# MODERN SOLDIER

## AN ARMADA INTERNATIONAL COMPENDIUM SUPPLEMENT

2018

ARMADA INTERNATIONAL : THE TRUSTED SOURCE FOR DEFENCE TECHNOLOGY ANALYSIS

# The Best For The Best

*The AR-20 is the smallest, lightest, most compact 20-watt booster amplifier in the world.*

When used with your tactical radio, the AR-20 Booster Amplifier provides a clearer, stronger, more dependable signal and extends your range of communication. It provides a communications advantage that saves missions… and lives. The AR-20 is a manpack amplifier - easy to use, easy to carry.

There's a whole family of small AR-20 booster amps – for use in the air, on gunships, wherever you need – and they all give you big advantages:

- The AR-20 weighs just 1 lb., 10 oz. The entire kit weighs only 2 lbs., 12 oz.
- Only one antenna needed – covers the entire 30-512 MHz frequency range
- Fully Automatic Tx/Rx switching and harmonic filtering
- Waterproof – IP67 rated
- Battle-Tested in the most extreme conditions – it keeps on working!


*To learn more, visit us at www.arworld.us/tactical or call us at 425-485-9000.*

**modular rf**

Other ar divisions: rf/microwave instrumentation • sunar rf motion • receiver systems • ar europe

*www.arworld.us*

*Download the AR RF/Microwave Mobile App: www.arworld.us/arApp*

US ARMY

*A platoon leader from the 173rd Airborne Brigade, US Army, uses the End User Device to report information to his company commander through the Integrated Tactical Network during a live-fire exercise on 2 May in Germany, May 02*

# BATTLEFIELD OVERMATCH FOR THE MODERN SOLDIER

**As an increasingly complex operating environment continues to present small unit teams with a series of evolving mission requirements, armed forces and industry are seeking next-generation technologies that will be capable of maintaining the tactical overmatch over near peer and high capability adversaries.**

## Andrew White

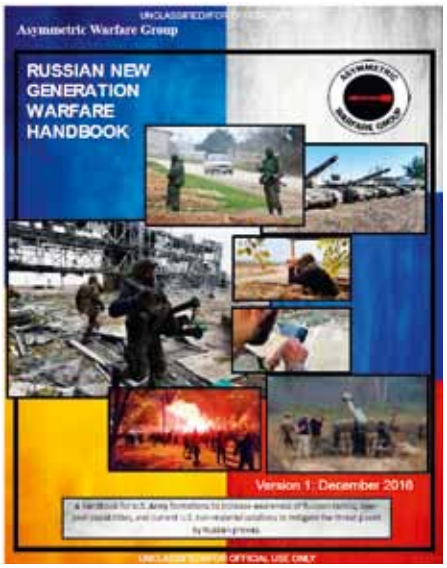
Aimed at providing the modern soldier with the most effective means of executing the full spectrum of operational capabilities, a series of next-generation technologies continue to be explored, developed and introduced into service in order to optimise lethality, survivability and precision at the lowest tactical levels.

Options range from communications systems and situational awareness end user devices that are capable of operating in denied environments through to unmanned support vehicles and target acquisition systems that can reduce both physical and cognitive loads on the modern soldier.

According to NATO doctrine, the contemporary operating environment is defined as one comprising levels of 'complex conflict in complex environments and increasingly contested maritime domains, where information must be treated as a weapon.'

Today's armed forces face near-peer and high capability opponent forces from the likes of China, Iran, North Korea and Russia. These have emerging capabilities in a range of areas. Consequently, armed forces have to be equipped to engage conventional and legacy threats and also to counter emerging threats associated with hybrid warfare – which include both kinetic and non-kinetic effects.

These threat areas are of particular concern to the dismounted close combat (DCC) and special operations forces (SOF) communities. However, solutions include not only hardware and software upgrades, but also developments in doctrine, concepts of operation (CONOPS), tactics, techniques and




procedures (TTPs). All of these must be fused together to provide small unit teams with a capability mix that is suitable for countering a wide array of threats across the information, cyber and electronic warfare space.

As an example, Russian armed forces continue to successfully employ their 'New Generation Warfare' concept (their own variant of hybrid warfare). This continues to be demonstrated by operations in Ukraine and Syria where forward deployed ground elements have been supported by mature levels of information operations.

It is precisely these activities which have led the international armed forces community to identify and exploit a series of next-generation technologies capable of supporting small unit teams (designated as comprising company strength and below) who could be tasked to conduct operations in anti-access/area denied (A2AD) environments where GPS, satellite and other communication signals can be routinely disrupted.

Real time operational experience in eastern Europe, and especially Ukraine, has seen coalition forces operating in close proximity to Russian forces suffering from breakdowns in their communication networks.

Major General Borys Kremenetskyi, Ukrainian Defence and Air Attaché, in the UK, told *Armada International* that EW remains an "attractive" option for Russian forces operating in the region.

"EW is a highly effective option as a non kinetic form of attack and one that is less likely to be traced," Kremenetskyi explained while describing how coalition troops operating in the area continued to experience jamming in VHF, UHF and GSM communications networks.

Effects include the "sudden disappearance of radio communications" due to unknown reasons, while unmanned aerial system (UAS) and unmanned ground vehicle (UGV) platforms, heavily reliant upon GPS signals, were also being regularly disrupted.

There has been a growing investment by armed forces in C4ISTAR technologies to support "asymmetrical warfare and digitisation strategies," according to Getac sales director Jackson White, including his company's X500 server and notebook and the latest EUD in its family of systems following the emergence of the MX50 ruggedised tablet in 2017.

The 15inch EUD provides an ability to support high density data demands for Three-Dimensional (3D) mapping applications and for other C2 and SA (Situational Awareness) programmes. Providing operators with the ability to store up to 6TB in data, the briefcase-sized mobile service can be used to process, exploit and disseminate (PED) mission data from ground and airborne platforms, providing forward deployed elements with the ability to "analyse platform, mission and engine data to ensure operational sustainability in high demand environments".

The X500 features a Generic Base Architecture allowing it to be integrated into legacy and future C4ISTAR networks while relying upon the Windows 10 operating system for data protection, authentication and tamper-free start up. The EUD can also be disabled remotely by Mobile Device Management software, if compromised by enemy forces.

## DENIED COMMUNICATIONS

The requirement to securely communicate across this congested and contested battlefield remains a critical pre-requisite for armed forces seeking to efficiently execute missions in contemporary and future operating environments.

According to NATO defence sources, next-generation communication systems must now feature not only increased protection against jamming threats (as witnessed in Ukraine) but must also provide higher data rates to give modern soldiers the ability to support the full spectrum of C4ISTAR capabilities.

Such demand continues to result in the slow proliferation of next-generation software defined radios (SDRs). These are able to host a variety of specialist waveform technologies and are aimed at ensuring connectivity in the most contested of environments.

Additionally, many more advanced armed forces are seeking to extend their influence and establish global partnerships. This requires greater levels of interoperability in communications systems with local partner nation forces who may not benefit from the same high technology SDR and tactical radio systems available to 'western' forces.

Referring to requirement to improve the signals signature management of small unit teams, Lieutenant Colonel Michael McFarron, Plans Officer for the USMC's 1st Marine Division warned: "We have to consider electro-magnetic interference and the signals we are


*Armed forces exploit C4ISTAR technology down to the lowest tactical level with tablet and smartphone end user devices including Getac's MX500.*


Silvus Technologies

*Small units conducting operations in contested urban and subterranean environments are beginning to benefit from MANET and MIMO technology such as in the Streamcaster 4200 handheld radio.*

putting out. If you emit [signals], you die.

"How do we operate in that space?" McFarron asked, while discussing the potential to shut down enemy communications while protecting the USMC's own capabilities. "If we do operate in that environment, can we have our systems shut off against higher end threats? And how are we training to operate in that environment?"

Consequently, Mobile Ad Hoc Network (MANET) technology represents an increasingly popular communications type due to its non-reliance upon satellite constellations. This technology is slowly proliferating across the DCC and SOF communities, providing small unit team members with self-healing and anti-disruption connectivity.

Speaking to *Armada International*, Jimi Henderson, vice president of sales at communications specialist Silvus Technologies, gave his view of emerging requirements from the contemporary operating environment. He said that these called for the ability of DCC and SOF personnel, as well as UAV and UGV technologies, to operate in contested environments where datalink signals may be jammed.

Examples, he explained, included the ability of personnel and UGVs to counter the interference of radio frequency (RF) bands by using dual-band radios capable of supporting two RF bands (2 and 4GHz for example) in a single piece of hardware. Such a solution, Henderson described, provided the modern soldier with a quick and easy means of switching between alternative frequencies to avoid interference sources without any requirement for hardware changes, Henderson highighted.

"It's all about being aware of the spectrum," Henderson explained before suggesting how legacy radio systems could be "blind" to interference and performance issues.

Reiterating current requirements to support communications in urban and subterranean environments, Henderson also explained how tactical radio systems must be capable of operating inside buildings, tunnels and culverts where Line of Sight (LoS) communications can be easily disrupted. This is the reason why Non Line of Sight (NLOS) connectivity between operators and vehicles remains a critical operational requirement, he added.

Solutions include Silvus Technologies' family of StreamCaster radios. These retain options for 2x2 and 4x4 transmitting beam-forming antennas, providing 2-3db and 5-6db signal boosts respectively. This makes them suitable for "extreme NLOS and mobile situations without regard to antenna spacing and antenna lengths," Henderson said.

The Streamcaster 4200 2x2 MIMO (multiple-input multiple-output) radio represents the company's smallest form factor system that is capable of supporting DCC and SOF operators at the tactical edge. Providing up to 4Watts in output power, the radio is available in a 'rugged handheld' form, and provides push-to-talk voice and dual frequency band capabilities to assist in achieving low probability of interference (LPI) communications.

According to Henderson, Streamcaster radios are capable of supporting up to 380 MANET nodes in a single network. This allows signals to be bounced from one node to another in the most efficient and automated manner, thereby reducing any reliance upon GPS and satellite constellations.

The Streamcaster 4200 also includes optional Wi-Fi and GPS connectivity through an external dongle. Each radio system also retains the capability to save up to 128GB of data on board the handheld system. Henderson claimed that a network of these radios could achieve "ultra-low latency issues," with an average of 7ms per hop between nodes.

In line with ongoing mission requirements across the C2D2E (Communications Degraded/ Communications Denied Environment), a host of MANET-dedicated communications platforms are becoming available to armed forces. Alternative standalone SDRs include TrellisWare Technologies' TW-950 Shadow. This was unveiled at the Special Operations Forces Industry Conference (SOFIC) in May 2017.

Similar to the Streamcaster, the Shadow also comprises a handheld radio which can be operated across an expanded frequency range. It provides operators with higher throughput data rates, allowing for the viewing "multiple high definition videos and full interoperability with TSM-X (waveform) capable devices", TrellisWare Technologies' Matt Fallows explained to *Armada International*.

With a total weight of about 11oz, the Shadow operates between the frequency ranges of 225-450MHz and 1250-2600MHz and provides soldiers with a transmitting power of 2Watts. The radio can support up to 16 channels with a latency rate of "less than a second" and can be operated in underwater environments at a depth of down to two metres.

Fallows also confirmed that various SOF components were already using multiple types of MANET specialist radio systems, especially for counter-terrorism in urban areas and for use in GPS-denied environments.

Elsewhere, Persistent Systems continues to market its MPU5 which features a 3×3 MIMO (multiple-input and multiple-output) radio. This gives up to "6W of transmit power, providing a secure IP (internet protocol) network in any environment or application with usable throughput exceeding 100 Mbps," according to Dr Herbert Rubens, CEO of Persistent Systems.

US Air Force

*A US Army Pacific Soldier moves down a road while controlling an unmanned vehicle as part of the Pacific Manned Unmanned – Initiative.*

The MPU5 also includes an integrated video encoder/decoder capable of distributing multiple real-time high definition video feeds; an Android operating system which can run ATAK software; as well as 16 channels of Radio over Internet Protocol (RoIP).

"The MPU5 translates into enhanced situational awareness, increased mission success, and an overall enhancement in safety. Additionally, the MPU5 provides an extremely cost effective solution for the Bureau by incorporating so much capability into a single commercial item," Dr Rubens explained in a company statement.

## AUTONOMOUS SUPPORT AND ARTIFICIAL INTELLIGENCE

MANET-capable radio solutions are also beginning to be relied upon to support the connectivity of autonomous platforms, including UAVs and UGVs. These continue to be deployed across the operating environment to reduce the burden on DCC and SOF personnel.

There is a range of diverse UGV options available across an internationally diverse market place. These include smaller form factor and tracked UGVs, capable of executing explosive ordnance disposal (EOD) and counter-improvised explosive device (C-IED) missions as well as other intelligence-gathering scenarios. There are also a number of larger, wheeled platforms that are used to assist load carriage and combat support missions. UGVs can even provide organic fire support effects to dismounted close combat and special operations forces.

Emerging technologies are now providing even greater potential to explore the utility of UGVs across an increasingly complex, congested and contested battlespace. There are, in particular, increasing levels of demand for UGVs to support missions in urban and subterranean environments.

Industry sources aver that these technology uplifts have not concentrated on the design and development of revolutionary new platforms but instead centre on the introduction of open architecture standards for the universal acceptance of 'plug and play' payloads and controllers. Trade-offs continue to be made between size, weight and power, and there are continuing concerns regarding current levels of autonomy across the UGV domain.

According to Group Lead and Associate Division Manager for Unmanned Systems and Security Products at ARA, Matthew Fordham, only now is the modern soldier benefiting from autonomous technology.

"The widespread use of off-road UGVs for military applications has been a [US] Department of Defense (DoD) goal for more than a decade, but until recently, has been largely driven by Research and Development projects.

"It was only really in 2017 when the DoD became very focused on funding military applications, releasing Requests for Proposals (RfP) for the Route Clearance Interrogation System (RCIS) and the Squad Multipurpose Equipment Transport (SMET) programme," he explained to *Armada International*.

On 15 December 2017, the US Army selected four industry teams to participate in its latest effort to support forward deployment combat teams with UGV technology. Participants in the SMET effort include General Dynamics Land Systems; Polaris Government and Defense teamed with Applied Research Associates (ARA); HDT; and Howe and Howe.

The SMET concept, according to the DoD's official solicitation published on 23rd March 2017, demands the ability to carry a 1,000-lb payload for up to 72 hours. Additional requirements call for the generation of 3 kilowatts of power when static; and 1 kilowatt when mobile, in order to power payloads. SMET will be able to support a variety of mission sets including the carriage of ammunition, water, batteries and specialist equipment; C4ISTAR; and fire support missions.

Polaris

*The Polaris MRZR X IS being offered to meet the SMET requirement is an optionally piloted autonomous evolution of the manned Polaris MRZR all terrain vehicle.*

ARI

*The 6x6 AMSTAF 6 is one of a range of wheeled UGV variants currently offered by Israel's Automotive Robotic Industry.*

The DoD is expected to confirm whether SMET becomes an official Program of Record in the second quarter of 2019. The US Army is considering a follow-on procurement of up to 80 platforms once a preferred industrial partner has been selected.

According to Fordham, platform and sensor technologies associated with such UGV developments today are mature enough for widespread proliferation in support of the modern soldier and are also now cost-effective enough to ensure continuing investment.

Referring to future challenges associated with increased UGV development, Fordham described "absolute safety" as the most critical element in any successful robotic vehicle design. He explained that the UGV platform must be able to operate in a safe manner all the time, with no unintended movements or unexpected behaviours.

"It only takes one safety failure to set back robotics progress by years. Predictable operations are key to success," he explained. "First, safety is always the most critical challenge. Redundant controllers and safety-critical software, reviews, traceability, and testing is key to a successful safety programme.

"Second, there are many challenges to off-road robotics. We don't have Google Maps that show the best route or display "rules of the road" like commercial applications do. But we have many unmapped obstacles like boulders, trees, holes and massive terrain changes that have to be solved by the system," he explained.

ARA has teamed up with Polaris for the SMET programme with a solution comprising an evolution of the manned Polaris MRZR all terrain vehicle (ATV) which is already in service supporting DCC and SOF soldiers across the US, NATO and other partner nations. The MRZR X is an optionally-piloted and autonomous variant of the MRZR ATV, designed to ensure a smoother transition from manned to unmanned robotic operations.

The MRZR X features ARA's Modular Robotic Applique Kit (M-RAK), which allows the integration of autonomous technologies while maintaining the existing physical and software architecture of the legacy manned platform.

The vehicle can operate in contested and congested environments using artificial intelligence (AI) algorithms to enhance its machine learning capabilities. Fordham explained to *Armada International* how the company has continued to make "significant technology advancements in autonomy for both GPS-denied areas, follow-me, and squad formation scenarios in complex terrains".

"The maturation of machine learning algorithms, video processing, and field-programmable gate array (FPGA) technologies have made a significant contribution to the semi-autonomous behaviours the military is currently looking for," Fordham added.

"The UGV market is ever growing. As trust in robotic platforms continues to grow among soldiers, we will see more and more use of the systems. Budgets will reflect the need to introduce additional ground robotics into the military inventory. And as our perceived

*Suppressor technology continues to proliferate across the armed forces as small units identify benefits associated with reducing acoustic, audible and visual signatures associated with small arms.*

adversaries continue to develop unmanned weaponised systems, we will see additional payloads being deployed by ground robotics. These can go into harm's way rather than our soldiers," he concluded.

Ronen Fishman, Chief Executive Officer of Israeli company Automotive Robotic Industry expressed similar sentiments regarding the development of UGV support for the modern soldier. He expressed the belief that the homeland security market remained a more mature sector for the technology, ahead of military markets. However, he did predict a more widespread proliferation of the technology type throughout the international armed forces community in the near future.

"The understanding that UGVs must play a leading rule in the next battle is there but it will take about two to three years until the understanding will be translated into actions," he urged.

According to Fishman, critical requirements for UGVs supporting the modern soldier include all terrain capabilities and high manoeuvrability. But although these are vital to satisfy military requirements he admitted that software remains the key element of any UGV development programme, since only software will allowing multiple autonomous modes to be supported.

"The most difficult elements are in the software engineering, because it should allow a variety of subsystems to 'communicate' between themselves in perfect harmony, while being flexible enough to adopt new, advanced subsystems the minute they are out in the field," he concluded.

Automotive Robotic Industry currently offers a range of wheeled UGV variants including the 8x8 AMSTAF 8; 6x6 AMSTAF 6; and the 4x4 AMSTAF 4 which is currently in development in conjunction with BFL India.

At the smaller end of the UGV market, platforms and payloads continue to be downsized in in order to optimise their utility in supporting DCC and SOF personnel, particularly in the ISR and EOD roles.

## ARTIFICIAL INTELLIGENCE

Many within the NATO special operations community believe that AI software could soon be integrated on board a variety of Command and Control, Communications, and Computers (C4) end user devices carried by DCC and special operations units. This will allow them to optimise and speed up decision-making processes in the tactical environment. Generally, though, the further proliferation of AI in support of the modern soldier has yet to filter down to the lowest tactical level, although an appetite remains for small unit teams to benefit from man-wearable technology in the near future.

Currently, AI is relied upon to support vast data centres at operational and strategic levels in the PED (processing, exploitation and dissemination) of intelligence, surveillance and reconnaissance data. There are, however, ongoing efforts to reduce form factors and energy requirements in order to support development in the tactical space.

## SIGNATURE MANAGEMENT AND LETHALITY

At the lowest, tactical edge of the battlefield, the modern soldier must be capable of avoiding detection before delivering soft and/or hard effects in order to successfully execute his mission. Armed forces are paying particular attention to both areas as they address emerging requirements calling for small units to be able to avoid detection across the full EMS (electromagnetic signature).

The USMC is seeking to implement a series of shorter term upgrades to provide soldiers with a more immediate solution to these current and emerging operational requirements. The Corps is attempting to identify means of reducing battlefield signatures on the soldier, including efforts to minimise the EMS output associated with man-wearable and man-portable C4ISTAR technology. The noise and acoustic signatures emitted from personal weapon systems are also being assessed and reduced, as well as physical signatures associated with camouflage and other disruptive pattern designs. In practice, the USMC is continuing to evolve its experimentation and training programmes to identify lessons learned. Relevant technologies are being developed to reduce EMS and physical signatures.

"Efforts include the integration of 'live force free play' in field exercises. This allows for real-time feedback in regards to signature management across all radio frequency, physical and audible signals emerging from the battlefield," a service official told *Armada International*.

"We had given up on these when combating violent extremist organisations as they had seemed to be less important at that time," he said, referencing ongoing operations against the self-proclaimed Islamic State (IS) and its affiliate organisations across the Middle East, Asia Pacific and Africa.

Specific technologies capable of supporting these types of mission requirements include 3D printed suppressors. These are able to assist in the physical and audible signature management of modern soldiers. Additionally, the technology also provides a secondary benefit to DCC and SOF personnel operating in urban environments. "We are seeing great feedback using suppressors on all weapon systems for better communications and situational awareness," McFarron observed.

Examples include Delta P Design's Brevis

III- the latest variant in its line of 3D printed suppresors specifically designed for DCC and SOF soldiers to reduce physical and audible signatures. Their use encourages greater levels of C2 and situational awareness. Additional benefits include keeping excess gas out of the operator's face.

Manufactured from a single piece of DMLS and Titanium, the Brevis III comprises a 120mm long suppressor which can be fixed to the flash eliminator of personal defence weapons including Heckler & Koch's MP7. Weighing just 235g, the Brevis III can also bee used to suppress larger weapon systems including assault rifles, carbines, light and even heavy machine guns, company officials claim.

In order to optimize precision and lethality, the modern soldier will soon be equipped with a series of next-generation weapon- and helmet-mounted technologies. These promise to be capable of increasing levels of situation awareness and target acquisition, according to industry sources.

Examples include Elbit Systems' SmartSight which is due to be demonstrated to the German Army Infantry Training Centre in July 2018 as part of a technology demonstration programme. Sebastian Bauer, key account manager for defence and security at Telefunken Racoms (Elbit Systems' distributor in Germany) said that the product continues to be upgraded in line with emerging operational requirements.

The sight can be used as a standalone or 'in-line' weapon sight mounted behind a red dot or magnified optic, supporting both day and low/zero light missions. It provides operators with a "see-through, augmented reality (AR) situational awareness" which can also be integrated into wider future soldier solutions including Elbit's own Dominator combat suite.

The SmartSight itself comprises a GPS module and inertial positioning unit, with a compass and integrated laser rangefinder manufactured by Jenoptik. According to Bauer, the sight also includes "target acquisition capabilities with command and control interoperability" thanks to its integration with a tactical radio system. The SmartSight is also ruggedised to support military operations and to negate the effects of rifle recoil on the accuracy and stability of the optic.

A three-button control unit attached to the foregrip or rail adaptor system of the firearm retains manual control of the SmartSight, providing a soldier with the ability to designate a target or point of interest using an integrated reticle. This can be recorded and networked back to a C2 or Battle Management System (BMS). The BMS is then capable of recording and disseminating the information across a MANET or alternative communications network to other firers and formations.

Bauer explained that this could allow other soldiers in different fire teams, squads or platoons, to visibly scan a battlefield with their own SmartSight and to be informed of friendly and enemy forces as well as points of interest when the reticle passes over

Author

*Elbit Systems' SmartSight continues to be developed in line with user requirements to network optical weapon sights through augmented reality to battle management systems.*

IDF

*The IDF is planning to evaluate hundreds of SMASH Fire Control System sights as part of a wider move to enhance the first hit probability of dismounted close combat soldiers.*

them. Additionally, the SmartSight is also able to generate relevant target information including GPS coordinates and ranges.

Elbit Systems is currently working on a series of upgrades to the existing SmartSight to provide greater capabilities for soldiers operating in contested environments. Potential upgrades include a colour end user display featuring integrated BMS mapping overlays.

A total of six prototypes have been manufactured to date, Bauer confirmed, although he was unable to comment on exactly how many will be supplied to the German Army for evaluation.

Telefunken Racoms has now integrated the SmartSight into a wider future soldier concept. This would enable a DCC or SOF soldier wearing the Raptor end user device to benefit from a suite of technologies including Torc2h BMS software; communications established via a PNR-1000 personal role radio; night vision goggles; SmartSight; and SmartTrack solution, the latter being used to generate position, navigation and tracking information in GPS-denied environments.

A similar system, SmartShooter's SMASH optical weapon sight, is undergoing an ongoing evaluation by the Israel Defense Force (IDF). SMASH is a fully integrated fire control system capable of being integrated onto the top Picatinny rail system of an assault rifle or carbine, and was designed to improve the first hit probability of DCC soldiers, especially when engaging moving targets at extended ranges. According to IDF officials, several hundred SMASH sights are due to be evaluated the Ground Forces by the end of the third quarter in 2018.

The IDF is understood to be considering evaluation of several different products from the SMASH family, which include the SMASH 2000; SMASH 2000 Plus; SMASH 2000M; and SMASH 2000N.

The FCSs provide soldiers with a see-through optical display with electro-optical/infrared sensor providing target detection and lock-and-track capability. Solutions have been manufactured up to MIL STD 810 to negate any effects of rifle recoil to the accuracy of the sight.

The 'Plus' variant includes a recording device to facilitate debriefs and after-action reviews during mission and training cycles; while the '2000M' provides soldiers with a four times magnification capability for extended ranges. Finally, the '2000N' includes an infrared sensor for low light and zero light use, in addition to four times magnification.

The SMASH sight is also being considered to assist in various specialist mission roles including counter UAS (C-UAS) operations. A company spokesperson explained how SMASH products had been designed to provide "kinetic protection" against evolving threats with a "precision anti-drone capability at the fingertips of its users, featuring built-in targeting algorithms that can track and hit even very small drones skimming along at high speed, at ranges of up to 120m, with the first shot."

Elsewhere, the market is witnessing a slow proliferation of CMOS (Complementary metal–oxide–semiconductor) digital technology as a replacement for more traditional image intensified (I2) and thermal imaging (TI) solutions. This shows particular promise for situational awareness and target acquisition in close quarter combat (CQC) scenarios in low and zero light conditions.

Other similar examples include Rochester Precision Optics' (RPO's) CMOS Night Observation Device (CNOD), which is currently in service with US Special Forces components. It is used as both a handheld standalone solution for joint terminal attack controllers (JTACs) and battlefield counter-surveillance missions; and also as an optical weapon sight capable of being integrated on assault rifles, carbines and even handguns.

Austrian company AD2V (Absolute Darkness To Vision) has taken the CMOS concept to the next level with an alternative design for the Luxiter PM1 Digital Night Vision Goggle system. According to industry

DVIDS

*It is envisaged that augmented reality-assisted weapon sights will still be visible through ballistic personal protection solutions such as visors and other mandible systems as illustrated by the USMC.*

sources, the technology is already in service with an undisclosed SOF unit in Europe.

"The Luxiter system provides unique analog and digital interfaces such as exporting the night vision image stream for recording or radio transmitting. It can import information from external sources, control commands from devices and prompt text commands," according to Wilhelm Gronauer, business development for night vision at Griffity Defense (AD2V's distribution partner in Germany).

Also capable of being worn under a visor to maintain required levels in ballistic and mandible protection which might be integrated into a combat helmet design, the Luxiter is designed to support very short range engagements in confined spaces where legacy night vision solutions might not be suitable.

"Live firing or a flash bang will not create a blinding or blackout condition and its ergonomic design and light weight allows comfortable use in motion, even during extended operations," Gronauer claimed.

The device features an adjustable infrared illumination setting for active or passive operation; although the unit can also be used in daylight conditions for enhanced target detection, particularly in cluttered environments where objects of interest are hard to differentiate, Gronauer added.

"Digital black and white screens allow better target recognition and fast decision times while instant dark to light or light to dark conditions are compensated for by the device and the user is unaffected," he stated.

Operating at a resolution of 795 x 596, the Luxiter heads up display provides users with variable fields of view, ranging from 19-, 46- and 56-degrees. The device weighs a total of 290g, exclusive of a 50g cable and plug and an additional rechargeable battery pack which can be attached to a combat helmet or personal load carrying equipment.

A single battery charge can allow a user to operate the system for up to 10 hours, Gronauer added although he conceded the system only provides an operator with a maximum range of vision out to 100m.

The digital night vision goggle device can also be supplemented with the Luxiter-EC-2H Digital Night Vision External Camera System which is capable of streaming full motion video directly to the night vision goggles (or via a software defined radio connection).

The Luxiter-EC-2H can also be used in daylight conditions without any damage to sensors and neither does it suffer from 'blinding or blackout conditions' when conducting live firing drills with flashbangs and demolitions.

## CONCLUSION

The contemporary operating environment remains a highly complex one for the modern soldier. He is on the verge of benefiting from a vast array of next-generation solutions aimed at optimising his connectivity on the battlefield; while minimising his physical and electro-magnetic footprint in the face of highly capable enemy forces.

The successful integration and proliferation of these technologies must be carefully managed in line with the cognitive capacity of modern soldiers who have yet to benefit from AI capabilities in the dismounted role. The day may yet come when soldiers are equipped with man-machine interfaces, networked to centralised and man-wearable C4ISTAR mission suites. In the meantime, though, the threat of cognitive overload will remain a significant concern for commanders seeking to optimise the performance of small unit team members.

# USMC'S ROADMAP

**The US Marine Corps (USMC) is considered by many to be one of the most technologically advanced expeditionary fighting forces in the World.**

Andrew White


USMC

*A light tactical all terrain vehicle at the Urban Advanced Naval Technology Exercise on 19 March 2018. The USMC continues to consider emerging technologies to improve survivability, lethality and connectivity in complex urban environments.*

The USMC is leading the development of alternative approaches to handling the complex operating conditions encountered across the hybrid warfare environment. This includes developments in CONOPS and TTPs but also in software, hardware, doctrine and training support.

Speaking to *Armada International*, senior service officials described how armed forces around the World must now be capable of operating in a "Command and Control Denied or Degraded Environment" (C2D2E). Each soldier will have to be able to rely on secure digital communications if he is to successfully execute his task.

However, as Lieutenant Colonel Michael McFarron, Plans Officer for the USMC's 1st Marine Division disclosed to *Armada International*, an optimal solution to equip the modern soldier has yet to be found.

Instead, McFarron outlined a series of what he termed "urgent" requirements, designed to maintain relevance across the increasingly complex operating environment. Simultaneously the USMC is continuing to implement a broader strategy aimed at improving future expeditionary warfare capabilities.

This, he went on to explain, includes the consideration of a series of general themes which have been identified to assist in the development of technologies, CONOPS and TTPs between 2020 and 2035.

According to McFarron, all of these mission requirements are intended to develop "Modern Breakthrough Technology in 2035 and beyond." Equipment upgrades will support the USMC's manoeuvre warfare fundamentals with mission sets including military engagement, security cooperation, deterrence, crisis response, limited contingency operations and large scale combat operations.

Exemplifying the growing importance of the information space, the USMC is also considering the integration of an additional Marine into the squad formation (normally 10-15 personnel) in order to manage growing demand for and reliance on C4ISTAR (C2, Communications, Computers, Intelligence, Surveillance, Target Acquisition and Reconnaissance) at the tactical level. Such a move could see a Marine dedicated to the operation of maintaning communications networks, operating small UAVs, as well as overall electro-magnetic spectrum (EMS) management for the squad.

McFarron also explained how the USMC had coined the phrase "quads for squads" in a bid to proliferate UAS and UGV technologies across the lowest tactical formation.

Specific areas of interest include enhanced levels of situational awareness (SA) including the generation and dissemination of a common operating picture. This provides DCC and special operations units with a detailed picture of the layout of the battlespace. To aid this evolution in capability, the USMC is continuing to consider the introduction of tablet and smartphone end user devices at the lowest tactical level. This promises to provide every Marine with their own organic command and control (C2) capability in order to facilitate increased capabilities in "squad-level information sharing."

Capabilities of such a system must include blue, red and green force tracking technology as well as displays of ingress and egress routes to and from target areas. Additionally, the system would provide DCC and SOF teams with the means to disseminate intelligence, surveillance, target acquisition and recon-naissance (ISTAR) data across the battlefield.

# USSOCOM'S APPROACH TO FUTURE OPERATIONS

**Concurrent to USMC efforts, the US Special Operations Command (USSOCOM) is continuing to conduct a series of Technical Experimentations (TE) that are designed to identify next-generation technologies which will support operators overcome challenges associated with the contemporary operating environment.**

## Andrew White

First disclosed in November 2017, the Thunderstorm Technology Demonstration Program is preparing to conduct its second TE. The first TE event was completed in March and involved the US Army Special Operations Command and Georgia Tech Research Institute.

With a focus on the support of "small unit operations" in denied and complex environments, the first TE considered a variety of technologies currently lying between Technology Readiness Levels 4 and 9, according to a USSOCOM official.

Highlighting a future operating environment experienced by SOF operators, official documentation for the Thunderstorm programme echoed USMC thought patterns to describe how a small unit team could be deployed into a "hostile region".

"The team (must be) lightly equipped and required to be highly mobile to support the mission requirements. The operational area may have a variety of physical and electromagnetic environmental constraints. The team is required at all times to operate in all types of terrains (desert, forest, mountain, open, urban), vegetation (desert, grassland, brush, forest, etc.) and in all environmental conditions," the documents revealed.

Specifically, USSOCOM sources revealed that the first TE had considered a range of technologies particularly suited to supporting operations in a C2D2E. This included wireless tactical headsets for improved tactical communications; power solutions for extended battery operations; head mounted display systems to include augmented reality for improved situation awareness; and an extensive list of sensor solutions including see-through wall, smoke and obscurant technology, stand-off biometric systems, and predictive analysis tools.

Tactical communications systems considered ranged from smart phones featuring integrated High Frequency and Very High Frequency transceivers; through to LTE and Wi-Fi tactical hotspots that were able to ensure operations in denied environments.

The Command also considered a series of autonomous capabilities designed to support decision-making processes; reducing the number of personnel deployed to conduct a mission; and supporting multi-mission capabilities across different terrain types. Also considered were various small unit and covert unmanned aerial systems, some with reduced acoustic signatures, which could be used to support organic surveillance and reconnaissance missions at the lowest tactical level.

Finally, USSOCOM called for improved personnel signature management tools,

similar to those being sought by the USMC. This includes textiles capable of protecting against radar, electronic, thermal, infrared, visual, electro-optical, and acoustic detection technologies as well as camouflage solutions capable of making an operator either undetectable or unrecognisable. The Command is also seeking an enhanced suppressor for small arms systems, providing firers with lower acoustic signatures and with reduced muzzle flash and recoil.

Echoing the demands of the USMC, USSOCOM officials described how technology considered during Thunderstorm TEs must pay particular attention to "individual mobility and automated operations with a goal of limiting/reducing size, weight and power and reducing or eliminating operator workload requirements."

Details of the second Thunderstorm TE were disclosed to *Armada International* on 21 February 2018. These reflect current operating demands, and specific consideration is being given to operating in "dense urban and subterranean" environments.

Scheduled to take place over a two-week period between July and August this year, the TE will consider technologies relating to position, navigation and timing (PNT) in GPS-denied environments. It will also look at options for inertial measurement unit (IMU) and inertial navigation system (INS) systems.

Additionally, the exercise will feature unmanned ground vehicles (UGVs) and man-wearable and/or man-portable systems that can map "tunnels, buildings and street-level environments" in real time. Finally the TE will examine multi-domain communications systems that allow small unit teams to be networked between surface and underground environments.




**ON THE COVER:** A US Air Force Special Operations team member during the joint US-Jordanian forces Exercise Eager Lion in Jordan, 2017. Special operations teams are often the first to use the latest technology to achieve their exacting missions. (*US Navy*)


**Modern Soldier**
Supplement to **ARMADA** Issue 3/2018
Volume 42, Issue 3, June/July 2018

**ARMADA**
is published bi-monthly by Media Transasia Ltd.


**Publishing Office:** Media Transasia Ltd.,
1603, 16/F, Island Place Tower, 510 King's Road, Hong Kong

**Editor:** Andrew Drwiega
**Chairman:** J.S. Uberoi
**President:** Egasith Chotpakditrakul
**Chief Financial Officer:** Gaurav Kumar
**General Manager:** Jakhongir Djalmetov
**International Marketing Manager:** Roman Durksen
**Digital Manager:** David Siriphonphutakun
**Sales & Marketing Coordinator:** Wajiraprakan Punyajai
**Graphic Designer:** Khakanaa Suwannawong
**Production Manager:** Kanda Thanakornwongskul
**Circulation Assistant:** Yupadee Seabea

**Advertising Sales Offices**
■ FRANCE/SPAIN
Stephane de Remusat, REM International
Tel: (33) 5 3427 0130
E-Mail: sremusat@rem-intl.com
■ GERMANY
Sam Baird, Whitehill Media
Tel: (44-1883) 715 697, Mob: (44-7770) 237 646
E-Mail: sam@whitehillmedia.com
■ TURKEY / EASTERN EUROPE / UK
Zena Coupé
Tel: +44 1923 852537, zena@expomedia.biz
■ NORDIC COUNTRIES/ITALY/SWITZERLAND
Emanuela Castagnetti-Gillberg
Tel: (46) 31 799 9028
E-Mail: emanuela.armada@gmail.com
■ RUSSIA
Alla Butova, NOVO-Media Ltd,
Tel/Fax: (7 3832) 180 885, Mob: (7 960) 783 6653
Email :alla@mediatransasia.com
■ USA (EAST/SOUTH EAST)/CANADA (EAST)
Margie Brown, Blessall Media, LLC.
Tel : (+1 540) 341 7581
Email: margiespub@rcn.com
■ USA (WEST/SOUTH WEST)/BRAZIL/CANADA (WEST)
Diane Obright, Blackrock Media Inc
Tel : (+1 858) 759 3557
Email: blackrockmediainc@icloud.com
■ ALL OTHER COUNTRIES
Jakhongir Djalmetov
Tel: +66 2204 2370, Mob: +66 81 6455654
Email: joha@mediatransasia.com
Roman Durksen, Tel: +66 2204 2370, Mob: +66 9 8252 6243
E-Mail: roman@mediatransasia.com

**Annual subscription rates:**
Europe: CHF 222 (including postage)
Rest of the World: USD 222 (including postage)
**Controlled circulation:** 25,118 (average per issue)
ABC certified by ABC Hong Kong, for the period 1st January 2016 to 31st December 2016.
**Printed by** Media Transasia Ltd., 75/8, 14th Floor, Ocean Tower II, Soi Sukhumvit 19, Sukhumvit Road, Bangkok 10110, Thailand.
Tel: 66 (0)-2204 2370, Fax: 66 (0)-2204 2390 -1

**Subscription Information:** Readers should contact the following address: Subscription Department, Media Transasia Ltd., 75/8, 14th Floor, Ocean Tower II, Soi Sukhumvit 19, Sukhumvit Road, Bangkok 10110, Thailand.
Tel +66 2204 2370 Fax: +66 2204 2387
Email: accounts@mediatransasia.com

**www.armadainternational.com**

THE TRUSTED SOURCE FOR DEFENCE TECHNOLOGY ANALYSIS

# ARMADA INTERNATIONAL


**Get an in-depth special on programmes, advanced technologies and procurement opportunities in these domains.**



- **Unmanned Systems + UAVs (September 2018)**
- **Tactical Radios (October 2018)**

**FOR MORE INFORMATION CONTACT YOUR LOCAL ARMADA REPRESENTATIVE OR:**

**Joha Djalmetov:** joha@mediatransasia.com (+66) 2 204 2370 ext 125
**Roman Durksen:** roman@mediatransasia.com (+66) 2 204 2370 ext 123