



The Army Lessons
Learned Centre

DISPATCHES

LESSONS LEARNED FOR SOLDIERS

The Artillery Corps In Afghanistan



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Disclosure Statement

Dispatches are targeted at disseminating information and increasing the knowledge of the soldiers and leaders across the Canadian Army and the Canadian Forces. The discussion is a snapshot of relatively current issues or procedures in a specific operating environment. *Dispatch* articles may not reflect doctrine, but articulate evolving ideas based on the recent operational experiences of our deployed forces. The information contained within this *Dispatch* is UNCLASSIFIED but sensitive in nature and distribution should be controlled.

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DISPATCHES—DIRECTOR OF ARTILLERY'S INTRODUCTION

This edition of *Dispatches* is the first specifically covering the Artillery experience in Afghanistan. The Royal Regiment of Canadian Artillery (RCA) has been in theatre since 2005 with an increasing array of capabilities beyond the guns themselves. Those readers that have been deployed to Afghanistan may have come to know the many ways in which the Gunners are contributing to the fight. As an institution, the Army has relearned the value of indirect fire and the many capabilities relating to target acquisition and coordination vital to the modern battlefield in a joint and combined environment. It would be fair to say the Army, as seen through the eyes of the many soldiers who have worked with or called upon the guns, now look at the Gunners in a new light, appreciating the ways in which Gunners have helped to keep them protected and to get them out of trouble when needed.

Professionally, the last five years have been an evolutionary experience for the Artillery. Like the rest of the Army, the RCA went into Afghanistan with our Canadian background of peace-keeping, plus a few long-distant memories of training for conventional Germany-style warfighting. Neither of these were a perfect start state for the counter-insurgency campaign we found in Kandahar province. Five years later, however, the RCA is in much better shape. Gunners have received some great new kit—not the least of which is the new M777 howitzer—allowing us to provide the kind of precise and effective fires those counting upon our support have needed. The experience—though mentally and physically tough—has been intellectually and doctrinally thought-provoking. The aim of this issue of *Dispatches* is to share some of those insights and thoughts among a wider audience in order to create discussion and gain more from this experience. It is not new doctrine, nor is it authorized Tactics, Techniques and Procedures, but it is the considered advice of Gunners who have been there for other Gunners and those we work with in Afghanistan. It should provide insight, spark discussion, and ideally result in more articles. It is above all shared observations to improve understanding and make for a more effective fight. Please use it as such.

I would like to thank the many contributors and authors of the following articles from the Artillery School, the Regiments, and the staff. In the words and pictures included here, hopefully we have been able to give you a greater insight into the issues and concerns of your Artillery soldiers that have proudly served with distinction in Afghanistan.

Ubique!

Colonel
B.W.G. McPherson
Director of Artillery

DISPATCHES—DIRECTOR OF ARMY LESSONS LEARNED CENTRE'S FOREWORD

Major-General David Fraser, while Commander LFDTS and 1 Cdn Div HQ, recognized the important requirement to capture the main lessons identified and lessons learned from the Army's experience participating in full spectrum operations in Afghanistan *before* our collective memory fades or we get too focussed on any future major operations.

As such, he directed that the next series of *Dispatches* be dedicated to capturing the major lessons from our Kandahar operations by Corps and Capability. As a direct result of their comprehensive lessons collection protocol in theatre, I am happy to report that the Artillery Corps was first off the mark with the production of this edition, which covers all aspects of the Artillery's force employment in Operation ATHENA, 2005–2010, from the provision of howitzer and SUAV support to joint fires to sustainment.

Ab Uno Disces Omnes

Lieutenant-Colonel
J.M. Barr
Director of the Army Lessons Learned Centre

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GUN LINE OPERATIONS

This is an insight into the various aspects of preparing and conducting the many different activities necessary for operating the M777 gun line in the Afghanistan contemporary operating environment (COE). It is primarily an overview of themes, rather than gun drill or Tactics, Techniques and Procedures (TTP), and ranges in scope from preparation of individual personnel to troop/battery command posts (CPs), and their interaction with the Fire Support Coordination Centre (FSCC).



M777s firing at sunset

Predeployment Training. Training a gun battery for deployment must be a creative process given some of the training limitations on the Road to High Readiness (RTHR). The wide breadth of skill sets unique to the counter-insurgency (COIN) environment makes time the most limiting factor in predeployment training; however, access to the most recent equipment can also create training challenges. For example, when gun-towing, most drivers have experience with the MLVW towing the C3 Gun, but few have experience with the operational AHSVS vehicle. When the AHSVS is towing the M777, the combination is twice as long as the C3/MLVW, and many of the accidents involving gun tractors and guns in theatre are a result of driver error while towing. Unfortunately, there will be shortages of all equipment and vehicles required in training, and this is where the creativity of troop leadership can overcome these obstacles. Another example is the Digital Gun Management System (DGMS) and Detachment Commander Display Terminal (DCDT). DGMS and DCDT are new equipments that enhance the capability of the M777 by speeding up the laying process. During predeployment training batteries had little exposure to this equipment, and when either system failed in theatre soldiers were unsure how to troubleshoot problems properly. Through trial and error, inventive solutions were developed and evolved to resolve issues and improve these systems. Leaders must be ready to listen and consider every idea. In the case of DGMS and DCDT, the suggestion that a wireless system be considered to reduce system failure due to damaged cables running across the gun platforms was passed on to M777 project staff. Technology will fail

regardless of how well trained the individuals are on the specific instruments. A troop commander (TC) needs to realize this, train for it, and be ready to revert back to supplementary technology or manual methods at any time.

Forward Operating Base (FOB) Life. Adjusting to the unfamiliar and harsh environment of Afghanistan is challenging for even the most seasoned soldier. Gun line operations can be characterised by sustained periods living in relative degrees of austerity on a FOB with occasional deeper incursions outside the wire. In the FOB, the guns provide an umbrella of indirect fire cover for a range of battle group (BG) operations within the local area. There is a higher degree of protection in the FOB and soldiers can get psychologically distant from the enemy. The perceived sense of security within the FOB can lead to a tendency for soldiers not to don personal protective equipment during fire missions and to move around without weapons. If not anticipated and acted on early, complacency can follow, leading to the need to remedy a hazardous and sometimes difficult situation. In remote positions, this is less of an issue as soldiers realize they are in the presence of insurgents (INS) and force protection (FP) looms large. Leadership must remain vigilant in dispelling the attitude towards complacency. While it is important to train for the worst case austere scenario, troops must also be prepared for extended periods out of direct contact with the enemy—a challenge to gunners and their leaders. Units that will collocate in an FOB with the guns should be identified early in the RTHR in order to foster strong relationships between soldiers and their counterpart chains of command for mutual support in overcoming these challenges.

Physical Fitness. Fitness needs to be developed well in advance of deployment. The body needs to be able to operate in temperatures exceeding 45°C in the Afghan environment. Intensive cardio and endurance training that focuses on improvement rather than sustainment is highly recommended. Cardio and endurance physical training (PT) should continue while deployed; however, troop PT is nearly impossible while deployed, and leaders need to encourage their soldiers to carry out daily individual PT. Dismounted patrols are not on flat dirt roads but in arduous terrain, and three kilometres (km) on the map often equates to 6 or 7 km manoeuvring on the ground. Movement often involves crawling over 2 to 3 metre (m) high walls, moving into and climbing out of similar depth wadi banks, and squeezing through small holes in compound walls. These factors and level of difficulty should be replicated in training whenever possible.

Soldiers' diet can suffer from an abundant and sometimes un-nutritious supply of food, which can easily become an enemy to physical fitness. This problem, combined with daily heat, an irregular PT regime, and the effects of absence on leave, can detract from an individual's effectiveness, and needs to be watched carefully. Completely removing junk food from troop rations is not the answer, but moderation and self-determination to remain fit and able should be engendered in every soldier.

Continuation Training. Gunners need to be subject matter experts (SME) in all aspects of gunnery, but with the rapid implementation of new technology there is always a training delta and on job training is required. Units are often left to their own means to conduct continuation training and any opportunities to conduct courses or informal training should be seized. Leaders must instil a learning culture and build an expectation of continuous troop training and self-improvement. Leadership must refresh old skills and teach new skills while deployed. Not only will this benefit the soldier upon return to Canada (CA), but it will also benefit troop effectiveness and help combat complacency.

Multinational Fire Support Operations. Realistically exercising multinational tactical field operations in predeployment training is typically not possible, and interoperability issues will need to be addressed in theatre via joint continuation training. The earlier this training can occur the better. The FSCC is often aware of most manoeuvre operations well in advance and the CP will know whether foreign forces will be involved. Multinational planning, war gaming and mission rehearsals should be conducted whenever possible. British (UK) and CA fire discipline is very similar, but there are some differences with the United States (US). For example, in the US call for fire (CFF), the observer requests fire support and the FSCC/Fire Direction Center decides the nature and quantity of ammunition required. Knowledge of fire discipline, voice procedure, relevant NATO Standardization Agreement procedures, and even common slang of other armies should be developed as early as possible.

CP Battle Tracking. A Gun Troop CP must remain vigilant during operations and know its established priorities. Battle tracking is extremely important, and assists TCs to anticipate engagements and adjust their centre of arc in accordance with the battle. This is important when there are multiple troops in contact throughout the area of operations (AO) and only one or two gun troops to support them.

Clearance of Fires. The application of Rules of Engagement (ROE) and authorization to fire can be confusing, frustrating, and sometimes time consuming. A thorough understanding of extant ROE will save precious time during extreme situations. If ROE are well understood by all in the battery then authorization to fire will likely be granted sooner. Requesting authorization is a troop responsibility, and should be one of the first things the CP starts to template. Training the signaller in acquiring critical data and immediately sending it to the FSCC will save time. The method of requesting authorization to engage is different to current regimental TTP and should be introduced to the troop during predeployment training. Every command post exercise needs to incorporate requests for authorization, and the TC must know why authorization might not be given in order to brief their supported arms commanders. Briefing other national forces on the required data for authorization is also important. As an example, the US does not have to send a target description with fire orders, while this is required by CA before granting authorization.

Fire Missions. The conduct of operational fire missions is very different from training since there is no safety officer. The CP must thus check to ensure that every round fired is safe. If a round does not look safe, the CP must inform the Forward Observation Officer (FOO) and FSCC. There may also be significant quantities of ammunition in each FOB, and natures will vary from what is common during training. The various procedures associated with these different types needs to be understood and practiced. Collecting meteorological (met) data is a troop responsibility, and the CP needs to ensure that updated met is acquired and entered into the indirect fire control computer software before an operation can be supported. It is still necessary to refresh gunnery skills, and live technical missions should be rehearsed. If possible, allocate a number of rounds each month to keep up skills on the least-used munitions and schedule dry missions whenever convenient. Any possible type of fire mission may present itself during operations and therefore a wide variety of missions should be exercised throughout the deployment.

THE FORWARD OBSERVATION OFFICER'S PARTY

FOO party operations in Afghanistan can best be described as a challenging experience, often frustrating, and ultimately rewarding. It is the type of job that many soldiers and officers join the CF to do, and it can be the pinnacle of an individual's military experience. It is not the work of one, but of many, and very much a team effort. The following are insights into how the FOO party operates in this rugged environment, and recommendations to consider during training and planning for the future operating environment (FOE).



FOO G31 preparing to deploy from Sperwhan Ghar

Party Composition. The FOO party operates as a six-person Light Armoured Vehicle (LAV) based team consisting of a FOO/forward air controller (FAC), an observation post detachment commander (OPDC)/FAC sergeant (sgt), two FOO technician (tech)/LAV gunners, and two driver/signallers. When possible, having a second FAC in the party is valuable; this allows the sgt to remain in the LAV and more effectively execute controls without distraction. The FOO usually remains in the turret as the vehicle commander, manoeuvring and fighting the LAV while maintaining communications (comms) with the supported company or squadron. The FOO also deconflicts fire missions and controls close combat attack (CCA) when both fast air and aviation are on station. However, the FOO essentially remains detached from any one task in order to orchestrate all aspects of the fight, allowing the party to maximize the effectiveness of the fires at their disposal. The sgt uses the Rover video downlink in the back of the LAV to control fast air while monitoring the unmanned aerial vehicle (UAV) feed. The LAV gunner controls fire missions and the 25 millimetre (mm) cannon. Signallers track company/squadron and battery nets, and assist the sgt with FAC as required. Maintaining this setup through predeployment training builds team cohesion and forms tailored FOO party standard operating procedures (SOPs) that leverage the individual strengths of the team, critical to success on operations.

Flexibility. A six-person party allows one half of the party to dismount while maintaining the ability to manoeuvre. The LAV acts as an anchor for both air control and fire missions, as comms are generally better from the LAV. A similar approach can also be employed while dismounted. The party can split, leaving the OPDC with a tech/signaller to find a position of overwatch and act as the anchor. The FOO moves with the officer commanding (OC) the company/squadron, using a tech/signaller as a fire team partner. The party can also be split again (into thirds): the FOO with the OC; OPDC, tech and a signaller as the anchor; and the remaining tech and signaller positioned where required. Splitting in thirds using the anchor is achievable for shorter missions, but is not however sustainable for longer operations.

Individual Load Carriage. The average load for a typical 48 hour dismounted operation was about 75 pounds per person (longer operations received helicopter resupply). The FOO/FOO tech carries the Imbiter radio and spare batteries monitoring the company/squadron net, and the signaller carries the PRC 117 radio and monitors the battery. The PRC 117 is needed to guarantee battery comms anywhere; however, the Imbiter is often sufficient. Daypacks are usually sufficient; avoid older rucksacks due to the increase in weight that could balloon in excess of 90 pounds. The new rucksack is quite comfortable, but designed for use without ballistic plates did not position well on the body with them. Some kit can be redistributed if grouped with snipers, such as the KITE sight, spotter scope, etc., if required. Each operation usually calls for mission specific kit, and a party can often find itself carrying extra C4 explosive charges for the engineers or even 60 mm mortar bombs.



Dismounted FOO party ready for operations

Predeployment Training. The FOO party's relationship with their OC must be established early. If possible, the FOO should remain with the sub-unit they trained with, but this is not always possible. Understanding the OC's thought process, attitude toward using indirect fire, and approach to fighting the company/squadron can make the difference in a firefight, reducing the time to rounds on target. Training with platoon/troop commanders and soldiers builds mutual trust. The FOO party should be familiar faces to the supported sub-unit, and must have earned the soldiers' trust through shared hardship and an ability to put rounds on target. Simulation can only go so far. Practicing combat team attacks in a desert environment provide experience in movement over desert scrub and sand, obscuration due to dust and the dust created by fall of shot (FOS), and the difficulties of establishing observation in a flat pool table like environment. Firing M777 under these conditions is ideal as the fall of shot is extremely consistent and accurate, and training with the guns to be used in theatre allows infantry and armoured leadership to gain confidence. Time should also be dedicated to training the FOO party one level up in order to reduce the immediate impact of casualties and inevitable absences on leave. Airmobile missions are also common, and training should prepare the FOO party accordingly; this type of training also exercises the anchor OP principle well.



A FOO under rocket propelled grenade (RPG) and mortar fire confirms coalition locations prior to giving the executive order to fire

Balancing Mounted and Dismounted Training. An appropriate balance must be struck between mounted and dismounted training. LAV Drills with a six-person FOO party allow the FOO to focus on basic crew drills, particularly the interaction between crew commander and gunner. Running a fire plan while engaging with 25 mm cannon and manoeuvring the LAV for observation is challenging, and developing SOPs are critical to team building. LAV gunners must also be able to remedy stoppages on there own,

as crew commanders are occupied manoeuvring and fighting the LAV, tracking the company/squadron net, sending SITREPs, and observing FOS. These skills are important to mounted operations, but can not come at the expense of dismounted operations. Once deployed, almost every operation has a dismounted phase, typically employing the three-person dismounted FOO party. Learning to effectively distribute mission specific kit throughout the party and manoeuvre in training will pay dividends in challenging terrain. Predeployment training is also the time to hone proficiency in shooting with vector binoculars while under contact. A large proportion of CFFs will be supported arm call for fire (SACFF). The FOO must train their supported arm in SACFF whenever possible, and conduct gunfighter training and section tactics as a team to develop strong individual soldier skills.

The Adversary. INS typically manoeuvre in roughly section-sized groups and coordinate their attacks. They sometimes reinforce their positions but often employ shoot and scoot tactics, typically creating 15-minute firefights followed by 10-minute lulls. When coalition forces are in static positions, INS often attempt to cloverleaf in order to isolate individuals. When moving in column, INS will picket, keeping parallel with our forces and employing linear ambushes. They habitually use the same wadis for infiltration and exfiltration, and often chose the same grape huts or compounds as firing positions. Typically, INS have proven to be poor marksmen, and once our initial artillery rounds impact they stop shooting and try to break contact. Proximity was the ammunition of choice as it satisfied collateral damage (CD) concerns and effectively neutralized the INS. When no CD concerns are present airburst artillery is preferred, as the effects on both friendly and INS morale are significant.

Mounted Operations. Mounted manoeuvre is often conducted by following the Badger armoured engineer vehicle, while other vehicles isolate the objective. The FOO/FOO tech dismount with the signaller to move with the OC or find an OP with the company snipers. The FOO vehicle acts as an anchor, OPDC stays with the LAV as FAC, and comms relay is required. During periods of reduced personnel due to leave, the FOO stays in the LAV as FOO/FAC anchor and the FOO tech and signaller dismount. At last light, all vehicles typically enter a hasty defensive position, with standoff dependent of the terrain (often 300 m plus). The FOO is positioned at the most dangerous arc identified that still facilitates the best observation and comms within the leaguer. All LAV maintain turret manning throughout the night. The drill of conducting a radio check before settling into an OP is critical. LAV engagements often use the 25 mm cannon, and the LAV gunner must be proficient at ranges from 50 m to 750 m. The FOO/crew commander will not usually have time to assist with stoppages and misfires, highlighting the importance of LAV and weapon maintenance by the crew. Danger Close (DC) artillery engagements less than 150 m are not uncommon; however, they average between 200 m and 300 m when mounted. The M777 is very accurate and large corrections on a reasonable opening grid are uncommon.

Dismounted Operations. The FOO and signaller typically remain with the OC and occupy an OP at a company strongpoint, or accompany the OC on patrol if no fixed strongpoint is established. A FOO tech and signaller often accompany a platoon, or establish a dominant OP with snipers or an infantry section. Visibility is typically limited to approximately 150 m in the agricultural areas of the Zhari and Panjwayi Districts. This reduces the likelihood of the FOO identifying targets and the speed of engagement. Also, if a member of the FOO party differs in appearance from the rest of the patrol they may be targeted by INS RPG or small arms fire. All members of the FOO party should expect to fire their personal weapon on multiple occasions, and most, if not all, artillery targets will be DC. The initial firefight will often need to be won in order to acquire and engage the target.

Complex terrain makes for slow but deliberate movement, and continuous water consumption is critical to avoid heat stress injuries; depending on the season, consuming in excess of eight litres per day is not uncommon. Route selection will help evade an improvised explosive device (IED) or ambush, and the easy road must be avoided whenever possible. Retracing routes and setting patterns should always be avoided whenever possible, and manoeuvre through the more difficult grape fields and wadis, or at night, is preferred. FOO parties should train and maintain endurance throughout the tour; however, even the most robust can expect to feel worn down by the end of a tour.

Supported Arms Call for Fire. Most indirect fire missions conducted in Afghanistan are in close proximity to friendly forces, usually at distances between 200 and 400 m, and well within DC distance of 600 m. Supported arms conducted many indirect fire missions, relaying target information through an observer or the FSCC. Proficiency in using SACFF must be gained throughout predeployment training by both the BG and those engaged in Security Force Capacity Building (SFCB) with the Afghan National Security Forces (ANSF), including live fire missions. All sub-unit leadership, section commanders and above, and other key individuals, should be competent in using SACFF and in the essentials of tactical and technical employment of indirect fire. BG staff should also be well versed on the commander's directives regarding the use of fire support. The more exposure that leadership at all levels has to the application of indirect fire, the better their understanding of SACFF drills and procedures. This training provides insight into the terminal effects of lethal and non-lethal indirect fires in close proximity to own troops. Ideally, DC SACFF training would allow the other combat arms to see the fall of 155 mm shot inside 300 m prior to deployment, however this is currently restricted. Another challenge for SACFF is consistent blue force situational awareness (SA), particularly with ANSF locations. Without solid blue force SA authorization for fire is significantly slowed.



G31 lays down a smoke screen under RPG fire, while controlling an OH 58 Kiowa Warrior, to cover a wadi where an infantry company is patrolling

Artillery Effects. The M777 is extremely accurate, and a FOO is often able to open with fire for effect (FFE) with proximity fuze if the target is more than 300 m from troops. Inside 300 m, the FOO will push a high explosive precision delivery (HEPD) round out beyond 300 m, looking for likely enemy exfiltration routes at this stage, until FOS is

confirmed. Once FOS is confirmed, the FOO will bring it back in to the target (similar to DC procedures), freezing the enemy while walking in the rounds. By first firing FFE, the aim is to contain INS movement and subsequently eliminate them. Using proximity inside 150 m is highly effective. A FOO must be aware of the gun target line (GTL) in reference to friendly troops and use M777 firing tables to fine tune impact points. This process will hem in the INS, who could subsequently also be dealt with by close air support (CAS) and CCA if they survive the initial artillery. Smoke is also extremely effective. Base ejecting (BE) smoke tends to hang in the air and provides excellent screens that last much longer than anticipated. Smoke can also be used to determine the intent of suspicious males of fighting age and to deter spotters from watching friendly forces. White phosphorus (WP) smoke fired airburst is impressive and produces a quick smoke screen, or can be an excellent show of force. For CD reasons authorization for WP can be difficult, so be prepared for a quick switch to BE smoke rounds.



The effects of smoke

SURVEILLANCE AND TARGET ACQUISITION *(The Eye in the Sky... and Other Places)*

The deployment of surveillance and target acquisition (STA) artillery assets to Afghanistan has brought new and emerging technologies into the Army. These various new capabilities enhance FP, early warning, decision support, and intelligence support, providing tools which have accelerated modernization and proved indispensable on operations. Current STA artillery consists of three principal capabilities: UAV, weapon locating radar (WLR), and acoustic weapon location, formerly known as sound ranging.

STA Troop. The STA troop can surge lightweight counter-mortar radar (LCMR) detachments forward on BG operations to enhance FP of a BG leaguer and strongpoints. LCMR deployed in this manner can detect multiple points of origin (POO) mortar attacks against coalition forces and give an extremely accurate grid, facilitating rapid engagement by artillery and CAS. This POO indication also allows coalition forces to push forward patrols to locate base plates and INS. LCMR is capable of providing up to 10 second warning of imminent mortar attack, allowing friendly forces to take cover. The targeted location, provided by a hostile artillery locating (HALO) acoustic detection system increases the ability to cue intelligence, surveillance and reconnaissance (ISR) assets and assign direct fire weapons to engage targets based on the grid reference generated from the HALO CP. However, STA troop must be sufficiently manned to permit forward deployment of sensors to include LCMR

and HALO sensor posts (SP). Cross-training of gun line personnel to assist STA troop can provide the flexibility required to surge these capabilities.

Mini UAV. The role of the Mini UAV is to provide direct ISR support to a sub-unit commander, delivering real time information about activities in the vicinity. Mini UAV provides early warning by displaying activities along specific routes and axes of advance, and near critical areas and locations of interest. Mini UAV can also facilitate FP through observation of exposed areas, surveillance of key areas prior to operations, and overwatch of likely INS ambush sites. Understanding the capabilities and limitations of these systems is critical to their effective employment.

The Mini UAV consists of three main components: ground control station (GCS) (laptop with specialized software), launch mechanism (rail, bungee or manual), and aerial vehicle (AV). The AV has a propulsion system, a mechanism for providing lift, a guidance system, and at least one sensor. Weather is the most significant limitation for employment of a Mini UAV, affecting the AV and most cameras. Fog, rain, snow and dust are all major factors which can prevent optimum employment. Maintaining an unimpeded line of sight between the AV and the GCS is also a significant factor. In order to ensure Mini UAV employment is understood, early integration into predeployment training is recommended. When conducting operations with the Mini UAV, the detachment (det) should be involved in initial planning to provide necessary input into the planning process. In particular, unique requirements of the system must be anticipated, e.g. locations from which the det can be effectively employed, resulting FP considerations, and development of a reliable and consistent sustainment plan.

Small UAV (SUAV). The role of the SUAV is to operate at BG or brigade (bde) level, providing direct ISR support to the commander and staff. SUAV provides a commander with real time point surveillance and reconnaissance capability that is flexible and rapidly responsive. It can be employed in direct support to elements on the ground or for intelligence assessments of areas without a ground presence. Using various feeds (hard-wired, wireless and Rover networks), SUAV can provide deployed sub-units an aerial view of their AO.

Similar to the Mini UAV, SUAV has several components: C2 element, GCS, launcher, recovery apparatus, maintenance system, and at least one AV. The TC is responsible for reconnaissance and deployment, the troop sergeant-major for administration and manning, and a master-bombardier (mbdr) or sgt typically commands the GCS. The GCS consists of a HQ element with flight control computers, comms equipment, and deployed troops with a ground data terminal antenna which talks to the AV. All flight operations are the responsibility of the GCS det commanders, and the launch and recovery element is responsible for all aspects of AV preparation and launch. Depending on the system, the recovery element may also be responsible for preparation of the retrieval apparatus and for the AV upon completion of its flight.

Based on circumstances and given sufficient planning time, SUAV troop can have up to three AV airborne simultaneously conducting operations. In order to facilitate this level of support, there are a number of requirements. Through the STA Coordination Centre (STACC), the SUAV should be integrated early into the planning process in order to allow reconnaissance, deployment, AV preparation, and airspace coordination. Coordination must also include a detailed comms plan between Airspace Coordination Centre (ASCC), supported HQ, GCS, launch and recovery elements, imagery analysts in the All Source Intelligence Centre (ASIC), and any directly supported forward deployed troops.

Weapon Locating Radar (WLR). WLR is a sensor that emits a beam reflecting off a projectile in flight. After several detections of this projectile, an accurate ballistic trajectory can be calculated towards the point of impact and extrapolated back to POO. Depending on the system, the radar may also be able to calculate a response for subsequent counter-battery fire. Future systems may have the ability to conduct simultaneous observation for aircraft and projectiles. WLR are typically classified as short or medium range radar. Both of these systems are deployed with troops and coordinated by the STACC.



LCMR troop

LCMR troop. The role of the LCMR is to provide short range mortar locating capability to sub-unit commanders. Typically a four person det is commanded by a mbdr. The radar requires between 8 and 23 successful reflections from a projectile in order to properly calculate the trajectory. LCMR is designed to look for mortar rounds, but can also be successful against artillery and rockets. The best terrain to locate mortar rounds accurately is flat, providing the fewest obstacles between radar and horizon, as LCMR detects target rounds once they clear the horizon. It takes 20 minutes to assemble and align the radar, and 10 minutes for disassembly. LCMR provides a commander with 360 degree observation against mortar attack, giving up to 40 seconds early warning. A highly accurate POO will be provided by the radar to a computer loaded with the latest imagery and mapping, but point of impact is less reliable.

Due to its shape and size LCMR is conspicuous, and INS are more likely to attack if it is clearly visible. In order for this capability to function effectively, early integration with the ground commander's plan is necessary. CA currently has no medium range WLR; however, other coalition partners can field equipment such as the AN/TPQ-36 Firefinder in this class. This system is mounted on a vehicle providing protection, mobility, and the ability to deploy rapidly. Compared to LCMR, Firefinder has greater range, increased accuracy, ability to handle multiple targets simultaneously,

and flexibility of employment. The role of medium range radar is to provide the formation commander with a wide area surveillance capability for mortar, artillery, and rocket fire. It can provide the commander all-weather, around the clock, and reliable wide area ground surveillance for indirect fire. Future radars will likely have the ability to produce wide area surveillance of the airspace to contribute to the recognized air picture (RAP).



LCMR deployed in overwatch

Acoustic Weapon Locator (AWL). The role of the sound ranging troop is to detect enemy indirect fire. This is facilitated through deployment of unmanned SP with sensitive microphones able to detect an acoustic event caused by gun or mortar fire and other types of explosions. Up to eight SP will be surveyed and connected to a CP. The CP plots bearings to the reported events; these are correlated to other reports and a likely location for the event calculated. The troop consists of a captain (capt), warrant officer (WO), CP section, SP section, and maintenance det. The TC is responsible for reconnaissance and deployment. The CP section commander is responsible for operation of the CP. The SP section commander deploys individual SP and manages the survey plan. SP are best deployed throughout an area of interest, providing maximum area coverage and better geometry. Terrain, local obstacles, weather and environmental conditions will degrade the range and accuracy of the equipment. The HALO sound ranging system can provide continuous all-weather capability that can detect mortar, artillery, rockets, mine, IED, demolition, tank or light vehicle activities over a wide area. Dependent on conditions, accurate identification is between 5 and 50 m. HALO requires several hours to set up or tear down; however, once established, the ability

to cover an expansive area with one system is highly beneficial. This passive weapon locating system can function either as a weapon locator, or as a passive cueing device for WLR or intelligence collection.

STA Coordination Centre. Doctrinally, the STACC is established at formation HQ, however any level HQ can employ these systems. The role of the STACC is to coordinate surveillance systems. At the BG, STA coordination is the responsibility of the FSCC, and the STACC is subordinate to the FSCC and is part of the STA battery. The STACC is typically manned by a capt, wo, sgt and 3 to 5 junior non-commissioned officers in order to maintain operations around the clock. The STACC is highly technical in nature, provides invaluable information, and is becoming an increasingly robust capability. It is also responsible for coordinating frequency deconfliction, terrain management, and allocation of tasks, and facilitates reporting. To accomplish this, the STACC must have comms with the other coordination centres (CCs) as well as deployed troops. It provides an integrated target location program balancing early warning/FP and collection of information for the intelligence plan. The STACC must be connected to the FSCC in order to complete the sensor-to-shooter linkage, provide timely information, contribute to the CD estimate, and permit the FSCC to lay guns onto and engage targets using appropriate sensors. In the event that more personnel are required at the BG FSCC to coordinate STA, or in the absence of a higher operational HQ, the necessary personnel are often drawn from STA troop.

Many pooled airborne ISR platforms are available to the BG in Afghanistan, including Scaneagle, Heron, Predator and Reaper UAVs. The STACC can effectively plan, coordinate and synchronize all these battle winning enablers with numerous other complex surveillance systems, and is responsible for integrating STA into the targeting process. Coordinating UAVs ensures the BG has sufficient SA and protection, and it is not uncommon to have 2 to 4 layers of different assets on station at any one time during a major operation.

The STACC assists with planning and management of intelligence, surveillance, target acquisition and reconnaissance (ISTAR) resources through the FSCC, and ensures BG priority information requirements are integrated into higher level collection plans through the formation FSCC and ASIC. If required, the STACC can act as the ISTAR CC. Recent rotations in Afghanistan have demonstrated that having a fully integrated STACC inside the BG or bde HQ has significantly increased the value of the information that STA sensors provide either CA or coalition forces.

THE BATTERY FIRE SUPPORT COORDINATION CENTRE

The asymmetric battlespace in Afghanistan is extremely complex and reinforces the importance of the FSCC and STACC within the BG. Technological advances in sensors and precision fires available to a BG result in contemporary operations which differ from traditional conventional warfare operations. The FSCC and STACC are vital to the effective coordination and synchronization of all assets and the engagement of targets, and while the traditional functions of the FSCC have remained intact, the disposition of a battery in this battlespace demands flexibility, requiring the battery FSCC to perform command functions normally held at the regimental level or above.

Function. The battery FSCC performs the same functions as the bde FSCC but does so at BG level, continuing to evolve to meet the growing demands of joint fires integration. The FSCC is responsible for coordinating all aspects of fire support

including CAS requests. It deconflicts resources and airspace through the ASCC, and establishes priorities for BG fires. The main difference in responsibilities between the levels of FSCC is the command relationship and positioning authority. In a theatre where the only manoeuvre unit supported is the BG, the battery FSCC executes positioning authority over its troops. It acts as battery CP, and in the absence of a higher HQ must be able to control and coordinate the fire of multiple units on multiple targets simultaneously and prioritize multiple CFF at any level from multiple observers. The FSCC officer (FSCCO) must be prepared to function as both the operations officer and regimental command post officer.

Battery Command and Control. The battery commander (BC) acts as chief of fires for the BG and is responsible to the BG for the control of all fire support, as well as ensuring airspace availability. The FSCCO participates in BG planning, and presents options for the employment of all fire assets, including STA. This demands a high level of competency and versatility from all staff operating in the FSCC. Selection of the right staff is paramount to FSCC success in integrating and synchronizing fires at the BG level.

Clearance of Fires. One of the most critical and challenging activities undertaken by the FSCC is clearance of fires, to ensure timely and effective application of fire and prevent unintended consequences. CD resulting from fire can undo a campaign and hinder our ability to maintain a principled position against an enemy who will capitalize upon these situations. INS tactics combined with the complex terrain can make clearance of fires a daunting task for staff and commanders as they fight to attain the SA required for target engagement using either artillery or air support. The application of ROE and tactical directives assist in the application of force and establishing parameters for indirect fire and air-to-ground munitions. However, the need to mitigate CD within an asymmetric environment where battle lines are blurred also calls for the inclusion of specific tactical information beyond that transmitted within the standard CFF format. These essential elements within the clearance of fires process include location of friendly forces and civilians in the battlespace, proximity of risk objects (such as buildings and civilian infrastructure), and positive identification (PID) of the target. These safeguards ensure that the target engagement authority (TEA) adequately understands and assess the risks associated with each individual engagement before authority is granted. Although this makes indirect fire missions a much more deliberate process, it provides the TEA (whether it is the FOO or the BG comd) with critical information required to assess risks and mitigate CD. The FSCC is pivotal in sourcing the essential technical and tactical elements required to ensure thorough clearance of fires and achieve required authorization. Proactively sending this tactical information in every CFF expedites this process. Detailed battle tracking conducted by the FOO in conjunction with air and ISR enablers, coordinated by the STACC and Tactical Air Control Party (TACP), also facilitates passage of essential tactical information required for clearance of fires.

Tactical Air Control Party. The relationship of the TACP to the FSCC should be symbiotic, not competitive. The FSCC establishes priorities, initiates air requests and allocates resources. The TACP actions the requests and secures the CAS resources necessary. The TACP provides air advice and should be prepared to engage targets with Type 2¹ procedures when required. It is of paramount importance that the TACP work through the FSCC to ensure fire support control measures (FSCM) are respected and the right type of fire is employed at the right time. Equally important is that the TACP

1. Partial visual contact with aircraft or target by the FAC at time of weapons release.

works with the ASCC to establish the necessary procedural means to provide CAS with the least impact upon the BG's airspace. Air-to-ground fires can often be a simpler and more precise method of engagement, but they are limited by availability, weather and time. Artillery support is often as precise as and faster than air support which may or may not be available.

Airspace. Flexible and responsive management of BG airspace is maintained by the bde ASCC using planned procedural measures coordinated with all airspace users. If BG operations require more detailed coordination and responsiveness, an air defence cell (ADC) would be established by the ASCC for that particular operation. In the absence of an ADC to deconflict airspace, the FSCC coordinates with the higher FSCC or ASCC directly for clearance of fires, entry of air and ISR assets into the BG AO, and safe passage of routine rotary wing flights. These circumstances underscore the requirement for all artillery leadership to provide advice across the full spectrum of artillery capabilities.

UAV Engagement. The FSCC can engage targets using armed UAV in certain specific circumstances. When a FOO is in contact but cannot observe or engage the enemy, FSCC staff must have a qualified OP tech and ideally a FAC to engage with a UAV. This type of engagement is sometimes necessary but must be controlled by the FSCC, not the TACP or STACC, to ensure SA of the observer on the ground. The FSCC will attempt to minimize CD and deconflict local fires of all friendly forces in the target area or participating in the operation. The ground commander and FOO must be advised of the field of view of air and UAVs, since this occasionally may not permit engagement. FSCM must also be considered and deconflicted to avoid friendly fire.

JOINT FIRES IN TASK FORCE AFGHANISTAN

Joint fires is the process for employing coordinated fire effects from two or more services (most commonly, air and land based fires). Employment of joint fires in Afghanistan is dictated entirely by International Security Assistance Force (ISAF) HQ in Kabul. Bringing to bear large volumes of artillery fire or dropping hundreds of cluster bombs is not a viable option in the COE. INS do not present themselves as targets suitable for this weight of fire, and perhaps more importantly the potential CD does nothing to help endear coalition forces to the Government of Afghanistan and to the local populace, whom we are there to support. Today's joint fires must be timely and accurate, for targets are fleeting and the enemy is far wiler than one might expect. Fortunately, ISAF brings a multitude of air and ground based enablers to the table categorized as air/land integration (ALI), i.e. the integration of land and air forces to produce a synchronized effect on the ground.

Joint Fires and ALI. Kandahar is a complex AO, with any number of manned and unmanned aircraft, aviation platforms and other weapons systems operating in a shared battlespace. Each must be planned, resourced, managed and deconflicted in real time by the FSCC, TACP, ASCC, ISTAR CC and the Electronic Warfare Coordination Centre (EWCC) at every level from BG to ISAF HQ. Each of these CC work together and with the operations staff to ensure synchronization.



CCA in support of operations: aviation is used extensively to cover coalition force movement. The OH-58 Kiowa Warrior is flexible, well-armed, and excellent for identifying firing points

Ground Based Combined Fires. In Kandahar province, CA has 155 mm M777 howitzers with a range of dumb and smart munitions. Each M777 gun det is also equipped with two 81 mm mortars. The UK in neighbouring Helmand province has 105mm L118 Light Guns, 81 mm mortars, and Guided Multiple Launch Rocket System (GMLRS). GMLRS gives GPS accuracy to a 200 pound HE warhead capable of striking targets out to 70 km, putting some areas of Western Kandahar within range of this system. It is also not unusual for UK guns or mortars to be tasked in support of other coalition partners or vice-versa, especially those that are part of the reserve BG. Similarly, it is also not unusual for M777 or other assets to be requested to support Special Operations Forces (SOF) operations.

Fast Air. NATO can support ground operations in Afghanistan with CAS including US F-15, F-18, A-10, B-1 Bomber, and AC-130H Gunship; UK Harrier and Tornado; and French Mirage aircraft. These aircraft are tasked in the daily air tasking order and must be submitted 72 hours in advance of need. It helps to know the capabilities of the various air platforms when requesting an effect, as some are more capable than others. Upon arrival in the AO, fast air reports in to the TACP and is allocated to FOO/FACs as requested.

Tactical Aviation. Joint Task Force Afghanistan (JTF-A) in Kandahar also has armed CH-146 Griffon and CH-147 Chinook heavy-lift helicopters in theatre, servicing the Regional Command South (RC[S]) AO. While the primary role for Griffons is to escort Chinooks, they are capable of many other roles including convoy escort, reconnaissance, and show of force missions, the latter because INS are wary of helicopters. For urgent requests, they can also conduct CCA support employed as another manoeuvre arm and given combat tasks such as cut-off or firebase support. CCA is normally carried out by dedicated attack helicopters such as the AH-64 Apache, although the small and nimble OH-58 Kiowa Warrior frequently performed this task for CA. Tactical aviation operating in the CA AO must check-in with the BG FSCC or the controlling FOO/FAC for a threat brief and flight plan verification.

ISTAR. The ISTAR CC at each level coordinates the ISTAR plan on behalf of the commander. Through this plan, ISR assets such as snipers, FOO/FAC, Coyote LAV, UAV with various ISR pods, and more persistent STA systems such as HALO and LCMR, are tasked to collect information throughout the battlespace or provide PID of the enemy

for decisive action using ground forces or joint fires. Airborne ISR with Rover video downlink is essential for successful engagement of the enemy during the dynamic or deliberate targeting process. Airborne ISR checks in with the TACP and is allocated to FOO/FACs as required.

Electronic Warfare. JTF-A HQ has an electronic support (ES) capability deployed in theatre, and until recently collection of intelligence via ES was the only form of EW CA conducted in theatre. However coalition assets in theatre can conduct various forms of electronic attack (EA). As most EA systems are airborne it is the FSCC's responsibility to plan and deconflict EA with the EWCC and other stakeholders. The TACP and FOO/FAC are best suited to talk to the aircraft and provide real-time comms and attack deconfliction. The FSCC, ASCC, TACP, operations staff, EW troop and BG signals officer must be familiar with EA procedures, and how they can be utilized to maximum effect.

Targeting. Strategic, operational and tactical targeting are part of every campaign. In Afghanistan, targeting may be kinetic or non-kinetic, lethal or non-lethal, against medium value interest (MVI) or high value interest (HVI) targets. While development and prosecution of MVI/HVI targets is predominantly by SOF, circumstances do exist where they may be prosecuted by conventional forces as a deliberate or dynamic target. As most targets on the Joint Prioritized Effects List (JPEL) are MVI/HVI, targeting staff in the FSCC must be prepared to prosecute these targets as required. More traditional targeting can also be conducted against known INS C2 nodes, bunkers and infrastructure. Prosecuting these targets requires strong intelligence, and the targets officer must work with J2 to develop the target pack for nomination to the JPEL at ISAF HQ. All deliberate or planned targets must be vetted and approved in order to ensure their prosecution is proportionate and in line with the greater aims of the mission. Identification of actionable targets, allocation of ISAR assets to develop a target package, and the decision to nominate a target to the JPEL for strike is accomplished using the targeting cycle. When prosecuting a target of any type, whether hastily in self defence, dynamically because a MVI/HVI has been presented and the opportunity to strike is fleeting, or deliberately as part of a planned operation, four factors must always be considered: ROE, PID, pattern of life, and the CD estimate (CDE). In self defence or other scenarios where there is an imminent threat, an assessment is conducted to ensure the application of force is in line with the law of armed conflict. The TEA weighs the risk and authorizes engagement based on the information presented by all relevant agencies. Whenever targets are engaged, it is the responsibility of the FSCC to verify that the target is not on the prohibited or restricted target lists, which are updated weekly by ISAF HQ.

Battle Damage Assessment (BDA). Whenever a target is engaged, thorough BDA is conducted immediately post-strike. This must be more than an assessment of the degree of destruction inflicted, for INS are quick to issue false propaganda to the media or via the internet. In Afghanistan, NATO forces must be first with the truth to maintain the population's trust. The BDA plan must be tightly synchronized with the information operations plan, which includes informing the populace of the strike, the need for the strike, the number of enemy or civilians killed and/or wounded, and the findings of any exploitation. This can be done by the public affairs officer through local media, or by tactical psychological operations teams or civil-military cooperation dets talking to villagers. Not doing so often allows INS to seize the initiative to quickly turn the local population against ISAF and the Government of Afghanistan.



Combat team commander and FOO observe a potential ambush and INS positions

THE ASCC AND AIRSPACE

The ASCC is responsible for coordinating airspace within its AO on behalf of the ground commander. Although the ASCC does not control assets capable of delivering kinetic effects, as do the FSCC or TACP, it is responsible to ensure that these capabilities, e.g. guns firing in conjunction with air support, are coordinated, including coordination with other units and nations deployed in the vicinity. An ASCC has been deployed in Afghanistan since the beginning of the mission, first in Kabul with CA HQ, and then in Kandahar with RC(S) HQ, various BG rotations, and, most recently, with JTF-A HQ.

Multiple Information Systems. With each deployment there has been increased use of varied information systems by coalition partners, with different levels of security classification. This is a complicating factor for all HQ elements, but the ASCC is particularly affected due to the nature of the task and levels of command involved. The ASCC has used up to four different systems with different security classifications, and air gaps are required for transferring a significant amount of information from one system to the next. For example, the TACP requests an airspace control measure (ACM) be established on TACNET mIRC. This request is then plotted on the air defence systems integrator (ADSI)/Falconview terminal to ensure accuracy, then retyped and requested to RC(S) ASCC via CENTRIX mIRC. To assist in bridging this interoperability gap, ASCC established a number of templates for commonly requested ACM and other information transfers. This reduces the potential for mistakes made by retyping the same request multiple times. Digital interoperability remains a pervading issue in NATO that could be addressed by establishing one common system that all nations could use for operational C2.

High Mobility Artillery Rocket System (HIMARS) Airspace Coordination.

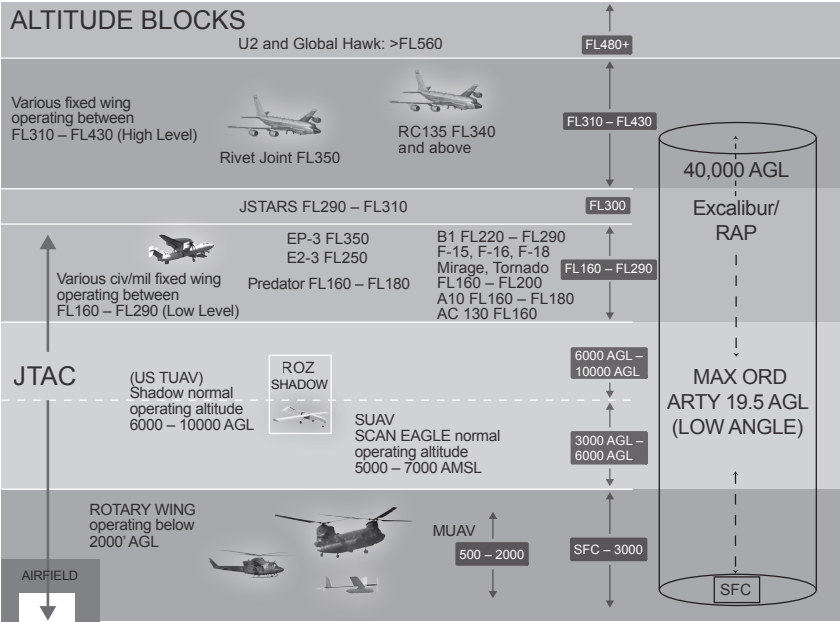
Employment of the long-range US HIMARS system required extensive airspace coordination. HIMARS has been used almost exclusively by SOF. However, in some instances HIMARS has been employed to support the main effort in high intensity operations, e.g. when inclement weather limited aircraft use or operations were conducted out of reach of the guns. From an airspace coordination standpoint, HIMARS use posed interesting challenges. Location of the launch platform is a critical planning consideration as it impacts all routine airspace operations in the vicinity. For example, when HIMARS deployed to Kandahar Airfield (KAF) for operations the runway would be closed until the fire mission was complete. In addition to the impact on the airfield, large blocks of airspace would be allocated in order to deconflict fire missions. The goalpost technique would establish a circular restricted operations zone (ROZ) at both the launch and target locations, with a corridor connecting the two within which the rocket would travel. These goalposts would interfere with ground operations due to the lack of airspace available for CAS. However, due to the altitude HIMARS reaches, approx 23,000 m above mean sea level (AMSL), there was little impact on aviation support.

C2 in Multinational Operations. ISAF, as with any coalition of many nations, has various national ROEs, SOPs, capabilities and experiences that influence airspace management. Many of the challenges providing air support and coordination to multinational operations stem from the lack of common voice comms and digitized equipment. This interoperability gap is commonly bridged through establishing manual SOPs, using multiple comms systems, transmitting unencrypted, and deploying liaison officers. This is a planning factor that must be considered early in the planning process, and unanticipated challenges are often identified during mission rehearsals and sometimes during operations. Challenges can also arise when two or more nations are operating within close proximity to one another, each with different missions and phases to their concurrent operations. These circumstances can prevent the use of one single ROZ, in which one element can clearly be identified as the main effort and act as the overall ROZ controller. The ROZ controller is responsible to hand off aircraft to various FACs on the ground. Well placed, capable liaison officers are crucial to managing the risk posed by these complex command and control relationships. Multinational airspace management SOP are not harmonized, and there is no formal SOP other than the theatre airspace control plan. The lack of formal multinational SOP has the potential to allow national or personal interpretations of airspace management within an AO, which can transition as troops and nations rotate over time. Organizations and individuals must recognize that this complex management function involves many stakeholders, and thus should remain flexible and well coordinated until NATO doctrine has been formally established.

Multiple Airspace Users. Within Afghanistan there is a wide variety of airspace users: fixed wing aircraft (CAS, transport, SIGINT, civilian, and recce), rotary wing (transport, attack, over-watch escort, civilian, and recce), UAV, HIMARS, field artillery of various calibres, civilian organizations such as contracted aviation and de-mining operations, demolition operations involving explosive ordnance disposal and Counter IED, and training ranges for all natures from small arms up to 120 mm tank guns. All these have different, and often conflicting, requirements for airspace, and all have an impact on the airspace within an AO. The control and reporting centre (CRC) manages and monitors the control and coordination of fixed wing aircraft and UAV. Fixed wing aircraft are handed-off from the CRC to a FAC within an established ROZ to conduct kinetic missions. Due to limited low-level coverage throughout most AOs, the same control capability is not always available for aviation, which can result in airspace violations in a ROZ.

It is critical that all users continually check with coordinating agencies² to ensure that they do not violate active ACM and place themselves or the mission at risk.

Civilian Air Traffic. Buildup of forces in Afghanistan has produced a significant increase in the number of civilian aircraft supporting the mission in less hostile areas. As a result, there have been numerous airspace violations and infractions. Contractors often do not have the proper security clearances to use military maps, encrypted comms, or most up-to-date air space management information. This can result in civilian pilots flying blind into a tactical situation on the ground. They often rely on infrastructure on the ground as navigation aids, increasing the risk of an incident with indirect fires and CAS. To mitigate this risk, an initiative to produce a non-classified map of the AO with airspace control points (ACP) on prominent land features as navigation aids is underway. This initiative synchronizes a civilian operations centre and the ASCC, establishing ACP along planned routes and maintaining positive control via non-secure voice comms. Civilian aviation would continue to be tracked via civilian C2 agencies, who would contact the battlespace owner prior to entering military-controlled airspace.



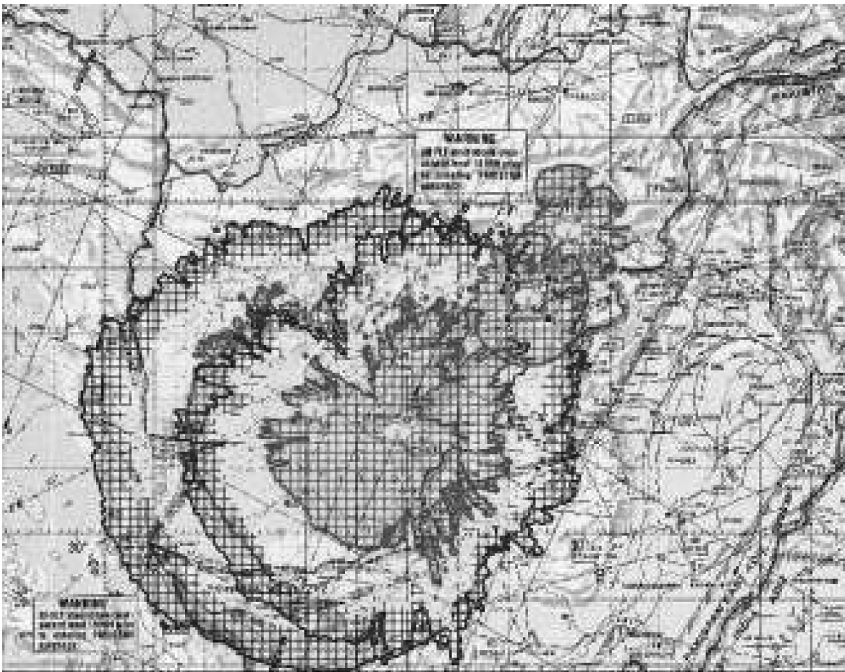
Afghanistan airspace usage by altitude

ANSF Airspace Deconfliction. As the capability, capacity and scope of operations conducted by ANSF expands, so do the challenges of coordinating combat winner enablers and airspace deconfliction. To date, this deconfliction has been conducted by operational liaison and mentoring teams, which report ANSF airspace requirements through ISAF comms systems. As the Afghan National Army (ANA) develops indirect fire capabilities, their ability to coordinate and deconflict fires and airspace should also develop. However this is not likely to occur in the short or medium term.

2. ASCC, CRC, and Regional Air Operations Centre (RAOC/Combined Air Operations Centre (CAOC).

In the meantime, until this challenge is resolved, SFCB elements must continue to remain cognisant of ANA operations within their AO, assist in planning and coordination of operations, and report airspace requirements.

ADSI and Radar Coverage. The ASCC deploys with ADSI which allows them to track most aircraft. Throughout most of the AO, the ASCC can maintain excellent air SA from approximately 1 000 to 30 000 m AMSL. ADSI pushes the radar feed from the CRC to JTF-A ASCC. While it would be preferable to augment the CRC picture with low level sensor inputs produced locally, the CRC feed provides the ASCC with an in depth picture of all aircraft transiting throughout the AO. In many instances this is a better picture than that available at higher HQ. The JTF-A ASCC uses this air picture to provide airspace coordination solutions to RC(S) ASCC in the event of complex challenges to normal ROZ activation procedures. In addition, this allows JTF-A HQ to provide SA and advice to RC(S) HQ. While this procedure was effective within the CA chain of command, it cannot be consistently relied upon where the multinational HQ prevents display of CRC radar feeds. To develop and maintain a comprehensive RAP for the JTF-A ASCC, local air surveillance with Kandahar CA radar capabilities is required. Local air surveillance would also improve the low level picture and increase ASCC effectiveness at all levels of command, reducing the gaps throughout the CA AO, and allowing more effective management of low and slow aircraft types. The graphic below displays radar coverage for all Southern Afghanistan.



Radar picture of Southern Afghanistan available from CA ADSI

ARTILLERY SUSTAINMENT

Sustaining a composite artillery battery in theatre consisting of 2 or 3 dispersed M777 troops, several OPs, and multiple STA dets spread throughout an expansive AO can be a challenge. This challenge is further compounded by the lack of a battery echelon, with only the battery quartermaster stores (BQMS) and a small team, and no integral logistic lift. Successful replenishment depends on four basic practices: comms, coordination, respect for support personnel (they are too often unjustly criticized), and hard work. In Southern Afghanistan, sustainment of all supplies for gun troops deployed outside of KAF was provided by the National Support Element (NSE).

Only building mutual understanding between the battery (specifically the BQMS) and NSE concerning the complexity of the sustainment problem will ensure that supporting assets are employed efficiently and the battery is sustained. BQMS and battery transport personnel should be involved directly with the NSE to solve any problems and ensure that equipment is always serviceable. Once contacts and a relationships built on trust are established, maintenance and replenishment problems can be resolved at the lowest level, ensuring tasks are effectively executed.



A hot day on the M777 gun line

Predeployment Training. The battery, assisted by the BG or HQ battery, will typically be responsible for its own sustainment during RTHR training. This includes maintaining and sustaining the training fleet of vehicles and equipment. Valuable lessons will be learned that will in the long run pay dividends on operations. However, upon deployment, the battery will be far more dependent on the NSE for daily sustainment, and direct liaison is required. The different approach during training and operations occurs because NSE support during training can be limited while they pursue their own training objectives. Leaders must note these differences, plan for them, and leverage the experience to build a deeper mutual understanding of the NSE.

National Support Element. Lack of an artillery echelon is far from ideal, however the NSE is capable of supporting all units deployed outside of KAF. Combat logistic patrols (CLPs) or contracted Afghan convoys regularly negotiate the most dangerous routes in theatre to ensure that ammunition, fuel, rations, mail, and all manner of logistical supplies are provided to a major FOB or platoon house. Resupply to the smallest and often most remote combat outpost can be more problematic, simply because a deliberate operation involving combat forces is usually mounted to resupply such locations. NSE FP elements are often engaged by INS and targeted with IEDs more than any other forces.

Ammunition. Artillery ammunition is controlled by the FSCC and distributed to gun positions based on operational requirements. The FSCC sends ammunition requests to the BG G3 Ammunition and onward to the JTF-A HQ ammunition section. Ammunition is delivered to troops by NSE Transport Company CLP under the supervision of a nominated representative from each gun troop, usually the senior Number 1. In general, ammunition is managed by the battery, determining the basic and maintenance load for each troop, to include natures and quantities required both for the M777 and 81 mm Mortar. The larger FOBs that house three-gun troops have protected ammunition supply points (ASP) to sustain the battery. Once depleted to 75% of authorized stock, the NSE automatically replenishes the ASP. The only time the battery does ammunition planning or gets involved in the process occurs when they are critically short due to high expenditure rates, a new ammunition type is introduced into theatre, or a deliberate operation is planned to take place outside the FOB, with ammunition needing to be dumped or staged forward in another location. Planning is done in conjunction with the BG, JTF-A HQ and NSE to ensure the plan is well coordinated and sound.

Maintenance. Maintenance is provided to each FOB by NSE Maintenance Company teams, and each gun troop has specialized maintenance for the M777. During operations outside of a FOB support teams are reinforced and replenishment is conducted mainly by helicopter, coordinated by the FSCC and JTF-A HQ with the NSE. When more advanced repairs are required, equipment is sent back to KAF either via CLP or helicopter. Due to extensive planning required, replacement or repair of a specialized piece of equipment may take time. Often it is a matter of getting the right technician, of which there are never enough, out to assess the problem, order the necessary parts, and then carry out the repair. Each step could be problematic, especially when the equipment was procured via unforecasted operational requirement (UOR), which may mean that spare parts and qualified technicians do not exist. The best way to avoid problems is to conduct as much preventive maintenance as time allows. New equipment is bound to experience problems as the systems are trialed on operations. It requires patience and due diligence to ensure problems are reported back to the applicable project manager or the life-cycle materiel manager (LCMM) through the appropriate chains so that they can be dealt with promptly on an institutional level and according to the contract. NSE and the supply chain must be kept fully informed in order to ensure they are prepared to receive any additional parts or perhaps welcome a technical assistance visit (TAV) team into theatre to effect upgrades or assess equipment functionality.

Combat Supplies. Replenishment of a combat outpost for standard stores including rations, water, fuel and other essentials is coordinated by the BG G4 and supported by NSE Maintenance Company via CLP. This system requires at least 72 hours combat supplies stored in location in case of emergency operations. Mail and amenities are sent as quickly as possible by CLP, however this is a lower priority than operational stores. Requests for special or non-standard items, including canteen items or other morale boosters, are coordinated daily by the BQMS staff, who submit requests to the BG G4 team. Defective equipment in need of replacement is sent to the BQMS via CLP on the return trip to KAF.

Personnel Management. Personnel management begins within the battery, months before the official stand up on the RTHR. The baseline manning requirement and the replacement pool must be identified early. Replacements will be required during the RTHR as a result of casualties, compassionate reasons, exceptional career courses, or unexpected postings that cannot be avoided. Experience has demonstrated that a 10% replacement pool will be used before the battery even deploys, and the initial replacement pool should be about 20%. The pool should have at least one, ideally two, qualified replacements for each key position, and more for gun det members, especially drivers. Replacement soldiers must be qualified on the vehicles and equipment used in theatre, and should attend the same individual battle task standard and theatre mission specific training as the rest of the battery. If a trained and qualified replacement is not identified, it can take months to get a replacement qualified on a vehicle/equipment that only exists in theatre. In the interim, the battery will go without, which is further exacerbated during periods when personnel are absent on leave.

Movement of Personnel. Due to the IED threat, aviation is always the preferred mode of transport throughout the AO. However, some of the more remote locations cannot be supported by aviation either because the anti-air threat is too high or there are no serviceable or secure helicopter landing sites. STA troop is often the most challenging to support because LCMR dets are often located in more remote areas in order to provide the best radar coverage. Rotating these personnel or servicing equipment often means scheduling a CLP well in advance due to the infrequency of regular CLPs to these locations. It is important to ensure that leave for all leadership and other key positions is well synchronized in order to ensure that there is always sufficient coverage of leaders on the ground.

ARTILLERY SECURITY FORCE CAPACITY BUILDING

Gunners employed in a SFCB role can expect a challenging yet immensely rewarding experience. CA has assisted in developing various units in the ANSF, and has begun to mentor ANA artillery. This nascent capability will continue to expand and should increase in importance as the ANA develops. A major hurdle to this concept, however, is that very few personnel in an ANA battery are literate or can do math, a severely limiting factor for immediate growth of the capability. To date, the coordination of all enablers and fires remains through ISAF coalition partners. While the ANA has a FOO capability which has been trained and mentored through live firing, further improvements in ANA indirect fire capability will need to institute formal qualifications and track personal progress in achieving higher skill levels.

Afghan Guns and Equipment. Mentoring an ANA battery has its unique set of challenges as they are equipped with Soviet era D-30 122 mm guns. Many types of Russian 122 mm ammunition are available. At least ten different combinations of HE rounds are in the ANA arsenal, all of which have various fuse/weight/charge combinations and only basic tabular firing tables translated into Dari and English. Russian manuals, calculating devices and panoramic sights used by the ANA are based on a 6000 mil, rather than 6400 mil, circle. While this can be overcome relatively easily, the presence of the two systems requires a clear understanding of whether the direction for corrections sent by the FOO is based on Russian or NATO circles, and particular attention must be paid during check bearing drills. Meteorology corrections, though initially provided by mentors from ISAF resources, are taken by ANA personnel using handheld devices and automatically computed using the Afghan Field Artillery Computer (A-FAC). The double-check concept is now well understood

by ANA artillery leaders for orientation, laying, manual calculations and ammunition, but benefits from the triple-check by mentors. Initially, very few ANA fire direction controllers (FDCs) were proficient using topographical maps and thus determining eight figure grid references was difficult, but this is no longer the case. Recent mentors have commented that ANA FDCs were on par with new Canadian Force members in acquiring these skills. The ANA battery usually does not possess their own imagery or maps, and must share with their supporting coalition partners.

ANA batteries are in the ANSF chain of command and their guns do not technically require any ISAF clearance for fire. An ANA BC however understands the need for airspace clearance and fire support coordination, and will work with mentors/advisors before live firing. It should be stressed that such adherence to ISAF clearance procedures is promoted through timely approval. For this reason, an ANA battery would typically co-locate with a coalition battery.

ANA Battery Logistics. As with most ANSF units, sustainment is a challenge. Culturally, the Afghan sense of time differs from ours, and this must be considered in all coalition planning. The battery CSS system functions with prompting from mentors and planning beyond 24 hours is problematic. Initially, when ammunition was resupplied the type was often discovered when the box was opened. The assumption that ammunition was all the same with the exception of calibre was overcome in the battery, but required continuing vigilance. Particular care is still required during pickup of ammunition at the depot, where other ANA elements do not necessarily have the same level of understanding of artillery ammunition as do ANA gunners.

Relationships and Culture. Leading by example and professionalism is respected by the ANA, and its importance cannot be understated. Personal presence, dress and deportment, and weapon control go a long way in building trust. Mentors should take pains never to make promises unless they can be delivered, otherwise credibility will be damaged, possibly irreparably. Once a positive relationship is established, the ANA were eager to learn, and will emulate the mannerisms of those they respect. They can however do things their own way and are in their own chain of command. Mentors/advisors should be adept at influencing in order to synchronize ANA artillery activities with coalition forces. In short, within an Afghan context SFCB relies heavily on interpersonal skills and mutual trust. These factors make careful selection of mentors that much more important in ensuring success of SFCB missions.

Despite beginning with little more than an assemblage of various equipments and personnel seconded into and out of artillery duties, the ANA battery has developed into a force capable of successful indirect fire operations, such as DC missions supporting ANSF or coalition forces in Panjwayi District. CA Gunners played a crucial role in this continuing transformation of ANA Gunners and, if called upon again, should rely upon their solid individual and collective training and experience.

FIELDING NEW EQUIPMENT AND CAPABILITY ON OPERATIONS

Since its initial involvement in Afghanistan the RCA have fielded much new equipment and capabilities, and many lessons have been identified. Over this period, the RCA have developed from essentially a 105 mm towed organization firing last-generation ammunition to a 155 mm digitized force using precision ammunition, supported with complementary STA capabilities including UAV, counter-mortar radars and sound ranging technologies. FOO parties have been equipped with state of the art

capabilities, FAC standards synchronized with the US Joint Terminal Attack Controller, and the ASCC has received a capable Bison vehicle variant.

The following observations provide context and insight into some of the challenges of rapidly fielding new capabilities and systems on operations in a time of conflict. They are points to be aware of, rather than an exhaustive list of principles, and are meant to facilitate the evolution of lessons identified on operations to lessons learned by the Army and CF as an institution.

Expectation Management. The support and resources invested in the Afghanistan campaign since moving to Kandahar has been unprecedented since perhaps the Second World War. Expectations have now mistakenly been established that dictate that only the best equipment is to be delivered in the shortest timeframe possible. The surge in support and rapid fielding of new capabilities has strained sustainment and institutionalization of these capabilities. The new generation of more tech savvy network-enabled soldiers has been exposed to this well supported Afghan COE, so when the situation is less than ideal there is the potential for disillusionment. The onus on leadership is to explain how and why systems function. The following four points are commonly misunderstood:

- **UOR.** The U in UOR is for *Unforecasted* not for *Urgent*. This differs from other nations, and helps to explain why procurement staffs do not drop current priorities because theatre has submitted a UOR. There is considerable confusion in the definition of a UOR, e.g. what it is not, and what support is expected.
- **Life-cycle Management.** For existing capabilities it is important to understand the fielding, support and training plans; these explain the training, delivery, and maintenance parameters for equipment. This is a knowledge management issue, as the information is available but users do not know how to access it, creating frustration and unnecessary staff work.
- **Initial Subject Matter Expertise.** When a new capability is deployed on operations, the initial users become the SME and have an obligation to educate others. The knowledge obtained must be captured and injected into the capability development process in order to develop the appropriate capability across the institution.
- **Leadership Support.** Integrating a new capability or system into operations hinges on key leadership support. Leaders need to thoroughly understand the capability and then employ it as intended. Once the value of the capability is understood and it has been proven, obtaining command endorsed support for rapidly rectifying deficiencies will follow. This was clearly demonstrated in solving initial M777 challenges, contrasted by a new capability like the Land Command Support System which struggled through its implementation within the RCA.
- **Personnel Management.** Training operators and maintenance personnel on a new capability is typically part of the initial contract with a civilian company. Those trained will play a critical role in evolving doctrine and TTP, and developing CF training for the capability. Before making this investment, units must select soldiers and leadership who will remain in post for a reasonable length of time, otherwise this can result in the continuous training of new personnel, additional contracted courses, and a high personnel turnover. Those involved in developing new capability must also understand that institutionalization is not always a streamlined process, particularly if it involves new or changing trades, specialties and/or career paths.

The Procurement Process. Acquiring new capabilities is a complex and developed system that supports the Army and CF's long term planning in support of the Government of Canada. It is subject to many regulations, processes and pressures which are often external to DND. These factors have traditionally slowed the procurement of new capabilities; however, the requirement for rapid innovation and adaptability in COIN operations has gone a long way to streamlining these systems. Assistant Deputy Minister (Materiel) (ADM [MAT]) and Directorate of Land Requirements (DLR) have deployed a technical liaison officer (Tech LO) to assist in identifying, tracking and reporting on equipment related issues, evolving technologies and new capabilities in theatre. The following observations have assisted in developing a culture of learning from operational experience as it relates to new capabilities:

- **Reports.** Traditionally, information exchange between operational units and DLR has not been timely, and technical staffs have become aware of issues late in a capability's development. Most soldiers have a tendency to make things work and not report faults or deficiencies. Initiative is to be supported; however it must be followed up. Passage of this information is critical, as a clear trail of technical defect reports will go a long way to convince decision-makers that efforts are required to address issues. There are many competing priorities both in theatre and in existing programs and projects. Equipment related issues can be addressed through a deliberately designed tech net which facilitates discussion and resolution of equipment issues.
- **Equipment Returns.** Turn in damaged and unserviceable items immediately; do not delay, even if spares are not available. New equipment often needs to return to the manufacturer for warranty work and inspection, and it takes time to return. Items are also competing for limited cargo space into and out of theatre.
- **Leveraging SMEs.** TAVs, advance parties and leaders' reconnaissance must be seized as an opportunity to better understand, relay and develop a new capability. While new users may be the initial SME for the capabilities, the knowledge, expertise and experience of those surged into theatre often proves invaluable. One example is how CANOSCOM facilitated creation of support requirements for the newly-deploying SUAV Troop when none previously existed. Should solutions not be immediately available, use those with experience. CA is not always the first to trial or employ new technologies or capabilities. Coalition partners are often able to assist, and through mutual cooperation many problems can be solved. If our partners are out of spare parts, we are often able to return the favour. For challenging situations, a TAV can always be requested to assist in studying, investigating and solving issues when expertise is not present in theatre.
- **Tech LO.** Units need to have better understanding of the role of the Tech LO and realize they are there to assist. Involving the Tech LO from the onset allows ADM (MAT) and DLR to better prioritize and utilize the chain of command based on Tech LO recommendations.
- **Maintenance.** New equipment is usually supported by an initial contract; however, often no maintenance days are planned, nor is there spare capacity for inevitable unexpected events. Given the pace of operations, the limited number of newly trained soldiers, and the paucity of qualified maintenance personnel, equipment and personnel often come under enormous pressure to keep the capability going. As long as all work arounds are documented and stakeholders are informed, innovation is a quality to be engendered, paying dividends in the longer term development of the capability.

Force Employment, Generation and Development. COIN operations in the COE require agile and adaptable force structures, processes, capabilities and personnel. CA initial deployments to Afghanistan were based on a Cold War model that did not have the framework to fully leverage new enablers and systems. Force structures and systems have since evolved and continue to rapidly change with the operational requirements of a modern conflict. However, this creates challenges for force generation and development, or, more simply put, for training the right people, for the right job, on the right equipment, at the right time.

In a multinational coalition there are numerous weapons systems and capabilities not resident in the CA arsenal. In addition, new capabilities are continuously introduced into theatre. These factors impact not only the force employment structure but training required on the RTHR and the ability to support. Prior to adapting training or support requirements, a thorough understanding of new capabilities and systems is required in order to avoid irrelevant training or fielding of systems without the necessary tools and processes. How new capabilities fit doctrinally is also important for developing appropriate TTP, sustainment processes, and determining how they nest into a system of systems.

Units should avoid procuring their own equipment without careful thought and advice from DLR; doing so can cause short- and long-term sustainment issues. Such equipment will not have baseline support, formalized maintenance, spare parts, and tools scaling, and might not be compatible with current and future plans and capabilities. If the in theatre command procures equipment on its own, the next rotation will not be trained on it prior to deployment and there is no assurance the next rotation will even use the equipment. In theatre procurement does not create an obligation or funding for the Army to equip the next rotations. Even if a UOR is assigned to another command for procurement, there must be coordination, as DLR might not be advised. Failing to consult DLR on operational acquisition can and has resulted in the procurement of the wrong item.

SUMMARY

The old gun line as it was—six guns lined up in half a grid square with the A echelon tucked neatly behind—is gone, at least for now. A dispersed, asymmetric conflict in urban or complex terrain as is found in the current Afghan COE bears striking similarities to the projected FOE. These circumstances have provided the opportunity to completely transform the Artillery in less time than it traditionally would have previously taken to field just one new gun; an evolution from monolithic gun-centric regiments to multi-disciplinary capabilities in modernized units.

Highlighted in this *Dispatches* are some of the more notable experiences of the gun line, FOO/FAC parties, STA assets, ANA battery mentors, and the various centres responsible for coordination of fires and airspace in the Kandahar AO. The lessons learned, and in some cases lessons relearned, include the ability to coordinate and conduct joint fires, kinetic and non-kinetic, and synchronize, fuse and leverage intelligence gathered from a myriad of modern ISR assets. These war winning enablers coupled with expanded battlespace awareness and a dynamic targeting cycle have given commanders the tools to select and direct the effects needed to achieve mission success.

A proven force multiplier, the Royal Regiment of Artillery can be very proud of its outstanding contribution to the evolution and successful employment of these new capabilities while on Operation ATHENA.