Improving communications between digital fire systems

By MAJ Mathew Neyland, FA, U.S. Army Command and General Staff College, Fort Leavenworth, KS

“The Mission of the Field Artillery is to destroy, defeat, or disrupt the enemy with integrated fires to enable maneuver commanders to dominate in unified land operation.”

There are many aspects necessary for the Fires WfF to accomplish its mission, arguably one of the most important is the ability to synchronize and mass effects across the battlefield. In order to accomplish this, it is critical that the Fires community maintains the ability to communicate quickly and effectively from sensor to shooter, across the entire fires spectrum. This involves taking targetable data from forward observers (FO), radars, and other sensors and passing it along to Fire Support Elements (FSE) for analysis, and then forwarding to firing elements for execution. At some point, targeting data is generally converted into a digital format for further processing and dissemination through the Advanced Field Artillery Tactical Data System (AFATDS). While it is possible to transfer all fires information via voice communications, doing so increases the risk of information being misinterpreted, as well as tying up radio nets for longer than necessary. The sooner fires data is converted into digital form, the faster and more efficient the entire fires process works. However, voice communications are still important in the confirmation process assuring that the message sent was the message received. Problems arise however, when our FOs, FDCs and FSEs struggle to establish and maintain digital communications. Observations from CTCs indicate training and equipment deficiencies are preventing reliable digital communication resulting in an over reliance on voice coms. This leads to slower mission processing times and exponentially increases the likelihood of introducing human error into the process.

Within the Field Artillery, the most reliable and stable method of digital communication is the upper tactical internet (TI) which S6 signalers provide and maintain. This form of communication generally restricts the digital information flow from AFATDS to AFATDS only, and excludes most FO or gunline digital systems (PFED, SCU, RHC, AFCS, PDFCS, etc.). The use of upper TI has proven itself reliable and fast.

However, its use puts the Fires community at the mercy of the S6 and other outside agencies to establish and maintain the network. This type of network generally requires units to be static. As the Army shift its focus back to the Decisive Action environment (DA), command posts at all levels have to remain mobile to varying degrees. Observations at the CTCs show that during times of transition the digital flow of fires is halted until one of two things: The S6 reestablishes the upper TI network (SNAP,CPN,JNN), or the unit transitions to a secondary means of digital communication. This is usually provided by ASIP, HF, or SAT-COM radios. However, the trend is that fire mission processing is paused until the command posts (CP) are reestablished, which typically take 4-6 hours.

At the tactical level, digital data transmitted over ASIP remains the most common form of data transmission. It allows fires personnel to remain mobile, yet maintain communications with each other. This method is the primary form of digital communication from FOs and gunlines to the AFATDS; however, serious problems arise with its use. ASIP radio data networks are built using the MIL STD 188-220C protocol. Establishing and maintaining this type of network can be challenging for even the most well trained units. These challenges stem from the difficulty in establishing the network, slow data transmission rate and the reduction in range that occurs when transmitting digitally over ASIP. The use of frequency hopping (FH) compounds the range problem even further. Additionally, if a single operator within the network incorrectly enters the parameters into their device, it can cause the whole network to fail. Finally, the ASIP radio is incapable of...
transmitting voice and data simultaneously requiring two radios on separate frequencies to maintain effective communications, one for voice and one for data.

Digital fire missions transmitted via ASIP provided a significant advantage when first introduced, but advancements in communications allow for increased capabilities beyond the ASIP radio’s limitations. It is time for the Fires community to catch up.

The ability to modernize and upgrade digital fire support networks currently resides in Army inventory in the form of the Harris PRC-117/G and PRC-152A radio systems.

These radios are an all-in-one package allowing users to communicate using SINCGARS, SATCOM, VHF, and UHF spectrums. One of the particular capabilities of interest is its ability to establish reliable digital networks utilizing the Adaptive Networking Wideband Waveform (ANW2).

The ANW2 waveform allows the creation of a multi user network with reliable connections and high bandwidth rates. It creates a standard internet connection between the radio and the devices it is connected to. By using standard IP addresses, ANW2 allows for seamless connections between digital fire systems. Furthermore, ANW2 creates a self-healing mesh network that allows the radios to enter and exit the net without interruption and the radios will correct themselves to determine the best path to transmit data from one point to another. The data can “hop” through several radios in rout to its final destination even if the two radios do not have line of sight with each other. This is a similar operation to the traditional EPLRS type network. Furthermore, the radio can be paired with a BGAN satellite transceiver that would provide true “over the horizon” capabilities. Effectively and efficiently creating a link between Observers, Fire Cells, Fire Direction Centers, and Gun lines that could operate worldwide.

Another advantage over digital ASIP data is the ANW2 waveform allows for simultaneous transmission of voice and data on the same net. This capability reduces the number of required radio in half compared to a traditional ASIP data network which requires one radio for data and one radio for voice on separate nets. The 117G can operate as a base station or vehicle mounted, extending its range through a power amp, or it can be configured as a man pack and used dismounted along with the 152a.

Multiple rotational training units (RTU) tested the ANW2 system at the National Training Center at Fort Irwin with great success. The test initially began as a way for the Fire Direction OC/Ts to monitor in real time the data being processed through the RTU’s AFATDS during live fire exercises. OC/Ts monitored the data using the Effects Management Tool (EMT) software or though their own AFATDS. As NTC acquired more 117G radios, the test expanded to include data and voice transmissions between FDCs, BDE and BN FSEs and FOs during the live Fire Support Coordination Exercise (FSCX) and BDE LFXs at the NTC.

The use of the PRC-117G and the ANW2 network proved to be an invaluable tool at NTC; helping the OC/T’s better train, coach and mentor the RTU as well as ensure safety during live fire events. The use of this new system proved viable and a far superior replacement to the ASIP radio systems currently in use. Testing at NTC demonstrated reliable digital communications out to 30 Km. While the desert training environment of “The Box” provides good conditions for radio transmissions, the system is capable of providing simultaneous voice and data over distances at or exceeding those of the ASIP radio in all other environments. Furthermore, radios operating in a mesh network, such as ANW2, significantly simplify retrans operations. If a radio receives data meant for another radio in its network, the radio automatically “hops” the data forward to the next radio until the data reaches the intended destination. This is similar to using indirect routing in AFATDS, except the 117G radio will do it automatically and it is transparent to all users on the network. If the radio system is paired with a BGAN satellite antenna and direct line of sight connectivity cannot be established with the intended destination, the system will automatically switch to SATCOM to pass the data. This provides the Fires community true “over the horizon” capabilities worldwide. Additionally, since the connection between the radio and the end device is a standard internet connection, any device capable of commu-
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tication via LAN can operate on the network. This includes, AFATDS, Profiler, JADOCS, EMT, and FOS (RHC and SCU).

In addition to a more reliable network, the bandwidth available is much greater. This allows for high data usage systems, such as EMT or JADOCS to operate effectively over the network. One proposed use of the capability is to outfit the FSCOORD’s vehicle with the 117G radio and a small laptop running the EMT program as a client to the BDE FSE AFATDS. This would allow the FSCOORD to monitor the BDE fire Support situation in real time, while remaining in a mobile command post or TAC.

Based on initial testing and analysis, a BCT’S Fires network will require 52 radios. Proposed distribution is to first focus on establishing connections between AFATDS systems within the DS FA BN, followed by upgrading the BDE Fires Net, and then to outfit the maneuver battalions.

Upgrading the BDE fires net and the FA BN fire direction net in ABCTs, SBCTs, and IBCTs would not require any new or specialized equipment that does not already exist within the Army inventory. Fielding a BCT will require only the PRC-117G, vehicle or TOC power amp kit, and the appropriate cables. This requirement holds true for the battalion FIST elements in ABCTs, and SBCTs, as well. The SCU and RHC digital fire support systems in the BFIST, and the Stryker FSV will accept LAN data connection making the system plug and play compatible. For IBCTs the current PFED devices in use do not have a LAN type connection available. However, since the platform is Windows or LINUX based it is possible to create that functionality within the PFED, resolving one of the primary complaints from light units against the use of digital FO systems. The fact that a FO must carry two radios, at least one ASIP for data and then a second ASIP or similar radio for voice; as well as, the batteries required to operate it, often negate the tactical advantage digital communications provides. An upgraded PFED paired with a PRC-152A running the ANW2 network would help alleviate that challenge, extending digital and voice communications down to the light fighter FO in one radio. Extending the network down to the cannons presents another friction point. The current AFCS and PDFCS systems on the M777 and M109A6 are configured to operate over the ASIP radio and have integrated cables to facilitate. The Army spent a lot of time and money to improve capabilities throughout the force. Within the Fires realm, this included advancements in weapon systems, munitions, target detection/sensor systems, and software. However, it did not include any improvements to help these new systems communicate digitally with each other. The ASIP will always pro-
provide a solid fallback option, but it is time for Fires to move forward and increase its digital communications capabilities. The Harris PRC-117G and PRC-152a utilizing the ANW2 network, or something similar, will provide the Fires WfF with its own mid-tier network. Offering reliable tactical data communications independent of the S6 maintained upper TI and more reliable than traditional ASIP systems, greatly increasing the capabilities and responsiveness of fires throughout the force.
*Note:
Both LAN ports have to be activated. This is done during AFATDS initialization. (Screen where you select the AFATDS role). The second NIC has to be selected in the drop down box for Secondary LAN.
GBS, Profiler and AFATDS Ops LAN 2 have to be on the same subnet (ex. 192.168.13.xxx). This will be a different subnet than the SPR (LAN 1) side IP’s are an example of “A Way”