ANW2 Expanded

Somewhere in South East Asia

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The forward observer (FO) adjusted himself on the rocky ground as he observed an enemy emplacement through his optics. He witnessed large- and medium-sized vehicles, about twenty total, as well as many antennas satellite dishes all being packed up in a hurry. This was certainly a command and control (C2) node of some sort, and it would not be there for long. The enemy was definitely getting ready to displace. The battalion landing team (BLT) had established a foothold upon landing in the area of operations but had stalled in its advance inland. The opposition consisted of a highly motivated and capable fighting force with one apparent weakness: its reliance on centralized control. Early on, the enemy proved to be ever elusive, evading contact and being targeted by fire support by quickly disappearing with their ambush-and-evade tactics, but now their entire combat operations center (COC) was directly in front of him. Here in his reticle pattern was the enemy's Achilles' heel, an opportunity that had to be seized upon. Adding to the pressure, the enemy had tucked their COC in the middle of a local village.

Without delay, the FO began to generate the fire mission. This was the perfect situation calling for an, "At My Command," High Explosive/Precision Guidance Kit (HE/PGK) mission—a can't miss opportunity. He grabbed his FO suite and sent a message to his battalion fire support coordination center (FSCC). The BLT's fire support coordination center would simultaneously check for any conflicts and approve the mission. Suddenly, as if Murphy was playing a cruel trick on him, the sounds of small arms and mortar fire came from the direction of the BLT's COC. Over the tactical net, SALUTE (size, activity, location, unit, time, equipment) reports started flooding the net with short choppy phrases like "small arms … incoming … mortar fire … squad element." Erratic gunfire was mixed in with each transmission.

Unbeknownst to the FO, the skirmish he just heard caused significant damage to some of the COC's communications equipment. The very small aperture terminal (VSAT) dish, the battalion's primary data connection to higher and adjacent units, was destroyed and the networking on-the-move (NOTM) was knocked offline. The BLT had just lost all data connections via satellite assets.

The FSCC raised the FO on the conduct of fires net to tell him what had occurred with instructions to send a voice mission. Sure, the voice mission was going to take longer, increase the potential for error, and potentially preclude the use of precision munitions, but that was better than watching the target drive away. As the FO began preparing the voice fire mission, his digital suite made a little beep. Perplexed, the FO looked at the screen. A pop-up message displayed, "MTO: AD3074, F, 2, HE/PGK, AMC, MO 4251." As the FO was about to grab the conduct of fires net to find out what was going on, the FSCC came over and said, "We're still up digital with everyone." Another pop-up appeared, "AD3074, Ready." How was this happening? The BLT had lost all satellite equipment, but somehow the critical digital traffic was getting through. Not caring to ponder how the network was working but rather content in the fact that it was, the FO hit the "Fire" button.

A few seconds later in the Fox Battery position, six howitzers digitally received the command to fire over their section's chief display shortly followed by the thunder of their discharge. The FO received "Shot" and "Splash" messages right in time to bring his binos to bear on the target. In near unison, six rounds dissected the rectangular target without warning—courtesy of the fuse's precision guidance; twenty seconds later the final volley impacts, dashing the enemy's hope of delaying

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FOs observed the impact of artillery rounds to determine need for a repeat fire mission. (Photo by Cpl William Perkins.)

the BLT's offensive. The FO scans the target, trying to decide if a repeat mission is necessary. There is no need; one of the line companies is maneuvering toward the position and will easily clear it. The FO taps "EOM" (end of mission); kilometers away, the howitzers traverse back onto their priority target.

Our FO was the beneficiary of a properly designed and configured tactical data network. Able to converge quickly, this network is rapidly adaptive, self-healing, and self-forming. Though the satellite access was eliminated by enemy action, the networking equipment was able to prioritize mission critical traffic and direct it over the tertiary line-of-sight networks populated by the PRC-117G and its variants. The network did this without end-user input, allowing the FO to focus on the critical tasks at hand. Meanwhile, behind the scenes, the network as a collective whole is constantly analyzing itself, ensuring reliable, adaptive, and timely transport of information. The waveform responsible for this is known as Adaptive networking wideband waveform (ANW2).
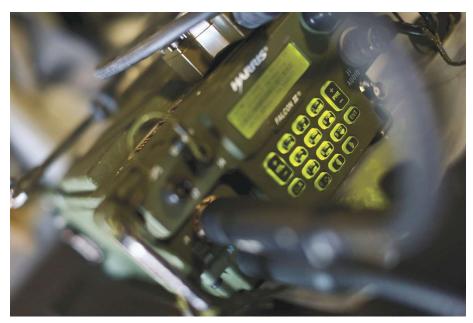
ANW2 has been in use in the Marine Corps for the past few years; however, its full capabilities have yet to be realized. 11th Marine Regiment, 1st MarDiv, Camp Pendleton, CA, was the first unit within the Marine Corps to

transition from the Enhanced Position Location Reporting System (EPLRS) to the AN/PRC-117G/VRC-114 based ANW2 network as the primary backbone for digital fires. ANW2 has been in use throughout the Regiment for the past 30 months and has been fully integrated into the 11th Marines' communications architecture. Prior to the implementation of ANW2, the EPLRS system was never integrated into the full communications network; it was used as a separate system allowing the regiment to solely transmit digital fire missions. As the replacement for EPLRS, ANW2 has expanded the C2 capabilities of 11th Marines exponentially.

ANW2 is a self-forming and self-healing waveform for fixed and mobile tactical operations. It can ensure immediate and robust data and voice communications across the network while automatically detecting the path with the greatest data rate and use that as its primary avenue of transmission. Using dynamic discovery, should that avenue suffer from interference of any kind, ANW2 will automatically redirect its path to a different transmission source because the PRC-117G updates its routing paths every 30 seconds. As the network changes and radios move locations, the optimal data path is updated as well. Every radio within the ANW2

network acts as a repeater, and this has enabled 11th Marines to significantly expand the range of its transmissions and ability to C2.

The integration of ANW2 within the regiment allows for multiple digital communications paths to maintain C2 of subordinate units. The regiment hosts a 30 node ANW2 network that provides connectivity to each battalion's main and forward COCs as well as the counter-battery radar teams. Each battalion hosts its own 20 to 30 node ANW2 network extending connectivity to the battery level and to each maneuver unit's FSCC. The battalion clouds are routed to the regimental cloud using the network switch organic to the mobile tactical shelter. ANW2, used in conjunction with the VSAT/NOTM, creates a hybrid mesh network with multiple data paths available to each unit. The FSCCs, located with the maneuver unit each battalion is supporting, are integrated both with ANW2 as well as any VSAT or NOTM the unit provides. The ANW2 and satellite network integration creates an unprecedented level of communications between the infantry regiments and the artillery battalions in direct support. Each infantry regiment is tied directly to its supporting battalion's ANW2 network, enabling quick and efficient fires processing and data sharing while the redundancy provided by satellite communications allows for fires to continue if a unit is beyond line-of-sight (BLOS), a capability previously not available within the regiment.

With the full integration of ANW2, a data path is now available to the battery level, providing the primary means for digital fires throughout the regiment. In addition to digital fires, ANW2 has proven to be a viable solution to accessing other C2 applications without the use of wide-band satellite communications. The full mesh network extends secret Internet Protocol router (SIPR) services to the battery level in addition to Advanced Field Artillery Tactical Data System and digital voice communications. C2 applications such as chat, Voice over Secure Internet Protocol (VoSIP), command and control personal computer (C2PC), and web browsing are now available at the

The ANW2 has been in use for several years, but its full capabilities haven't been realized. (Photo by Cpl Summer Romero.)

battery level. This has expanded the battalion's communications capabilities and enabled them and their batteries to pass digital information which was never previously available. Information such as imagery, digital files, position reports, fire capable reports, and the common operational picture can now be accessed quickly and securely.

The ability to extend SIPR network services throughout the regiment and down to the battery level has provided a reliable and redundant means to communicate without the use of wide-band satellite communications (SATCOM). SIPR, extended to the battery level through ANW2, allows the regiment to continue its operations in a SATCOM degraded environment. At the battalion level, the data paths have increased exponentially; for example, in the event a battalion NOTM becomes inoperable, network traffic can still traverse through the regimental ANW2 network and exit via the regiment's VSAT or adjacent through a sister battalion's NOTM. The mechanisms for this function are the Internet Protocol enabled switches present in each mobile tactical shelter. They perform the majority of routing for data traffic in the 11th Marines network. The switches choose the best path available for data traffic with ANW2 being prioritized because of its

more specific route. In the event either pathway is lost, the switches will direct the data traffic through the next programed path. The failover takes effect automatically, is transparent to the user, and will revert back to the preferred ANW2 route when it is available.

The implementation and integration of ANW2 into the pre-existing network has dramatically increased capabilities but has also increased complexity. The addition of multiple data paths has increased the requirement for traffic management on an ever-changing dynamic network as the nodes update their routing table every 30 seconds. Traffic management has become more complex as multiple routing protocols are now being utilized simultaneously on one integrated network. Configuring the network has become a challenge as it well exceeds the entry school-level training of cyber network operators. 11th Marines has invested time and training into mitigating this issue by sending cyber network operators to commercial certification training, such as Cisco certified network associate and Cisco certified network professional courses. Without the knowledge base these certifications provide, the Marines would be unable to implement and maintain a network of this complexity.

Although great strides have been

made in the employment of ANW2, more work needs to be done. 11th Marines is currently at work to extend ANW2 systems BLOS. They have successfully tested the broadband global area network (BGAN) terminal to bridge the ANW2 network BLOS. The developments have been significant for the HIMARS battalion as its batteries doctrinally operate BLOS from the battalion FDC. Additionally, the cannon battalions are expected to receive PRC-117Gs to replace the digital fire control system. The implementation of PRC-117Gs to the gun line will accelerate the kill chain, closing the sensor-to-shooter cycle for the warfighter. Any observer with digital connectivity will be able to send a fire mission directly to the gun line.

The impact that ANW2 has had on 11th Marines cannot be understated. By extending live SIPR services to the battery level and being able to tie maneuver units directly into its network, the regiment and its subordinate battalions have greatly enhanced their ability to C2 and provide precise and timely fires. Sharing information, passing digital fires, and communicating by voice have all been made easier with this waveform. The flexibility provided by merging ANW2 with the existing SATCOM network has created a redundant network for the 11th Marine regiment to communicate with its subordinate and adjacent units. This type of network can be scaled across the GCE and tailored to any mission and can provide critical data and communications means to the lowest level. While there are still improvements to be made, ANW2 provides a robust communications network that enhances a unit's ability to share information across the battlespace without the requirement for wideband satellite communications.

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