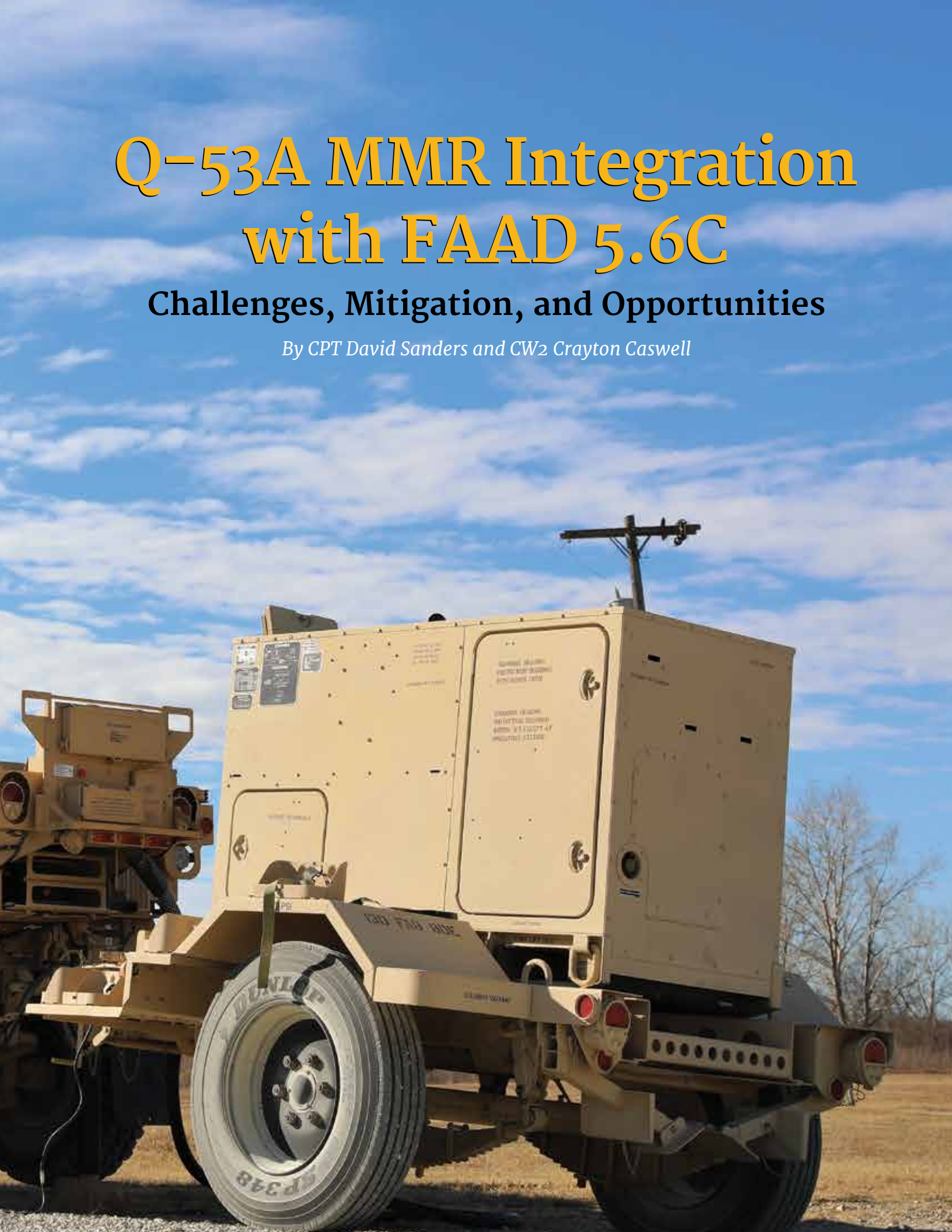
The AN/TPQ-53 RADAR staged for pre-mobilization training at the Regional Training Center in Salina, Kansas.

Q-53A MMR Integration with FAAD 5.6C

Challenges, Mitigation, and Opportunities

By CPT David Sanders and CW2 Crayton Caswell



The Q-53A Multi-Mission RADAR (MMR) is the latest version of the Q-53 Field Artillery RADAR, developed to track not only indirect fire but the growing threat of Unmanned Aerial Systems (UAS) as well. With this new system, both indirect fire and UAS can be tracked with a single platform, an obvious logistical advantage. The MMR was deployed to the Central Command (CENTCOM) Area of Responsibility (AOR) to begin operations and refine its capabilities before the system was approved for broad adoption.

Air Defense Artillery (ADA) RADARS, not Field Artillery, typically fill the role of maintaining the Air Defense picture, including UAS detection and mitigation. The new MMR – only found in the CENTCOM AOR, and coming from a different branch – was not integrated into this broader Air Defense picture. The MMR operated locally, in a separate world, delivering UAS warnings through voice communications. The operators performed well and showed good judgment, but the MMR and the ADA RADAR needed to integrate into a common virtual air picture.

The 130th Field Artillery Brigade (FAB), currently the CENTCOM Force Field Artillery Headquarters (FFAHQ), has developed the methodology for integrating these two air pictures into one. Shortly after they arrived in the CENTCOM AOR, personnel in the 130th FAB began to experiment with organic equipment to find a connection that would bring the MMR air picture to the Air Defense picture and the Brigade network, to be shared across the theater. Brigade personnel solved their connection problems by using an organic Forward Area Air Defense Command and Control (FAAD C2) to operate as a command and control device to each MMR system. The link of the FAAD C2 allowed the Brigade's Air Defense Airspace Management Cell/Brigade Aviation Element (ADAM/BAE) to bring in the UAS picture from the MMR. That process, the how, and the why is the topic of this article.

This article describes the successful integration of the MMR with the FAAD C2 system architecture, including troubleshooting issues and the realized benefit for the counter-UAS effort. Perspectives on the way forward and conclusions from the 130th staff are included. The purpose of this information is to:

- Assist future FFAHQ and adjacent units with maximizing the effects of their software and established operating systems, including the highest "bang-for-your-buck" in mitigating UAS and clarifying the air picture.
- Inform and provide options for Brigade and Senior Theater Command Leadership, with a useful depth and solutions that address the operational gaps identified by the classified Operational Needs Support Memorandum (ONS Memo 21-36132) generated by the 130th FA BDE.
- Synchronize the Brigade ADAM Cell's actions in the mission command and protection Warfighting Functions for the record to future FFAHQ units supporting Operation Spartan Shield and Operation Inherent Resolve.
- Enable the effective use of powerful new counter-UAS (C-UAS) tools and information that enable base defenses across the region.

A local physical connection between the Q-53A MMR and the FAAD C2 is simplicity itself: the RADAR connects by plugging in at a local switch in the Q-53A's cab, which feeds data directly to the



Left: CPT David Sanders and CW2 Richard Machina of the 130th Field Artillery Brigade, Task Force Spartan, conduct ADAM/BAE operations in the Brigade Combined Operations Information Center. Center: CPT David Sanders and CW2 Anthony Calanni of the 130th Field Artillery Brigade, Task Force Spartan, outside an AN/TPQ-53 command and control shelter. Right: CPT David Sanders and CW2 Anthony Calanni of the 130th Field Artillery Brigade, Task Force Spartan, look into the regulations outside an AN/TPQ-53 command and control shelter.

FAAD C2 through the Electric Remote Computer Terminal. Because of this, local connectivity is not an issue.

The problem was getting the FAAD to connect and communicate with the ADAM Cell's Air Defense System Integrator via Link 16. The ADAM Cell's current air picture is theater-wide and shared with Task Force Spartan, the Battlefield Coordination Detachment, and the CENTCOM ADA Brigade. This nearly real-time data originates from the Communications Reporting Center in theatre, and 130th FAB focused on bringing the MMR data into that picture, sending it to higher echelons and other interested units across a broad battlespace.

The network architecture operates on two separate network systems in the CENTCOM AOR: the South West Asia strategic network and the traditional tactical network. Both must be connected to bring together dispersed nodes, ensure network resiliency, and give Commanders the most up-to-date common operating picture. The process of making the connection between a known tactical system, like the ASDI or FAAD, required over 25 days of work before the link was established.

Part of the problem in establishing this link was policy. Integration of the FAAD to the broader system architecture required firewall exceptions, as the network administrators and managers were unfamiliar with FAAD integration and the MMR data. Gateways between the different protocols existed, but needed approvals to work. At first, Firewall Exception Requests (FER) did not work because there was no central coordination point based on network node and routing. Eventually, the establishment of a central coordination point for FER's proved critical to the long-term success of integrating systems for theater-wide use. Clearing these obstacles took much time and required significant coordination between 130th FAB personnel and theater system administrators.

With these obstacles cleared, the 130th personnel found that the Q53A MMR using software version 7.90.02 could integrate with this air picture provided the FAAD C2 used the recent 5.6c software version. This connection allowed the 130th FAB Target Acquisition Platoon to contribute actionable C-UAS data across the network, using the MMR in an integrated role for the first time.

As a result, the ASDI integration of the FAAD C2 and MMR created an enhanced multi-domain operating picture for the USCENTCOM Commander to use in the C-UAS effort. This enhancement came with no degradation of the Q53's indirect fire mission. C-UAS tracking and Counter-Target Acquisition (CTA) could take place simultaneously.

The FAAD C2's three-dimensional display of the RADAR search area provides better situational awareness to ground force Commanders and superior vision for base defense. The FAAD C2 filters the data source to provide low-altitude air tracks. This allows ground force Commanders to see UAS activity tracked by the MMR, on the same screen as the tracks provided by ADA RADAR. The FAAD C2 system connection with the Q-53 MMRs allows for ground Commanders to assess UAS threats probing the Area of Operations for surveillance, reconnaissance, or attack against the United States or Coalition Forces.

Many questions remain about the strengths and weaknesses of the integrated system, and evaluation procedures are strongly recommended. From a digital perspective, the network architecture and infrastructure in theater now process more data in a new way, and while the system gives every indication of resiliency, these changes add complexity to critical data, and analysis is needed.

Local force protection cells and Brigade personnel on the ground have been synchronized so all sensor nodes are interoperable with the protection plans and rehearsed into Tactics, Techniques and Procedures/Standard Operating Procedure development for base defense design. This allows the ground force Commander to prioritize key critical assets in the immediate Area of Operations for protection and provide passive air defense through early warning detection of the C-UAS system. The MMR might benefit from site locations that emphasize connectivity between C2 nodes and host servers, with the future movement of sensors bearing system integrity in mind.

From a technical perspective, ADAM Cells do not have assigned sensors or shooters; however, the major equipment items are C2 related. The ADAM Cell C2 Systems Integrator (140A Military Occupational Specialty) took on the responsibility to provide linkage between the MMR and FAAD

system, and in coordination with the Brigade S6, identified the appropriate data pathways, gateway protocols, information exchange points, and routing over various networks. All are now documented for follow-on Brigade ADAM Cells, held for reference at a higher classification.

Future FFAHQ ADAM Cells will need to update to the 5.6c FAAD software before arrival in theater to ensure they will retain this capability. Future FFAHQ RADAR units will need to coordinate with Project Management RADAR, appropriate vendors, and Field Service Representatives for the newest version of Q53A software, currently 7.90.02. These updated software versions and their capabilities for sensor and C2 assets should be identified and incorporated into DOTMLPF-P at the schoolhouse, which would negate the need for Necessary Equipment Training/Fielding and improve future unit readiness. Leaders should also share current version software during unit site surveys for future unit rotations, providing incoming units with ample time to execute the updates.

There is a known gap in communications that this integration helps to fill, bringing a command integration system into play when more sensors and more shooters are placed in a Joint coalition kill chain. The concept is "any sensor to the right shooter," where a sensor detects, transmits target information to a C2 node through flexible routing, and an engagement decision is routed to the best shooter available. The ideal is complete modularity of sensors and shooters through a C2 node that encompasses all response options.

Until this kill chain is achieved Machine to Machine (M2M), the implied task for Brigade and below remains bridging their known capability gaps and to piece together Joint kill chains which span multiple services and all levels of war.

The current network infrastructure, divided by specialties and sections, would likely benefit from a shift toward a Joint mission network with cloud technology and well-schemed C2 routing. In order to achieve a decisive advantage over near-peer threats in the region, a sustainable and resilient network like this would be a great improvement. A Joint kill chain can be achieved so long as the network architecture and infrastructure are sustainable and resilient, with a varied set of authorities and permissions, along with appropriate messaging formats and authorities. This would enhance an M2M kill chain through Hardware in the Loop and Man on the Loop; as long as gateway protocols and translation services exist. The establishment of these networks is under discussion among the senior levels of Department of Defense leadership on the Joint All-Domain Command and Control (JADC2) Cross-Functional Teams along with known capability gaps for the Joint Concept of Command and Control. In a multi-domain fight with unconventional threats like

The 130th Field Artillery Brigade ADAM Cell assigned to Task Force Spartan (Left to Right) CPT David Sanders, CW2 Richard Machina, CW2 Anthony Calanni, SPC Bryce Manker, SPC Christopher Dame, SSG Chase Weber, and SSG Johnathan Bustamante.

C-UAS certain to continue, these changes are critical to saving lives and winning the fight.

The 130th FAB proved the concept of the FAAD C2/MMR integration with the assistance of Task Force Spartan and Combined Air Operations Center. Several conclusions are evident:

- FAAD C2/MMR integrated system provides useful strategic and tactical value for Commanders, at both the low-level and theater air picture
- FAAD C2/MMR integrated system provides a greater footprint to detect, track, and locate C-UAS
- FAAD C2/MMR provides detection of low-level air tracks at a higher confidence level
- Local Q53 Air Picture deemed usable by the 32nd Army Air & Missile Defense Command (AAMDC)
- Forward-deployed MMRs provide local force protection, contributing to the C-UAS mission, while simultaneously providing effective FFAHQ CTA coverage.
- Future units will require the same routing methods, IP schemes, and data pathways identified by the 130th FAB

Several members of the 130th FAB's Target Acquisition Platoon gave relevant insights on UAS activity in austere environments, and the 130th FAB ADAM Cell collected data and recommendations for evolving C-UAS efforts and base defense throughout the AOR. Because of the sensitive nature of the topic, a classified version of this article is published with these specifics.

The Q53A MMR's ability to detect, track, identify, and locate UAS targets in testing is well-proven. Thanks to these efforts by the 130th FAB, those capabilities provide Air Component Command, Combined Joint Task Force and Task Force Tiger with greater awareness, better ground unit support, and another step forward in the process of creating the ideal targeting system.

CPT David Sanders enlisted in the South Carolina Army National Guard (SCARNG) in 2012. He was commissioned as an officer in 2016 from Furman University ROTC, branched ADA. Sanders has worked as a high school teacher and football coach for 3 years before being hired as an Air Defense Subject Matter Analyst to the Joint Staff J6 Joint Assessment Division, formerly known as the Joint Deployable Analysis Team. He has mobilized twice as an Active Army Air Defender and once as a Defense Contractor. Upon commissioning, Sanders served on battalion staff as an assistant tactical operations officer. From 2017-2018, he mobilized in support of Operation Noble Eagle as an Air Defense Artillery Fires Control Officer serving in the Joint Air Defense Operations Center as a part of the National Capital Region Integrated Air Defense System mission. Sanders then served as a platoon leader and as a Current Operations staff member of the 263rd AAMDC G3 staff. He served on the CJTF Integrated Air and Missile Defense with USARCENT supporting Exercise Eager Lion in 2019. Also in 2019, he deployed with the JDAT as a field analyst and data collector for the OCONUS Counter Unmanned Aerial Systems Assessment. Sanders has supported various exercises as a defense contractor spanning from CUAS Demonstrations, JADC2 events, and Exercise Bold Quest. As a "green suiter" Sanders has been activated with the SCARNG supporting various disaster relief, humanitarian, and civil support operations. Currently, he is deployed as an attached ADA Officer to the 130th Field Artillery Brigade, KSARNG, where he serves as the Air Defense and Airspace Management (ADAM) Air-Ground Integration Cell OIC.

CW2 Crayton Caswell joined in 2004 as a 13F, Fire Support Specialist. He gained combat experience while deployed to Iraq on convoy security. Since becoming a warrant officer in 2018, he has served as an assistant targeting officer and counter- fire officer. He currently serves as the Combined Joint Task Force - Operation Inherent Resolve sensor manager and liaison for the Headquarters and Headquarters Battery, 130th Field Artillery Brigade. On the civilian side, Chief Caswell is an entrepreneur and lives in Kansas City.

Members of the Target Acquisition Platoon, 130th Field Artillery Brigade, Task Force Spartan, conduct maintenance on the AN/TPQ-53 RADAR in the CENTCOM area of operation.

Members of the Target Acquisition Platoon, 130th Field Artillery Brigade, Task Force Spartan, discuss maintenance on the AN/TPQ-53 RADAR in the CENTCOM area of operation.