. Unit Universities allow your training staff to focus on training the unit – not on how/ where to get training material.

4. Unit Training Status Monitoring: Blackboard LCMS (Learning Content Management System) features provide commanders and training managers the tools and ability to monitor, track, and assess training at the unit or individual Soldier level.

5. Relevant Training: Unit Universities give units and Soldiers a single location to access the most up to date training developed by the Signal Center and the Joint Signal community.

For more information on, or to request a Unit University, contact Clark Solomon, LWN-eU Signal Extension Campus Coordinator, clark.solomon@us.army.mil, DSN 780-2571 or commercial (706) 791-2571.

The following Virtual/Personal Computer-Based Simulators are available via LandWarNet eU (https://lwn.army.mil) and LandWarnet eU Signal (https://lwneusignal.army.mil) web portals to facilitate communications equipment operations training:

Fielded SIMS

Phoenix Upgrades (Alpha Version)
Fielded: JAN 08
Target Audience 25S
Phoenix Upgrades (Bravo Version)
Fielded: JAN 08
Target Audience 25S
JNN Upgrades (Spiral 5-7)
Fielded: DEC 07
Target Audience 25N
STT Upgrades (Spiral 5-7)
Fielded: DEC 07
Target Audience 25Q, 25S
CPN Upgrades (Spiral 5-7)
Fielded: DEC 07
Target Audience 25B
Baseband Upgrades (Spiral 5-7)
Fielded: DEC 07
Target Audience 25N
JNN Upgrades Lot 9 (Spiral 8)
Fielded: DEC 07
Target Audience 25N, 25 B
CPN Upgrades Lot 9 (Spiral 8)
Fielded: DEC 07
Target Audience 25B
Baseband Upgrades Lot 9 (Spiral 8)
Fielded: DEC 07
Target Audience 25N
85/93
Fielded: APR 07
Target Audience 25B, C, F, L, P, Q, S, U, W, 250N, 251A, 53A, 25A, LT/CPT
SATCOM Hub (Spiral 5-7)
Fielded: MAR 07
Target Audience 25S
Baseband Hub (S 2-4)
Fielded: FEB 06
Target Audience 25N
JNN (S1)
Fielded: OCT 05
Target Audience 25N
BN-CPN (S1)
Fielded: OCT 05
Target Audience 25B
KU (S1)
Fielded: OCT 05
Target Audience 25Q
DTOC
Fielded: OCT 05
Target Audience 25B
TIMS (ISYSCON)
Fielded: OCT 05
Target Audience 25B
HCLOS
Fielded OCT 05
Target Audience 25Q
GSC-52
Fielded: JAN 04
Target Audience 25S
BSN
Fielded: OCT 04
Target Audience 25F, Q, P
FBCB2
Fielded: OCT 03
Target Audience 25U
TRC-173
Fielded: NOV 01
Target Audience 25P, Q

For more information on the status of Virtual/PC based Simulator training products, contact Pat Baker, chief, University Information Technology Division at DSN 780-86817445 or commercial at (706) 791-7445.

Editor's Note: The LWNe-U UIT staff has completed the initial upload to LWN-eU of numerous S6/G6 and related documents collected from across the operational army and vetted by the 442nd Signal Battalion Commander, LTC Kris Ellis. These documents include the draft S6 Officer Certification Checklist, a BCT TACSOP, C2 Equipment and Maintenance Trackers, Annex H/K templates, LTC Pat Dedham's CJTF-82 Lessons Learned brief, 4ID Commo Primer Re-Draft, BDE Below Signal FDU, BN Pocket Planning Guide, C2 Execution Matrix Template, CJ6 OEF AAR (Lessons Learned and Observations), COMMEX Template, FMI 6-02.71 Final, IT System Equipment and Maintenance Tracker Template, LandWarNet and Battle Command (BG Brian J. Donahue) Flag Officer Workshop, OPORD Para 5 Template, S6 OAKOC Template, S6 Staff Est Template, Trouble Ticket Tracker and U-CJ6 C4 Conference Brief. Note: The link ibelow.

URL address to access articles collected on S6/G6 issues

https://lwneusignal.army.mil/portalmodules.php?op=modload&name=UpDownload&file=index&req=viewdownload&cid=12

Acronym QuickScan

ABCS – Army Battle Command System
AC – Active Component
AKO – Army Knowledge Online
ARFORGEN – Army Force Generation
ASAS – All Source Analysis Sytem
BCKS – Battle Command Knowledge System
BCS3 – Battle Command Support Sustainment System
CBT – Computer-based Training
CCNA – Cisco Certified Network Associate
CPOF – Command Post of the Future
dL – Distributed Learning
DOIM – Directorate of Information Management
FBCB2 – Force XXI Battle Command, Brigade-and-Below
LCMS – Learning Content Management System
LLC – Lifelong Learning Center
LSA – Life Sustainment Area
LWN-eU – LandWarNet e-University
MTS – Movement Tracking System
PBUSE – Property Book Unit Supply – Enhanced
PC – Personal Computer
RC – Reserve Component
RTO – Radio Telephone Operator
SAMS-E – Standard Army Maintenance System-Enhanced
SAAS-MOD – Standard Army Ammunition System-Modernization
SKL – Simple Key Loader

TCM update

Updates from Training and Doctrine Command capabilities managers for networks and services including satellite communications, tactical radio and Warfighter Information Network-Tactical

JTRS / WIN-T
Networking Waveform Quick Reference Sheets

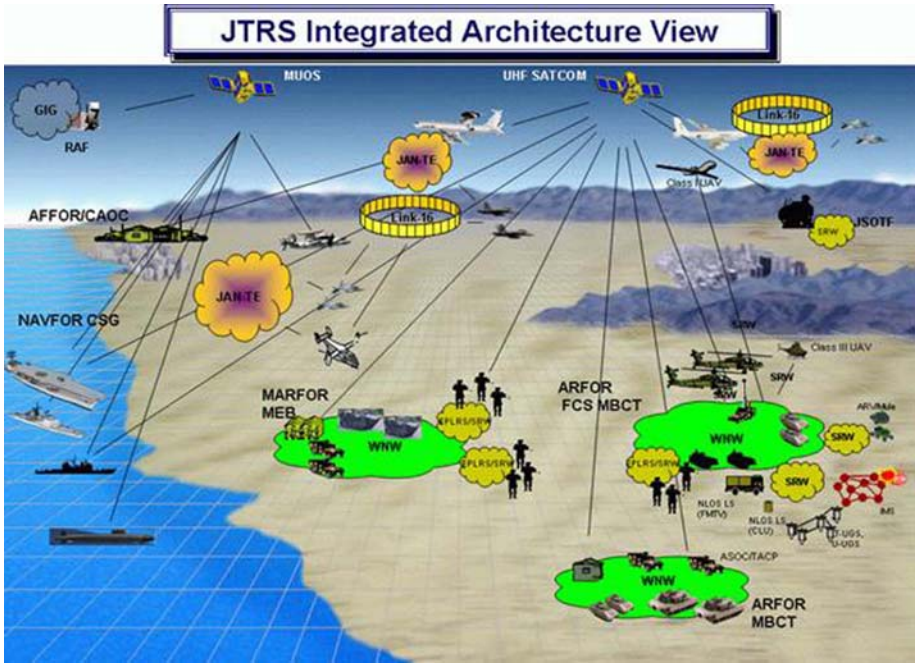
By MAJ Tracy Mann

TRADOC Capability Manager for Tactical Radios, Fort Gordon, Ga., created a Joint Tactical Radio System/Warfighter Information Network - Tactical Networking Waveform Quick Reference Sheet. The purpose of the quick reference charts is to provide a concise, readily available overview and comparison of the future networking waveforms that will transport the warfighter's critical battle command information.

The quick reference sheet features the JTRS networking waveforms: WNW (Wideband Networking Waveform), SRW (Soldier Radio Waveform), MUOS (Mobile User Objective System), and UHF SATCOM (Ultra High Frequency Satellite Communications) IW (Integrated Waveform) and the WIN-T networking waveforms: HNW (Highband Networking Waveform) and NCW (Network Centric Waveform).

The quick reference sheet serves as a companion to the "Warfighter's Smart Book". The following are the topics covered for each networking waveform on the quick reference sheet:

- **Available on Platform/radio**
- **Primary mission**
- **Technical explanation of IP data support**
- **Network Throughput**
- **Voice capability**
- **Utilizes frequency bands**
- **Range**
- **COMSEC Suite**
- **IP Reachability support**
- **Modes of operation**
- **Scalability**
- **Channel Bandwidth**
- **Freq Re-use: / Spectral Efficiency**
- **Highlight of any capabilities not referenced above**



Wideband Networking Waveform (WNW)

♦ Available on JTRS GMR and AMF-SA radios mounted on vehicles and aircraft
♦ Supports brigade and below lower Tactical Internet backbone and local area networking, enables GIG interface for mounted/dismounted network and interconnects legacy and SRW subnets.
♦ Provides mobile ad-hoc dynamic IP routing: supports unicast, broadcast and multicast traffic. Optimized for network routing performance, network stability, and higher data throughput. Includes functionality sufficient to organize, manage, and dynamically control network connectivity structures, routing mechanisms, bandwidth allocations and spectrum restrictions. Supports concurrent applications of multi level priority traffic via advanced QoS implementation, including voice, data, and video applications.
♦ Network Throughput: 2 Mbps.
♦ Provides no native voice capability, but supports voice packet transport. Requires external voice application.
♦ Waveform operation between 225MHz and 2000MHz but hardware constraints utilize frequency bands 225-400 MHz; 1350-1390 MHz; 1755-1850 MHz (banded PA 225-960 MHz, 1350-1850MHz).
♦ Range:
* 10 Km: ground-to-ground
* 28 Km: ship-to-ship, ship-to-shore
* 370 Km: air-to-air, air-to-ground
♦ Embedded GIG compliant HAIPE (1.3.5) COMSEC suite. WNW network can be directly to the GIG.
♦ Supports robust dynamic IP routing protocols (OSPF, BGP) allowing the network to perform backbone routing and increases network scalability while interfacing with external networks (R-OSPF/ R-PIM [SM-DM] implementation within waveform).
♦ WNW Increment 1 modes of operation for the signal in space / physical layer:
* OFDM – Bandwidth-efficient (2 bits/ Hz target)
* AJ – Anti-jam
♦ Employs selectable channel bandwidths (1.2 MHz, to 30 MHz) and variable data rates
♦ Frequency reuse implemented through automatic link adaptation (dynamic power and bandwidth allocation) using Link Adaptation Algorithm and Universal Slot Allocation Protocol.
♦ Scale to 250-node subnet size, without precluding scaling up to 1630 nodes.

Soldier Radio Waveform (SRW)

♦ Available on JTRS HMS, GMR and AMF-SA.
♦ Supports local area networking for intra-unit communications in the air and ground domains. Optimized for CNR voice, dismounted/unmanned applications, and small form factors with severe SWaP constraints.
♦ Provides IP based inter-networking and Mobile Ad-hoc Networking based Intra-networking capabilities. Supports unicast, broadcast and multicast traffic types. Network architecture assumes stub net configurations. Provides special power saving modes for IMS/UGS and Tele-ops mode for UAV/UGV.
♦ Network Throughput: 2 Mbps (with a single 1.2 MHz channel, INC 1)
♦ Provides native PTT based voice communications through SRW CNR voice application. Single SRW channel on a radio supports up to five logical voice nets simultaneously.
♦ Uses frequency bands 225-400 MHz; 1350-2500 MHz
♦ Range: * 5 Km - SFF and Hand-Held form factors
* 10 Km - Manpack and GMR
♦ AES based COMSEC/TRANSEC suite. Not fully HAIPE 3.x compliant. Requires Red Gateways in multi-channel JTRs to connect into the GIG. (Typically via WNW)
♦ Supports locally instantiated dynamic IP routing protocol (RIPv2) to perform IP network route discovery. Uses Link State based MANET routing protocol within SRW networks. Not designed to perform backbone routing.
♦ SRW Increment 1 modes of operation:
*Combat Communications (CC) – Bandwidth-efficient (1 bit/Hz)
*Electronic Warfare (EW) – Anti-jam *(0.13* bits/Hz) with DSSS spread
♦ SRW supports selectable channel bandwidths (75 KHz to 32 MHz)
♦ Frequency re-use supported via spatial re-use and frequency agility. Supports dynamic link adaptation, contention based link access, as well as allocated link access.

Network Centric Waveform (NCW)

♦ Available on WIN-T MPM-1000 modems and JC4ISR radios mounted on vehicles.
♦ Provides OTM and ATH satellite communications for range extension of the WIN-T backbone network through the use of various MILSATCOM and commercial transponded satellites.
♦ Provides a full-mesh, multi-frequency, TDMA network. Utilizes a network controller scheduler that automatically calculates optimum connectivity between all network terminals. Allows sharing resources across the network and optimizes throughput.
♦ Burst Rate Throughput:
* ATH – up to 6 Mbps transmit and 12 Mbps rcv.
* OTM – up to 1 Mbps transmit and 3 Mbps rcv.
♦ Uses frequency bands: SHF Bent Pipe SATCOM operation. Uses Ka/Ku SATCOM bands On-the-Move (OTM), and C/X/Ka/Ku SATCOM bands at the halt *(ATH)*. FDMA backward compatibility to legacy SATCOM terminals.
♦ Range: BLOS Satellite
♦ Includes TRANSEC protection for both user data and waveform signaling. WIN-T provides external COMSEC.
♦ "Selectable" spread spectrum to support small apertures & non spread for large apertures.
♦ Supports peer to peer communications without large hubs. Allows any advantaged node to act as hub when needed.
♦ Blockage mitigation techniques for OTM.
♦ Supports a max of 31 subnets, and up to 255 members in each subnet
♦ Full link management support: power control, data rate control, adaptive coding and modulation, and adaptive spectrum spreading. Dynamically adjusts throughput based on link conditions.
♦ Dependent on satellite payload and link conditions

High-band Networking Waveform (HNW)

♦ Available on WIN-T HNR and JC4ISR radios mounted on vehicles and aircraft.
♦ Supports terrestrial and aerial LOS comms, both OTM and ATH. Provides high capacity, long range, full mesh networking WIN-T backbone communications.
♦ Provides mobile ad hoc networking by automatically discovering and tracking moving nodes. Operates with a narrow beam, fast-switching, directional antenna for 360 degree plus aerial coverage. Automatic in-band neighbor discovery does not require operator intervention to establish links.
♦ Network Throughput: Ranges from 16 Mbps to 110 Mbps - dependant on modulation and FEC.
♦ Uses frequency bands: C and Ku bands to support ad-hoc ground-to-ground, ground-to-air, air-to-air LOS communications.
♦ Range:
* up to 45 km - ground-to-ground, pt-to-pt, non-networking
* 44 km - ground-to air *(ERMP)*
♦ Includes TRANSEC protection for user data and signaling. WIN-T provides external COMSEC.
♦ Provides spectrum efficiency of up to 2.2 bits/Hz.
♦ Frequency re-use implemented through directional antenna networking (Directive Network Technology – DNT) and auto-scheduled timeslots, greatly multiplying frequency re-use (up to 15x). Demand assigned timeslots allows sharing resources across the network, reducing spectrum required. Waveform dynamically adjusts throughput based on link conditions.

Mobile User Objective System (MUOS)

♦ Targeted to be ported to JTRS HMS manpack and AMF radio sets. Designed to SCA compliance.
♦ Provides ATH and OTM point-to-point, point-to-multipoint, netted, and broadcast communication networks for voice and data services between geographically dispersed ground, maritime, and airborne users. Replacement for the Navy's UFO constellation, while maintaining backwards compatibility with legacy UHF terminals.
♦ Supports GIG/Teleport access for voice and IP data services such as DSN, SIPRNET, NIPRNET, JWICS, CENTRIX.
♦ Network Throughput:
* 40 Mbps of total capacity
* 2.4Kbps to 384 Kbps per user
* Can connect up to 1997 terminals simultaneously.
♦ Provides voice capability using the MELP-E and G.729 A/B vocoders.
♦ Uses frequency bands UHF, Ka, and S Bands.
♦ Range: BLOS Satellite to BLOS satellite via ground segment achieving global coverage; 65N 65S.
♦ Uses High Assurance IP Encryption (HAIPE) for DISN services (SIPR/NIPR) and DSN (PSTN)
♦ Supports IPv4/v6.
♦ Channel Bandwidth: Spreads power across a 5-MHz bandwidth allowing higher signal power levels to users than permitted by legacy narrowband systems. WCDMA also uses adaptive power control to minimize interference and maximize system capacity for user terminals. Supports bandwidth on demand and assured communication services for deployed users.
♦ MUOS waveform is a Direct Sequence Spread Spectrum (DSSS) WCDMA waveform leveraged from 3G commercial cellular technologies modified to meet MUOS requirements.
♦ Frequency Re-use: Sixteen beam design allows significant frequency reuse.

UHF SATCOM Integrated Waveform (IW)

♦ Targeted to be ported to JTRS radio sets and designed to SCA compliance.
♦ Upgrade to the UHF SATCOM DAMA waveform designed to add additional UHF capacity for users until MUOS is in place. Designed on new DISA MIL-STD's 188-181C, 182B and 183B.
♦ IW will more than double the throughput of 5-kHz and 25-kHz DAMA channels over the existing DAMA standards.
♦ A 25kHz channel will now support up to 20 at 2.4kbps networks at mixed modulation rates as opposed to the previous five networks in the old standard.
♦ A 5 kHz IW UHF channel will support similar rates as the 25 kHz channel.
♦ Provides narrowband, low data rate services, i.e. data/messaging, facsimile, paging, and netted-voice communications requirements, to communications-on-the-move, mobile, and static operational elements.
♦ IW defines a single Demand Access method applicable to both 5- and 25-kHz channels, reducing the number of orderwire messages from 96 to only 30. This serves to simplify radio operation.
♦ IW provides backward interoperability in all modes, rates, and formats with today's DASA and DAMA services as defined in MIL-STD-188-183 and MIL-STD-188-183A.
♦ IW DAMA offers improved TDMA, time slot / burst rate efficiencies, and can now support a 56 kbps data circuit over the traditional DAMA 2.4kbps.
♦ IW does not negatively affect MELP voice coding.
♦ Supports up to 56 kbps PSC5C/D, ARC231, and AN/PRC117F.
♦ Projected fielding 3rd Quarter FY08.

MAJ Mann is assignmed as the JTRS Systems Engineer with the TRADOC Capability Manager for Tactical Radios, Fort Gordon, Ga.

Acronym QuickScan

AMF-SA – Airborne / Maritime / Fixed Site – Small Airborne
BGP – Border Gateway Protocol
BLOS – Beyond Line-of-Sight
CENTRIX – Combined Regional Information Exchange
CNR – Combat Net Radio
COMSEC – Communications Security
DNT – Directive Network Technology
DASA – Demand Assigned Single Access
ERMP – Extended Range Multipurpose
FDMA – Frequency Division Multiple Access
FEC – Forward Error Correction
GIG – Global Information Grid
GMR – Ground Mobile Radio
GMS – Global Mobile System
HAIPE – High Assurance Internet Protocol Encryption
HMS – Handheld / Manpack / Small Form Fit
HNR – Highband Networking Radio
HNW – Highband Networking Waveform
IP – Internet Protocol
IW – Integrated Waveform
JC4ISR – Joint Command, Control, Communications, Computers, Intelligence, and Reconnaissance
JTRS – Joint Tactical Radio System
JWICS – Joint Worldwide Intelligence Communications Systems
LOS – Line-of-Sight
MANET – Mobile Ad-hoc Network
Mbps – Megabytes per second
MELP – Mixed Excitation Linear Predictor
MELPe – Mixed Excitation Linear Predictor Enhanced
MIL-STD – Military-Standard
MILSATCOM – Military Satellite Communications
MUOS – Mobile User Objective System
MUDS – Mobile User Objective System
NCW – Network Centric Waveform
NIPRNET – Non-secure Internet Protocol Router Network
PSTN – Public Switched Telephone Network
QoS –Quality of Service
SIPRNET – Secure Internet Protocol Router Network
SM-DM – Short Message Delivery Multiport
SRW – Soldier Radio Waveform
SWaP – Size, Weight, and Power
TDMA – Time Division Multiple Access
TCM-TR – TRADOC Capability Manager for Tactical Radios
WCDMA – Wideband Code Division Multiple Access
WIN-T – Warfighter Information Network - Tactical
WNW – Wideband Networking Waveform
UAV – Unmanned Aerial Vehicle
UHF – Ultra High Frequency

TCM-SNE

Wideband Global SATCOM System Underway

By Dale Sleeper

April 15, 2008, was more than just "income tax day" for Army Soldiers. On that day, the first of six high capacity military communications Wideband Global SATCOM satellites became operational. The initial capability of the most powerful satellite in the Department of Defense inventory coupled with the subsequent launches of the remaining five satellites will provide all services a quantum leap in communications bandwidth in the X and Ka-band frequency spectrums.

Originally designed as a "gap filler" between the old but reliable Defense Satellite Communications System and a future satellite system, WGS has evolved into its own constellation with staying power. It will augment and eventually replace the DSCS. Just one WGS satellite has as much power as all 10 DSCS satellites combined! The digitally channelized transponded WGS satellites provide communications capacity, connectivity and flexibility for United States military forces while maintaining interoperability with existing and programmed X- and Ka-band ground terminals. WGS will provide essential communications services in the form of data, full motion video, maps, voice, and imagery. This translates to faster and more efficient information exchanges and thus more operational flexibility to warfighters at all levels – tactical, operational, and strategic.

The second and third WGS satellites are planned for launch later this year with the remaining three satellites launching in 2010-2012. By 2012, WGS will take over all communications functions of the DSCS.

Mr. Sleeper is with the Office of the TRADOC Capabilities Manager for Satellites and Network Extension. He can be reached at DSN 780-7917, 706 791-7917 commercial on by email at dale.sleeper@us.army.mil.

Acronym QuickScan

DSCS – Defense Satellite Communications System
WGS – Wideband Global SATCOM

Doctrine update

Updates in Signal doctrine from Directorate of Combat Developments, Army Signal Center, Fort Gordon, Ga.

Joint Network Node transitions to the Warfighter Information Network – Tactical

By Rick San Miguel

Four years ago, the 3rd Infantry Division was fielded with the Joint Network Node during their initial deployment to Iraq. The JNN was an interim solution to the long-awaited Warfighter Information Network–Tactical, but a viable improvement to the legacy mobile subscriber equipment currently in use. The Joint Network Node is a Joint-compatible communications package that allows the warfighter to use advanced networking capabilities, retain interoperability with current force systems, and keep in step with future networks (i.e. WIN-T). The JNN provides a suite of voice, video, and data communication tools designed to meet the needs of division, brigade and battalion command post structures. It is a rapidly deployable, early-entry system housed in an S-250 shelter and mounted on an Extra-vehicular Communication Humvee for roll-on/roll-off mobility.

The development of Field Manual Interim 6-02.60, Tactics, Techniques, and Procedures to the Joint Network Node – Network dated September 2006 provided the doctrine for the initial employment of the JNN-N. It provided the TTPs for pre-deployment, deployment planning, and management to support military operations and training. It included descriptions of the components, its functions, applications, procedures, planning, management, maintenance and a user reference guide to support the deployment and operation of the JNN-N in support of the digitized force. The JNN has been a great success as an interim solution to WIN-T and in June of 2007 a decision to restructure the WIN-T program and absorb the former JNN-Network program was made. The restructured WIN-T program consist of four increments:

Increment 1: Networking at-the-Halt

Increment 2: Initial Networking on-the-Move

Increment 3: Full Networking on-the-Move

Increment 4: Protected Satellite Communications on-the-Move

The Signal Regiment is developing a new FMI that captures the restructure of the WIN-T program and addresses the network transport systems in LandWarNet. The new doctrinal field manual interim, FMI 6-02.60X, LandWarNet: Network Transport and Services addresses the current network transport systems, JNN, WIN-T, and Joint Tactical Radio Systems.

Doctrinal Status:

Signal Doctrinal FMs and FMIs on the Reimer Digital Library (http://www.train.army.mil) ensure the most current doctrine is available to the Signal user and forward deployed forces. FM/FMIs are posted on the Army Knowledge Online at different stages of development (Program Directive, Initial Draft, and Final Draft as they are developed. FMs/FMIs are published digitally on the RDL as they are approved. Regimental Signal Doctrine in its development stages can be accessed at https://www.us.army.mil/suite/folder/926805 or from www.gordon.army.mil/doctrine (CAC Login is required.) Comments can be submitted electronically to signal.doctrine@us.army.mil.

Mr. San Miguel is a Department of the Army Civilian, and presently holds the position of Signal doctrine writer, Concepts and Doctrine Branch, Concepts, Requirements, and Doctrine Division, U.S. Army Signal Center, Fort Gordon, Ga. His background spans 33 years of service to the Signal Regiment.

Acronym QuickScan

AKO – Army Knowledge Online
Bn CP – Battalion Command Post
CAC – Common Access Card
ECV HMMWV
FMI – Field Manual Interim
FD – Final Draft
FCS – Future Combat System
ID – Initial Draft
JNN – Joint Network Node
JTRS – Joint Tactical Radio Systems
LWN – LandWarNet
JNN-N – Joint Network Node–Network
PD – Program Directive
RDL – Reimer Digital Library
SATCOM – Satellite Communications
TTPs – Tactics, Techniques, and Procedures
WIN-T – Warfighter Information Network–Tactical

Circuit check

News and trends of interest to the Signal Regiment

Lean Six Sigma project saves Army more than $9 million

By Gordon Van Vleet

A Lean Six Sigma project initiated by the U.S. Army Network Enterprise Technology Command/ 9th Signal Command (Army), focusing on optimization of the Defense Message System, has resulted in a $9.7 million savings to the Army and could potentially save more than $35 million if all recommended improvements are approved and implemented.

The project, which began in March 2007, focused on restructuring of the DMS contract support requirements in Southwest Asia, said project lead Lawrence Couture, an operations research systems analyst for Network Enterprise Command.

"In the past, DMS required special hardware and software right down to the user's personal computer," Couture said. "Now, as a result of this project, there are several options available that make it possible to provide both classified and unclassified DMS services from a single suite of equipment to an entire theater or regional area."

DMS is the Department of Defense system of record for organizational messaging, Couture said when explaining the importance of DMS. "Organizational messaging includes messages and other communications that are exchanged between organizational elements of the U.S. Armed Forces, our NATO (North Atlantic Treaty Organization) allies, our defense industry partners and other governmental agencies in support of command and control, combat support, combat service support, and other functional activities.

"Because of their official and sometimes critical nature, organizational messages impose operational requirements on the communications systems for capabilities such as precedence, timely delivery, and high availability and reliability."

DMS Optimization LSS project lead Lawrence Couture (left) receives his Green Belt Certification from Dan Bradford, Senior Technical Director/ Chief Engineer, NETCOM/9th Signal Command (Army), during a ceremony held in the command's conference room.

The objective of the DMS optimization project was to reduce the number and frequency of non-delivery notifications occurring in the Army Message Handling System, thereby increasing message availability and reliability while streamlining the network for better efficiency, said Couture.

"DMS optimization was selected as a good candidate for LSS improvements because prior to March 2007, the AMHS experienced a high rate of NDNs reducing the effective availability and reliability of DMS," said Couture.

"Restructuring of the DMS contract support requirements in Southwest Asia was initiated this year, and accounts for most of the almost $10 million in savings so far," Couture said. "The plan now is to continue with the same project to further consolidate resources in the Pacific."

"This project was a great example of the right LSS belt being applied to a process problem they know very well," said Laretta Hamlett, director, NETCOM Business Transformation Office. "Mr. Couture has been working with DMS for many years. He is not only well-versed in how the system operates and how it is funded, but also knows who the major players are."

The DMS optimization LSS project is not a typical Green Belt project said Hamlett. "LSS Green Belt projects are typically small, scoped to be completed within less than three months, and do not involve extensive cross-organizational coordination to complete.

This project not only extended across several of NETCOM's subordinate commands, but also touched other military departments."

"His (Couture's) ability to coordinate across such a wide variety of organizations while achieving project goals speaks to his leadership capability and the value of his experience, and was critical to the success in completing this project," said Hamlett.

Couture was placed in charge of the DMS restructuring project after receiving LSS Green Belt training, and was officially awarded his Green Belt certificate after completion of the DMS optimization project. Although this project is much more extensive than a typical Green Belt project, this is Couture's first completed project that was required for certification said Hamlett. "The Army program of instruction requires all belt candidates to successfully complete one project after attending two weeks of training to qualify for certification."

The savings from this project were not typical either; and as a result of the substantial savings to the Army and the success of this project, it is evident that LSS will continue to be a part of NETCOM's transformation efforts as the command continues to provide global communication capabilities to the Warfighter.

Mr. Van Vleet is a public affairs officer with Network Enterprise Command, Fort Huachuca, Ariz.

50th Signal Battalion (Expeditionary) provides superior communications support during Beyond the Horizon 2008

By 2LT Eric P. Young

In one year the 50th Signal Battalion went from a mobile subscriber, equipment-based, corps support signal battalion, to the new joint network node-based Expeditionary Signal Battalion. In addition to new equipment, the battalion acquired a new mission to install, operate, and maintain a rel
responsive, and robust com
control, communications, a
computers system anywhe
world. Shortly after trainin
fielding, and validating th
equipment, the battalion re
real-world mission in supp
United States Army South
deployed to Honduras, Tri
Tobago, and Suriname as p
humanitarian project called Beyond the Horizon 2008. While in South and Central America, one platoon from A and B Companies, 50th Signal Battalion supported U.S. Army South's mission, which required them to work side-by-side with other services and branches of the U.S. and foreign military and provide reliable communications support.

Tactical site set up of Bravo Company of the 50th Signal Battalion in Trinidad in support of Beyond the Horizon 2008.

Beyond the Horizon is a humanitarian effort designed to foster goodwill and improve relations between the United States and governments of the region. Since March 2008, U.S. military personnel have provided comprehensive humanitarian and civic assistance. Troops specializing in engineering, construction, and health care provide much needed services to communities in the area. Some of the services troops provide include building schools, clinics, community centers, water wells, and other life enhancement facilities. Furthermore, U.S. military health care professionals conduct Medical and Dental Readiness Training Exercises in each country, providing services to thousands of citizens requiring care. Beyond the Horizon simultaneously strengthens foreign military interactions, improves the conditions within communities, and benefits the integration among our nation's partner capabilities.

The mission of Beyond the Horizon required U.S. joint services to maintain a high state of readiness and enhanced ability to mobilize and deploy in support of active duty counterparts. The 50th Signal Battalion provided highly reliable and flexible communications among various branches and services. At any given time during the exercise, about 350 U.S. service members, representing National Guard and Reserve forces from all branches of service deployed as part of the mission. The 50th Signal Battalion operated with numerous Reserve and National Guard units, to include troops from Texas, Wisconsin, Connecticut, South Dakota, Puerto Rico, and the Virgin Islands. As part of a Joint Task Force, the Battalion also worked with the Marines, Navy, and Air Force. Additionally, U.S. Soldiers worked with host nation forces. Specifically, the Trinidad Defense Force personnel showed great support and responsiveness to the missions. According to SSG Matthew Kohn from B Company "it is interesting to see how all the other branches and services operate within the Joint Task Force to accomplish tasks." Overall, the 50th Signal Battalion proved an integral part of a concept that promotes strong and enduring relations not just with partner nations, but with other branches of the U.S. military.

The 50th Signal Battalion's new joint network node equipment provided vast capabilities to all task force subscribers. The subscriber requirements for each site included: 20 Non-secure Internet Protocol Router users, five Secure Internet Protocol Router users, one secure Video Teleconferencing, 10 Defense Systems Network users, 30 Voice over Internet Protocol users, and 30 POTS users. After initial installation, the Joint Network Node platoons shifted focus to setting up tactical operations centers for the Partnership of the Americas Engagement Team staff. Soldiers from Company

2LT Luke Nabozny, B/50th Sig Bn, participated in the Beyond the Horizon Trinidad Tobago opening ceremony on March 26, 2008. Here, LT Nabozny is with the USARSO DCO, the Trinidad Air Force commander, a member of the Trinidad Defense Force and one of the MEDRETE commanders.

POTS users. After initial installation, the Joint Network Node platoons shifted focus to setting up tactical operations centers for the Partnership of the Americas Engagement Team staff. Soldiers from Company A provided VoIP phones and laptops a full two days prior to subscribers getting on ground. 2LT Samuel McElroy's platoon initially encountered issues installing the link, however, they were able to work with a single channel team from the 56th Signal Battalion, and provide NIPR, SIPR and VTC capabilities a week prior to the team's first request. On a daily basis, the teams provided voice and data services to subscribers and troubleshot any issues users encountered. The two deployed JNNs ran effectively for the past few months. Overall, the JNN package provided excellent communication for this mission and proved vital to mission accomplishment.

Beyond the Horizon allowed Soldiers of the 50th Signal Battalion to sharpen current occupational tasks and cross train supplementary skills. Due to the high quality of Soldiers and their outstanding work, the JNNs maintained uninterrupted communications services for the duration of the missions. While on a command visit in April, the Commander of the 56th Signal Battalion, LTC Kirby Watson commented that "the sites look great, the customers are happy and the Soldiers show a lot of pride in their equipment and mission." In fact, during the times that they were not troubleshooting an issue or improving the site, Soldiers held classes to further increase their knowledge and perfect their skills. The primary operators of both the 93TSC van and the JNN switch each taught classes on 25N and 25S skill sets. Recognizing the need to maintain equipment in order to accomplish mission, they also trained on preventive maintenance checks and services and generator maintenance. SPC Anthony Harrison explained "the time we have for training and cross-training the troops is very beneficial to the team." Overall, Soldiers of 50th Signal Battalion provided continuous communication while developing skills to make the team stronger and able to take on more responsibility.

"Beyond the Horizon 2008 provided an opportunity for the 50th Signal Battalion to contribute to a humanitarian cause, exercise the capabilities of the new JNN equipment, and demonstrate the abilities of the Soldiers," according LTC Brian Foley, commander 50th Signal Battalion. "

2LT Young, from Minneapolis, Minn., is a graduate of the United States Military Academy and recently the Basic Officer Leader Course. He is assigned as Executive Officer in Bravo Company, 50th Signal Battalion (Exp) and working on his masters in software engineering.

Acronym QuickScan

AMHS – Army Message Handling System
C4 – command, control, communications, and computers
DMS – Defense Message System
DSN – defense satellite network
JNN - joint network node
JTF – joint task force
LSS – Lean Six Sigma
NATO – North Atlantic Treaty Organization
NDN – non-delivery notifications
NIPR – nonsecure Internet Protocol router
POT – Plain Old Telephone Service
SIPR – secure internet protocol router
TOC – tactical operations center
U.S. – United States
USSOUTHCOM – United States Southern Command
VoIP – voice over IP; voice over internet protocol
VTC – video teleconference center

Writing for your *Army Communicator*

Your interest in writing for the *Army Communicator* is appreciated. AC is published quarterly by the Chief of Signal at Fort Gordon, Ga.

Army Communicator is the U.S. Army Signal Regiment's professional magazine. The magazine explores trends in the Regiment and provides a place for Signal Regiment members to share good ideas and lessons-learned with their colleagues.

AC, as the Signal Regiment's professional-development magazine, is supported by article contributions from Signal Regiment members; *AC* depends on noncommissioned officers, officers, warrant officers, and Regimental Civilian employees to contribute quality articles on topics of interest to the entire Regiment.

We hope you consider sending us an article on Signal work that you and your unit are doing! To be more successful in getting your manuscript from raw manuscript to the published product, please see our writer's guidance and style manual found online at http//:www.gordon.army.mil/ocos/ac/. This information answers many questions and concerns, and it discusses our minimum requirements. There's a lot of material to absorb if you read everything, so we recommend that at a minimum, read the "How to submit an article" section before you submit your article. More detailed guidance beyond the general guidance is found on our manuscript-formatting webpage. If you have questions/concerns the writer's guidance doesn't answer, please feel free to contact the editor anytime. We look forward to reading your article. (Email address below.)

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Acronym list following short author biography (in alphabetical order);

Art: Photos or illustrations submitted separate from the text (not embedded in the text), with each piece of "art" as an individual file in JPG or TIF format;

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