Digital Interoperability in the Objective Area

The benefits of COTS technology

by Capt Daniel Rettedal

In combat, Marines' lives often depend upon the timeliness and accuracy of close air support (CAS). Technologies such as Link 16 and blue force tracker (BFT) were designed to facilitate timely and accurate CAS, reducing the kill chain against hostile targets, and differentiating between friend and foe. *MCWP 3-23.1, Close Air Support* states that "although attack helicopters and fixed-wing capabilities are complementary, neither capability can fully replace the air support provided by the other."[1] The problem is that Link 16 and BFT were not funded for all platforms charged with "air action … against hostile targets in close proximity to friendly forces, requiring detailed integration."[2] Even the BFT capability, with its vehicle requirement and limited throughput capacity, needs improvement to be optimized for detailed close integration of fires and maneuver, particularly when the force on the ground is fighting dismounted. Instead, the solution should be focused on technologies aimed toward "the seamless digital exchange of tactically relevant information between the different elements of the MAGTF"[3] coined digital interoperability (DI). DI-capable rotary-wing attack platforms would save American lives by facilitating precise aviation ordnance delivery faster than ever before and meet the intent of the *2015 Aviation Plan (AvPlan)* (Washington, DC: Headquarters Marine Corps, 2014), *Expeditionary Force 21* (*EF 21*) (Washington, DC: Headquarters Marine Corps, March 2014), and the *Co-*

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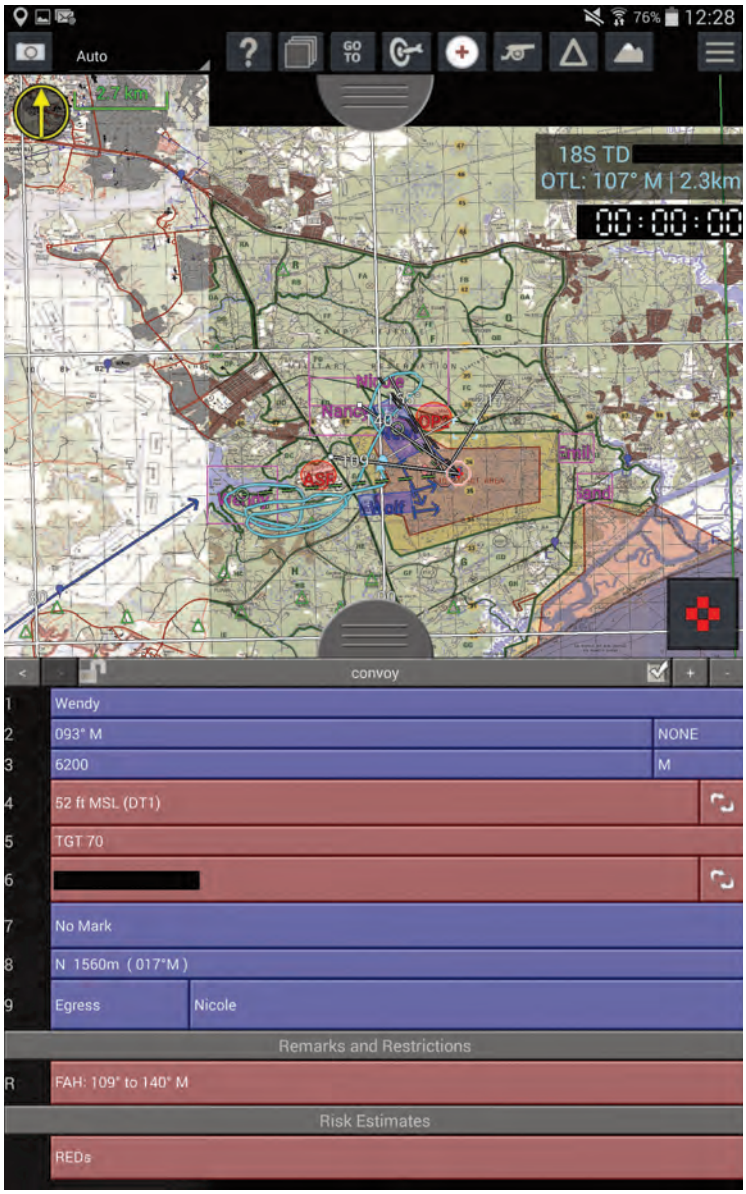
The cockpit placement of COTS digital device. *(Photo by author.)*

operative Strategy for 21st Century Seapower (CS 21) (Washington, DC: Headquarters Department of the Navy, Marine Corps, Coast Guard Headquarters, March 2015). Fortunately, the path has already been paved for the integration of rotary-wing DI by an application designed for use on commercial-off-the-shelf (COTS) tablets used by both aviation and ground forces. As it currently stands, however, the DI technology being formally tested and, in some cases, employed, in conjunction with the Adaptive Networking Wideband Waveform (ANW-2) is dependent upon assault support assets like the C-130 remaining overhead in an objective; this tactic is not appropriate in many threat environments. In contrast, COTS technology solutions can—and have—connected non-Link 16 or BFT platforms into a DI environment without the need for an assault support platform overhead. This capability was successfully demonstrated on AH-1Ws operating in conjunction with a ground combat element and should be considered as part of the DI solution going forward.



The CAS screen shot. *(Image by author.)*

HMLA-269 Proof-of-Concept

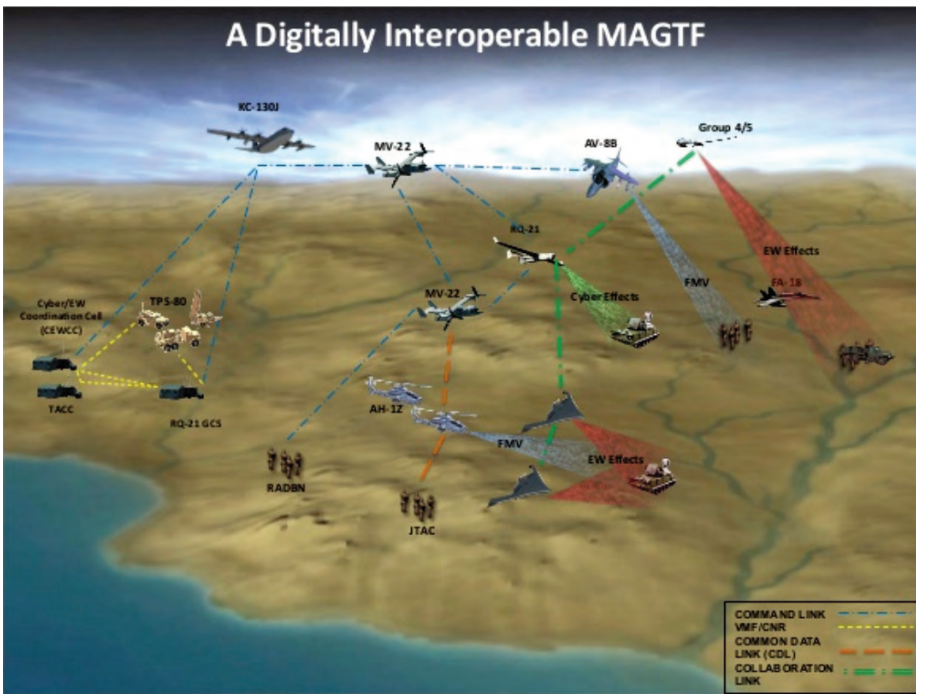
From February through May 2015, HMLA-269 sought to act on our senior leadership's guidance, both on DI and on innovating and adapting. A key component of this effort included an application designed for use on COTS tablets already widely used by both Marine aviation and ground forces. A goal for emerging DI technology is commonality between the ACE and the GCE, which is provided by the application Kinetic Integrated Lightweight SoftWare Individual Tactical Combat Handheld (KILSWITCH). This application was developed by Navy Air Warfare Center Weapons Division (NAWC-WD)'s Digital Precision Strike Suite, the same developers of the combat-proven Precision Strike Suite–Special Operations Forces (PSS–SOF). KILSWITCH produces a level of precision and situational awareness for aircrew, tactical air control party personnel, and GCE Marines previously unachievable by paper maps. Objective area development tools include the ability to plot precise friendly/enemy locations with associated proximities, airspace coordination measures, and terrain/line of sight (LOS) communication analysis. Tools for fires include call for fire (CFF) and CAS 9-lines, precisely depicting gun positions, final attack headings, gun target lines, and Laser geometry. KILSWITCH has already facilitated integration of DI technologies with built-in options for users to publish user-defined data (CAS 9-Lines, CFF, overlays, etc.) over a network, to chat, and to receive full-motion video (FMV) feeds. Thanks to KILSWITCH, digitally-aided rotary-wing CAS (a Link-like capability) is entirely possible today should the Marine Corps merely place the right network infrastructure (DI technology) in the hands of Marines. KILSWITCH also displays friendly positions of all players on a DI network, resulting in a BFT-like capability. But DI hardware needs to be placed in attack aircraft, predisposed toward persistent presence in the objective area—when this technology matters most—and it must operate independently of any other type of aircraft.

As it currently stands, DI technology is being tested that is dependent upon assault support assets remaining overhead; this tactic is not appropriate in most threat environments. These tests frequently seek to leverage ANW-2, enabled by Harris' AN/PRC-117G and PRC-152A (handheld) radios.* This waveform, particularly when operating at a 5MHz channel, advertises capabilities of streaming video, simultaneous data feeds, and combat net radio capabilities, all via radios that are faster and lighter than legacy radios. ANW-2 is secure and capable, but GCE inte-

*Information on the AN-PRC117G and PRC-152A can be found at http://rf.harris.com.

gration with the ACE in this network is currently reliant upon digital hubs bolted on to unmanned aerial systems, assault support assets, or jets. With ANW-2, every other aircraft or radio serves as a spoke, digitally interacting with these hubs—resulting in the possibility of attack helicopters being reliant upon assault support assets overhead to participate in DI. Instead, the independence of attack platforms within should be the priority of DI efforts.

NTTP 3-22.3-AH-1, 1.5.2., reinforces that Marines "plan the objective area first, then ingress and egress."[4] Thus, the driving factor of an emerging technology's functionality must focus, first and foremost, on the objective area. As demonstrated in Operation Iraqi Freedom and Operation Enduring Freedom, the GCE desires H-1s overhead in an objective area due to time on-station;[5] thus, if DI technology must have a hub (for example, ANW-2), it should be placed on the UH-1Y, not just the V-22 or C-130. Programs like the Vortex Box are trying to address this H-1 shortfall, but do not aim to equip the AH-1Ws that currently comprise the entirety of 1st and 2d MAW attack helicopters. The Marine Corps needs to capitalize on COTS technology now to equip non-Link platforms with the ability to participate in the DI environment, with Link 16 and BFT-like capabilities.



Connectivity diagram for the MAGTF. *(Image by Marine Aviation Digital Interoperability update, June 2015 from www.slideshare.net.)*

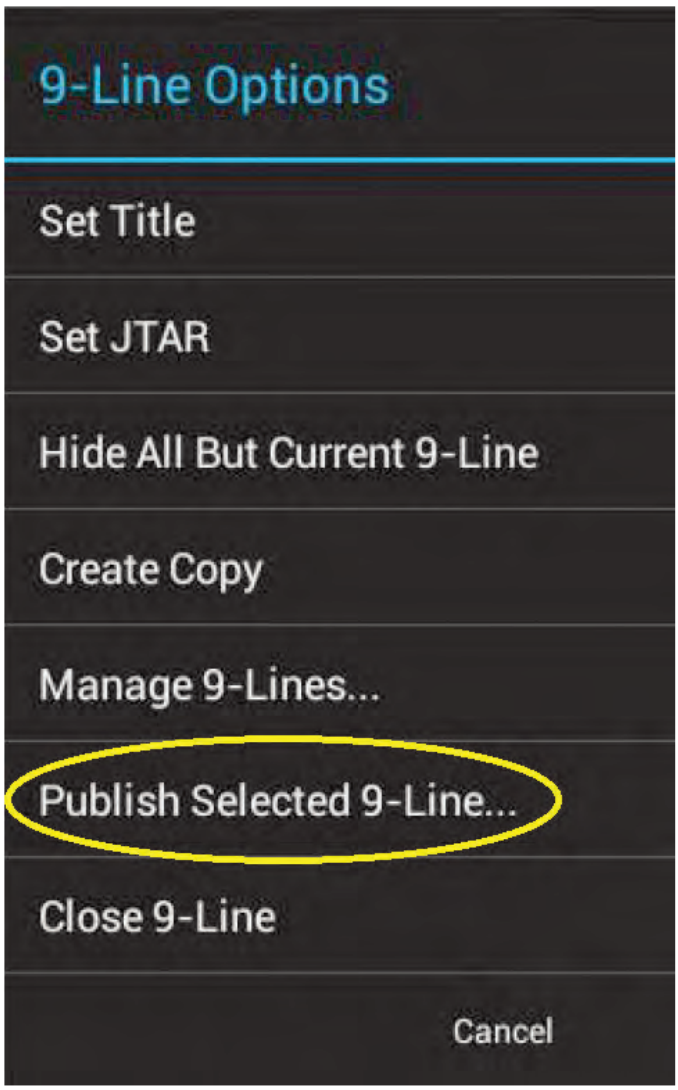
There is emerging DI technology that does not require a hub and allows independent access to all. One example is the TrellisWare mobile ad hoc network (MANET) DI technology which aims to independently connect a DI battlespace. Like ANW-2, this technology is capable of FMV and simultaneous data feeds/radio trans-

Juggernaut Defense product. *(Photo by Juggernaut Defense.)*

missions. The difference is that this MANET network is faster, enables greater data throughput, and is more adaptable than ANW-2, while providing extended ranges by flowing voice and data through each radio to the entire network with no hub—similar to a cloud, or every radio being a retransmission site. TrellisWare MANET claims to be a self-forming/self-healing network, resilient, and unaffected by the radios' entry and exit from the network, without the vulnerability of a hub. Cloud-type networks, like MANET, provide non-line-of-sight communications capability, wherein every new participant further increases communications and data range for the entire group. These capabilities have already been proven by other agencies in urban environments and within ships.

In February 2015, HMLA-269 flew a single AH-1W to Quantico, VA to provide simulated CAS in support of the Infantry Officer Course aboard MCB Quantico. MANET radios in each cockpit automatically joined the network upon arrival with one press of an icon on KILSWITCH validating TrellisWare's self-forming claim. A BFT-like capability was demonstrated by the network automatically plotting each MANET radio on KILSWITCH. The AH-1W received FMV from a tactical air control party Laser designator, which displayed split screen on tablets in KILSWITCH. The tactical implications of these kinds of capabilities include possible improved correlation processes, groundbased lase with airborne target verification, BFT-like situational awareness, and access to previously unavailable sensors.

After the initial exercise success in March 2015, HMLA-269 and MAG-29 explored the capabilities of "publishing" data over a TrellisWare network while leveraging KILSWITCH. As advertised, the MANET waveform achieved non-line-of-sight communications among all radios with each participant observing the others' position. Each participant transmitted and received CAS 9-lines, CFF, and casevac 9-lines, demonstrating a Link-like capability. DPSS's Android Precision Assault

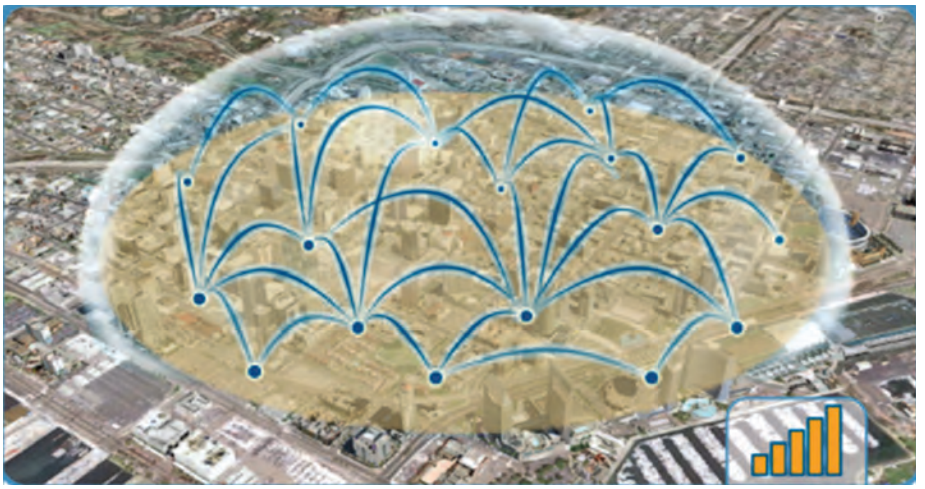


A screen shot of the publish CAS 9-line function. *(Image by author.)*

The XSUAS FMV screen shot. *(Photo by author.)*

Strike Suite (APASS), KILSWITCH's near identical counterpart which is used by other Services, seamlessly networked with no additional effort required, demonstrating interoperability in a Joint environment. Further, HMLA-269 conducted live fire CAS aboard MCB Camp Lejeune in the G-10 Impact Area wherein the participants aimed to explore DI implications within a section of AH-1Ws. One pilot published the textual and visual depiction of the 9-line to the entire flight and flight shared situational awareness through published points of interest via KILSWITCH marker. Additionally, from a safety perspective, leveraging network-enabled KILSWITCH improved safety by maximizing crew resource management and mitigating risks associated with loss of visual contact, lost communications, and inadvertent Instrument Meteorological Conditions.

Building further on previous successes, in April 2015, HMLA-269 worked with 2d Marine Special Operations Battalion to explore the feasibility of receiving FMV from a small unmanned aerial system (SUAS). In this case, by simply plugging one cable into a MANET radio, the SUAS ground control station FMV was accessible throughout the entire network. The significance of this part of the exercise anchors around the reality that Marine Special Operations Command Marines, and increasingly GCE Marines, employ SUAS to provide higher situational awareness of the surrounding area and to plot known enemy positions in real time. This experiment proved that various players within a MANET can have shared situational awareness, facilitating the nomination of more targets in an objective area, while enabling standoff for all players by sharing color video with precise target location. This all served to meet Deputy Commandant for Aviation's (DCA's) intent of "every platform a sensor" by linking the GCE and ACE together in a common network over a common application.



Graphic depiction of TrellisWare MANET. *(Photo by Mobile Ad Hoc Network (TrellisWare presentation).)*

Finally, HMLA-269 and MAG-29 quantified the time savings associated with digital 9-line transmission and the range of the MANET radio with one Marine on deck and an AH-1W overhead. Three CAS 9-lines were timed using the traditional voice radio method, followed by three using digital transmission. Digital transmissions reduce voice communications requirements, thus reducing likelihood of transcription error (receiving, recording, or entering incorrect data into the weapons system) during CAS 9-lines. Timing for this part of the exercise began with the CAS game-plan and ended at the completion of read-backs, the most time-critical portion of the CAS execution template. Based on these scenarios, *the kill chain was reduced by 33 percent to 50 percent from 9-line passed, to received and read-back, which, if in an actual combat situation, would have greatly expedited the ACE's ability to support the GCE.* Specifically, the implication here is CAS fires on target two minutes earlier than traditional means; two minutes of troops in contact where lives are in danger; two minutes less of rounds fired upon friendlies. COTS technology can save lives by using speed of information as a weapon. Combining KILSWITCH Grid Reference Graphic overlays, FMV from other sensors, and friendly positions on a COTS tablet, using COTS DI technology, skid aircraft can, today, significantly decrease the kill chain.

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Implications Going Forward

As the Marine Corps considers the best DI solutions to transition to programs of record, this series of proof-of-concept exercises repeatedly reinforced the benefits of COTS technology. Reflecting on these experiences, it is clear that successful implementation of DI should include the benefits of both ANW-2 (typically thought of as a Mesh Network technology) and COTS technologies like MANET. ANW-2 technology has been acquired and formally tested through the deliberate Marine Corps Systems Command process. In contrast, MANET technology is COTS, as are the tablets that aviators strap to their knee and those that GCE Marines connect to their flak jackets in order to leverage KILSWITCH. The good thing is that emerging DI technologies are not necessarily mutually exclusive. Within the next year, for example, it is very likely that Harris, one of the major suppliers of tactical radios for the Marine Corps, will offer

a radio that has both the ANW-2 and TrellisWare waveforms incorporated.

In keeping with our senior leadership's guidance to constantly seek ways to innovate and adapt, in April 2015, the *DOD Implementation Directive on Better Buying Power 3.0* was released. The Directive encourages the use of COTS technology. As highlighted throughout this article, MANET is one kind of COTS technology that works. The same applies for KILSWITCH, government-off-the-shelf technology that operates on COTS tablet devices. Our Corps' willingness and aggressiveness to pursue these types of technologies will directly influence whether DCA's intent of "every platform a connector" is met.

Conclusion

DI-capable attack rotary-wing platforms, created using COTS technology, provide speed of information as a weapon by facilitating precise aviation ordnance delivery in support of our GCE faster than ever before. KILSWITCH, already used by the ACE and GCE, has paved the way for the integration of rotary-wing DI. ANW-2 is secure and capable; however, it is not the only waveform option for our Corps. TrellisWare MANET radios have demonstrated that other COTS solutions can independently connect non-Link platforms into a DI battlespace, accelerating CAS tempo, thereby significantly increasing the MAGTF's warfighting potential. Due to the traditionally lengthy acquisition process, now is the time to take advantage of COTS technology such as MANET.

MANET if one kind of COTS technology that works.

Notes

1. Headquarters Marine Corps, *Marine Corps Warfighting Publication 3-23.1 (MCWP 3-23.1), Close Air Support*, (Washington, DC: July 1998), 1-6.

2. Joint Staff, *Joint Publication 3-09.3, Joint Close Air Support (JCAS)*, (Washington, DC: July 2009).

3. Headquarters Marine Corps, *2015 Aviation Plan (AvPlan),* (Washington, DC: November 2014).

4. Department of the Navy, *Navy Tactics, Techniques, and Procedures 3-22.3 (NTTP 3-22.3), AH-1 Combat Aircraft Fundamentals: AH*-1, (Washington, DC: March 2013).

5. *MCWP 3-23.1*, 4–52.