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14. ABSTRACT Since the end of the Cold War, western military forces have become progressively more reliant on expensive, high capability, low density weapons systems. This trend combined with budget limitations and force reductions, has reduced the capacity of forward deployed forces, increasing the military premium on strategically mobile forces. Unfortunately, such strategic mobility in land forces has historically entailed tradeoffs in protection, firepower, mobility and sustainability. Potential adversaries have significantly increased the range and capability of their artillery, air defense, and electronic warfare systems and this closing capability gap, along with technological advances over the past decade have created a requirement to reexamine the role of light forces within the land combat system of western militaries. Long range non-line-of-sight (NLOS) fires, micro-precision guided munitions, new smaller unmanned aerial systems (UAS) capable of intelligence gathering, resupply, radio rebroadcast, terminal guidance, and CASEVAC are some of the emerging technologies that could change the way land forces fight in the 10 to 15 year timeframe.					
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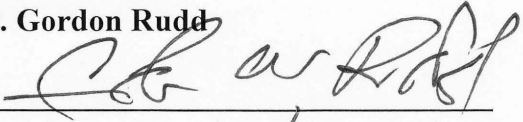
*The Joint Skirmisher Force:
Restoring the Resiliency and Lethality to Modern Light Forces.*

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF OPERATIONAL STUDIES

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FOREGOING STATEMENT

Since the end of the Cold War, western military forces have become progressively more reliant on expensive, high capability, low density weapons systems. This trend combined with budget limitations and force reductions, has reduced the capacity of forward deployed forces, increasing the military premium on strategically mobile forces. Unfortunately, such strategic mobility in land forces, such as the 82nd Airborne's Global Response Force (GRF), has historically entailed significant tradeoffs in protection, firepower, mobility and sustainability, a problem yet to be resolved adequately.

In the land domain, nearly two decades of counter-terror/insurgency dominated operations have focused resources and research chiefly toward survivability, intelligence gathering, and special operations forces.¹ This has contributed to a stagnation of conventional land force development with respect to fires and maneuver. Concurrently, rising state competitors have made significant advances in long range precision strike and low cost systems, designed to counter western military capabilities and military doctrine. Two key assumptions underlie the existing force employment constructs for all western land forces: 1) Assumed air superiority, and 2) Assumed functional communications. These two long standing assumptions, may no longer be valid as both Russia and China have significantly increased the range and capability of their artillery, air defense, and electronic warfare systems, but have had a particularly defining effect on western infantry employment concepts, resourcing, and organization.

This closing capability gap, along with technological advances over the past decade have created a requirement to reexamine the role of light forces within the land combat system of western militaries. Small units operating in a distributed fashion between the physical seams of the enemy and against high payoff targets in depth can be a significant force multiplier, but to do this viably, risk to force needs to be mitigated to an acceptable level. Long range non-line-of-

sight (NLOS) fires, micro-precision guided munitions, new smaller unmanned aerial systems (UAS) capable of intelligence gathering, resupply, radio rebroadcast, terminal guidance, and CASEVAC are some of the emerging technologies that could fundamentally affect the way land forces fight in the 10 to 15 year timeframe.

Modern light infantry forces must be able to win the find, fix, strike contest to once again become a valid joint skirmishing force and enable the protection and operational maneuver of heavier forces. The current force employment construct for infantry forces require adjustments to meet the demands of a conventional land conflict against a near-peer opponent such as Russia or China. Changes in the equipping and tactical employment of light forces should be adopted to regain a decisive advantage over a range of possible future adversaries.

I. Movement and Maneuver.

The employment of light forces often presents a challenging dilemma for commanders and operational artists alike. On the one hand, these forces are strategically mobile, able to deploy over long distances, directly into theatres rapidly and with limited logistical support relative to heavily forces. On the other hand, their operational and tactical mobility drops from the speed and range of fixed-wing or rotary-lift to that of a forced march once deployed. The Achilles heel of light forces since their inception is a serious physical limitation on amount of sustainment and heavy weapons and ammunition they can carry to deal with threats.

While the differentiation between light infantry and motorized infantry can be confused, light infantry units typically have a limited quantity of vehicles to support operations, but may not be able to simultaneously move their whole unit. In order to extend tactical range and the ability to disaggregate and aggregate as operations progress, a fleet of affordable, air transportable vehicles for light forces is required. Rugged terrain mobility vehicles are presently being trialed as a solution to crippling slow rates of dismounted movement, address an inability

to carry adequate equipment to ensure success, and to provide the ability to rapidly reposition to avoid becoming fixed and attrite fires available to potential adversaries. From an American perspective, the U.S. Army has an ongoing Ultra-Light Combat Vehicle (ULCV)/ Ground Mobility Vehicle (GMV) program attempting to solve this mobility delta. The idea behind the GMV/ULCV is to have a vehicle which is internally transportable in a CH-47/V-22 and can carry a nine-man section with its weapons, but not into battle. This will allow offset insertions and extractions well beyond the current typical stand off distances from objective areas and will allow light forces to rapidly disaggregate and re-aggregate during operations. As this vehicle will be the antithesis to vehicles such as the Mine Resistant Ambush Protected (MRAP) vehicle, they have virtually no armor protection, but will allow light forces to move at many times their current rate of advance once inserted by airplane or helicopter.



Figure 1. A section of soldiers in ULCVs move through rugged terrain.

Operations by light forces are presently limited in depth, dispersion and duration by a myriad of factors, chief amongst these is not only ground mobility, but also the ability to conduct

tasks such as resupply, casualty evacuation (CASEVAC) and command and control (C2) over extended distances without undue risk or the requirement for limited availability assets such as aircraft. One system with the potential to fundamentally change this is the Lockheed Martin and DARPA Aerial Embedded Reconfigurable System (ARES), which is a UAS.

The ARES UAS is quite large with a 41-foot wing span, but it is smaller than most in service helicopters and introduces an entirely new class of UAS to the battlefield. A UAS like ARES is capable of carrying significant loads, to include battlefield casualties, and could even conduct insertion and extraction for small teams. Like the USMC V-22 Osprey, the ARES uses tilt rotors and can take off like a helicopter and then fly like a plane. With a demonstrator scheduled to fly September 2017, the ARES once in service would have different flight modules, which could be underslung to execute different mission sets. Initial open source reporting indicates that ARES' flight module options will include cargo resupply, CASEVAC, intelligence, surveillance, communications, and reconnaissance (ISR) variants. A key requirement stated by the USMC, which has the lead on project requirements for the U.S. Department of Defense, is for the ARES to be capable of semi-autonomous flight, allowing non-pilots to conduct VTOL missions.² While this system is still under development, refinements are increasing the useable payload beyond the current 3000lbs and a similar final range and performance envelope is sought to that of the V-22. The ability to carry a small ground vehicle or employ a weapons package as a flight module is also being investigated by ARES developers.

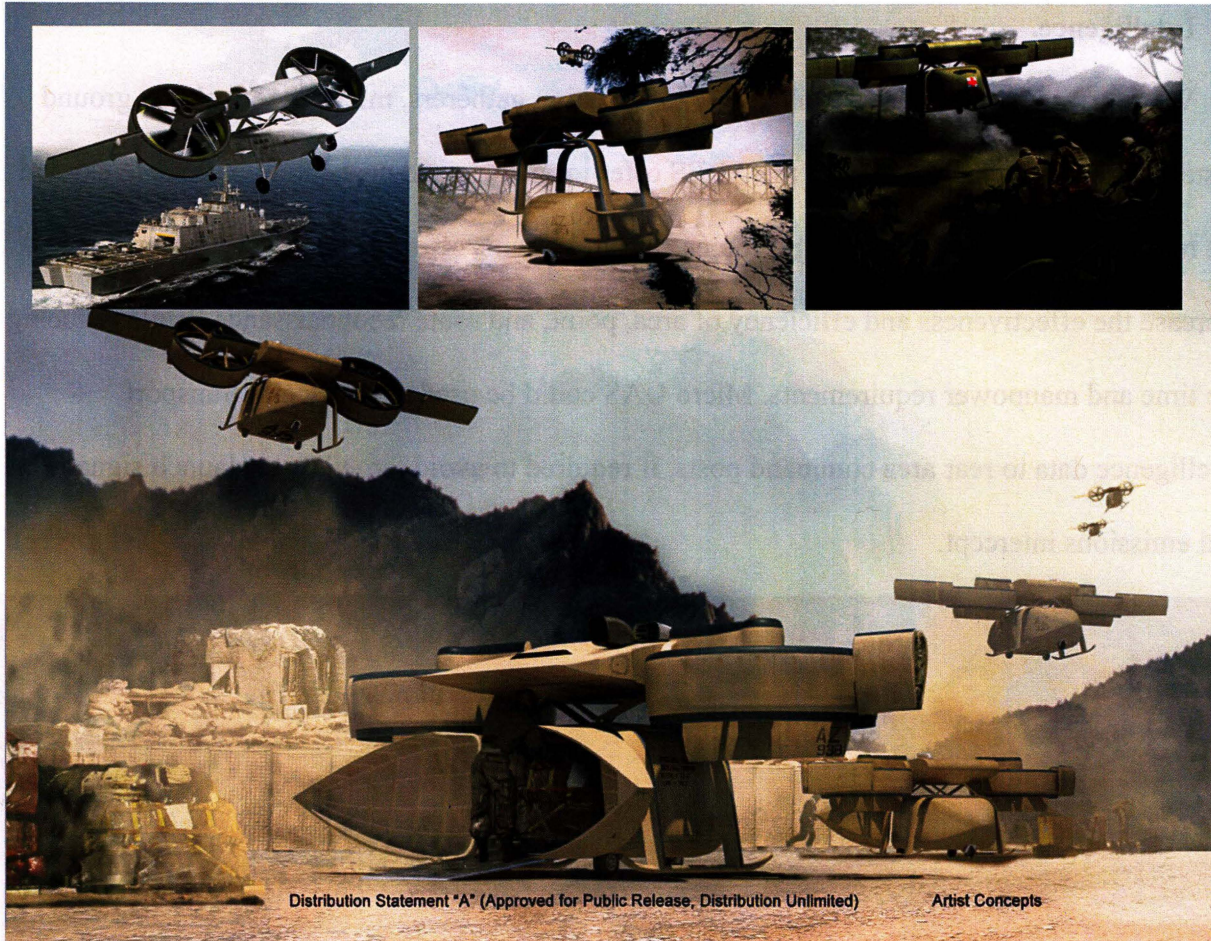


Figure 2 Artists renditions of the ARES UAS under development by Lockheed Martin

While such a UAS fleet would increase span of control and aerospace management challenges within a brigade, a light infantry battalion that could have squads, platoons or company sized forces spread over hundreds of kilometers, would significantly change the area of influence of light units. While a capability such as ARES will probably be too expensive and maintenance prohibitive to make an integral part of a light infantry battalion, for high readiness or designated units like the GRF, ARES augmentation could dramatically change the ability to support joint forcible entry operations and enable disaggregated light forces both in and out of contact with the enemy.

II. Intelligence.

While patrolling infantry are inherently information gatherers, micro UAS, robotic ground systems and other systems such as the ARES offer immediate and near future options to expand the reconnaissance capability of light forces. These systems offer the potential to dramatically increase the effectiveness and efficiency of area, point, and route reconnaissance, while reducing the time and manpower requirements. Micro UAS could be used to physically transport intelligence data to rear area command posts, if required to avoid targeting via launch signature and emissions intercept.



Figure 3. Prox Dynamics' PD-100 Black Hornet is nano UAS technology which has recently entered service with a handful of western armed forces. Weighing only 18 grams (1.3kg per system) and flying at 18Kph, with FLIR, live video and photo feeds over a 1.6km data link it provides a useful combat edge to the operator. Systems like this will have enhanced capability and will be ever present with friends and foes in future conflicts.

Light forces can also offer an important contribution to denying a valid enemy intelligence picture in situations where they are operating forward of a main force such as a river crossing

site. As military and commercial UAS proliferate, there is a danger of persistent observation and UAS enabled targeting of friendly forces. As counter UAS technology matures and doctrine is developed, light forces can be integrated into a counter UAS guard for main body during operations of high vulnerability such as urban operations or assault obstacle crossings.

III. Fires.

While the rifle and machine gun remain essential to the infantry for the foreseeable future, emerging weapons systems offer the ability to shoot from ranges and positions not possible with current direct fire weapons systems, thereby offering the potential to win firefights by simply avoiding a two-way gunfight. Smaller and more affordable miniature precision guided weapons (PGM) have the potential to make the modern light infantryman more lethal and difficult to detect.

The miniaturization of electronics and guidance system technology have enabled the recent creation of systems such as Raytheon's PIKE micro-missile. A fraction of the price of other larger guided missiles, the PIKE is only 17 inches long, 1.5 inches wide, weighs 1.7 pounds and has a blast fragmentation warhead that can take out enemy behind a wall or a light vehicle. Using a guidance system which searches for laser energy reflected off a target after the missile has reached the top of its trajectory, targets can be lased up to 15 seconds after launch by any properly encoded laser designator, allowing the firer, a spotter or a UAS with a laser to do the designation.³ The PIKE micro-missile is able to be fired from a variety of platforms to include UAS and rifle mounted 40mm grenade launchers. Terminal guidance of the Pike or similar miniature guided missiles, could be refined to work with an optional fire and forget capability or with the next evolution of nano UAS systems similar to the PD-100 Black Hornet, which could include a built in laser designator to conduct terminal guidance of PGMs.⁴

A MINI GUIDED MISSILE

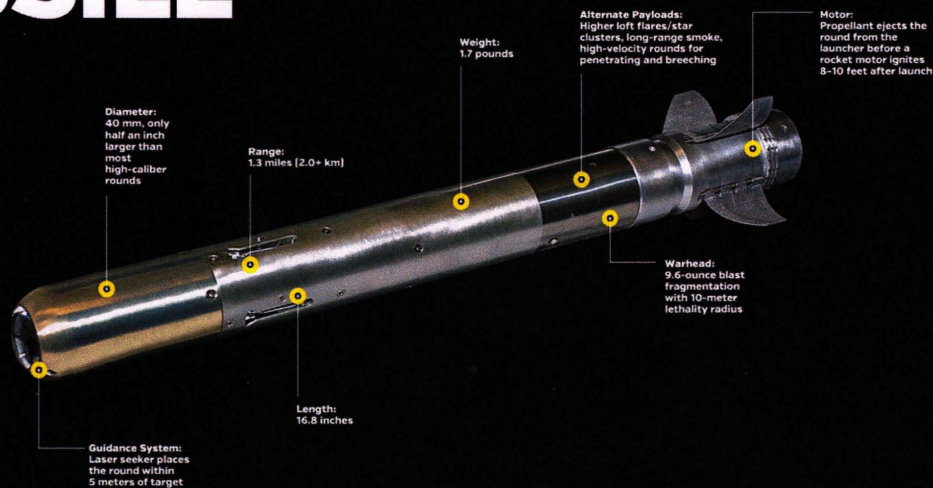


Figure 4. Raytheon's Pike micro missile.

Adding weapons to UAS is not a new concept and has been done successfully with large and expensive systems such as the Predator and Reaper drones which are essentially the size of small aircraft. What is relatively new, is the gradual maturation of low cost, highly portable small UAS, with offensive capability. While most of these systems are of limited interest and use to air forces due to their range and usable payloads, they could make a significant contribution to how light forces fight and the distance at which they can provide mutual support on the battlefield.

The U.S. Army's ongoing Lethal Miniature Aerial Munition System (LMAMS) program is an example of the ongoing experimentation with such small UAS and loitering munition systems. While this program was conceived during a counter-insurgency, lower intensity time period, lethal air munitions (LAMs) hold significant potential to enhance the light infantry's ability to combat near peer adversaries in more conventional fights. One of the early entries into

the program being examined by both the US Army and Marine Corps, is the Switchblade. The Switchblade at 5.5lbs, launched from a disposable tube about the size of a 60mm mortar is fully man portable, but is limited to a 10 kilometer range and only has 10 minutes of flight endurance. While it is claimed that it can engage targets in a Non-Line-of-Sight (NLOS) capacity, in reality the target operator has to maintain line of sight with the Switchblade before giving it the electronic order to dive and attack a target.⁵

While Switchblade is currently a partially fielded weapon system, ongoing US Army experimentation exhibits higher potential with respect to the range and lethality to make LAMs relevant to light fighters. UVision of Israel has developed a family of loitering munitions, the Hero series, which function first as a missile moving to their target area, then as a UAS to loiter, track targets and transmit video to the rear before finally acting again as a missile to attack the designated target. With six LAM variants, the Hero can loiter between 30 minutes to 7 hours once launched, engaging targets between 40km and 250km. With a variety of warheads, the Hero increases in lethality with missile size (ranging from man portable to light vehicle mountable), but can attack enemy tanks, artillery, air defenses system and structures. As of May 2016, Raytheon has partnered with UVision to develop a refined Hero system model for inclusion in the US Army LMAMS program. Able to function autonomously, semi-autonomously or manually in the man in the loop mode, the Hero is an excellent example of a system that could extend the infantry's organic ability to strike out to 40-250km.⁶



Figure 5. UVision's HERO 30 loitering munition on display.

Another similar lightweight loitering munition system is the Israeli Aerospace Industries Green Dragon. 12-16 Green Dragon units can be carried in a launcher on a small vehicle and when fired have a range of 40km and an endurance of 1.5 hours. With Green Dragon, an operator is able to bring a three kilogram warhead to within one meter of a target on command. If once fired no target is located, the Green Dragon can parachute safely to the ground and be reused, saving money and preserve capability.⁷

Such LAM systems have significant ramifications for vertical envelopment and deep operations, allowing a small force to strike at significantly longer distances from high pay off targets such as suspected enemy command and control, logistics nodes, artillery, and air defense systems. Procurement and employment of already commercially available LAMs, would make light forces immediately more lethal, while also more difficult to locate and strike. Light forces armed with LAMs would pose a persistent threat to larger enemy formations and rear areas, forcing changing in their security posture. This capability would allow insertion and extraction of

forces from outside the air defense threat of all but the high capability systems, like the S-400. Increased stand-off range would act as significant protection from larger enemy ground forces, enabling the inserted strike teams to be smaller than the current norm, perhaps a single detachment or section with 1-2 LAM equipped ultra light combat vehicles.

In addition to aviation based systems, remote ground systems could significantly extend the range and lethality of light forces conducting a range of operations including defense, raids and ambushes. Western nations have significant technological capability, but have under resourced the development of ground based unmanned systems. Alternately, Russia has stated an objective of having up to 30 percent of its ground combat systems be unmanned, and has made significant strides in developing feasible systems. A recently revealed Russian made unmanned ground combat vehicle (UGCV) family is scheduled to begin integration into the Russian military this year. Utilizing a 1,450kg modular combat unit which can be mounted on a variety of platforms from the BMP series of infantry fighting vehicles to heavy trucks, Russia has begun developing UGCV systems for export. The Vikhr model of this system is based on the BMP 3 chassis with a 30mm auto-cannon, coaxial machine gun and six ready to launch AT-14 ATGMs allowing it to engage tanks out to 8000m. It can also be fitted with a full suit of air defense weapons systems to augment tactical air defense zones. Weighing 14.7 tons, the Vikhir represents an interesting concept and a serious threat, but due to it's size and sustainment needs, it is of little use to the light infantry. The Vikhir's "little brother" the Uran-9 (soon to enter

service) is however a concept worth examining.



Figure 6. Russian URAN-9 unmanned ground combat vehicle.

At 10 tons combat loaded, the Uran-9 in standard configuration is armed with a 30 mm 2A72 automatic cannon, four ready-to-launch AT-9 ATGMs, four Igla-V surface-to-air missiles and a coaxial machine gun, making it a formidable adversary to armor and aircraft. As it might be anticipated, however there are weak links in this new Russian UMGCV system, such as the requirement for a control station based on two medium trucks with three operators, as well as the limited vehicle autonomy and remote control range. While this current configuration prevents the system from being easily air transportable and introduces a targeting and mobility vulnerability (the operator trucks), the Uran-9 should be viewed as an intermediary step in the design of a new class of UMGCVs.

A western developed UMGCV similar to, but smaller than, the Russian URAN-9, could be a useful system for certain light infantry operations. Such a vehicle could be designed to capable of internal or external transport by CH47 and CH53, internal loading in a C-130, and

parachute deployment from a C-17. A modest number of systems could be grouped at the battalion level or could be attached to smaller units to provide direct fire and air defense support as required. Unlike the URAN-9, a western UMGV could also be developed to operate with a much smaller control unit and more autonomy to simplify its operation. Whether such a suggestion is pursued or not, friendly forces will in the future need to be prepared to counter systems such as the URAN-9 with greater frequency as they are likely to be deployed to support lighter opposing forces which lack heavier mechanized capability.

Missile technology has advanced to the point whereby properly equipped light forces can defeat or delay enemy mechanized formations beyond the range of current in service anti-armor systems such as the Javelin or TOW anti-tank guided missiles (ATGM). Non-line-of-sight (NLOS) medium range missile systems such as the Israeli designed SPIKE NLOS, are available today as an off the shelf product capable of increasing infantry anti-armor capability to 25km without requiring a direct line of sight from firer to target.⁸ Furthermore SPIKE's new SPARC vehicle mounted launcher (presently mountable on vehicles such as the Polaris MZR), offers an inspiration for future research and development. A NLOS launcher system paired with a remote controlled UMGCV, would have almost three times the effective range of the URAN-9. Such a missile system could also be used by land forces to target naval vessels and small craft operating in littoral waters, as the SPIKE NLOS is already serving in an anti-ship capacity with several navies. A UMGCV which is capable of autonomous repositioning, is air transportable internally and externally via CH-47, CH-53 helicopters, air droppable, and in the future ideally transportable via a larger UAS, would mean a significant increase to ground fires capability outside of the artillery.

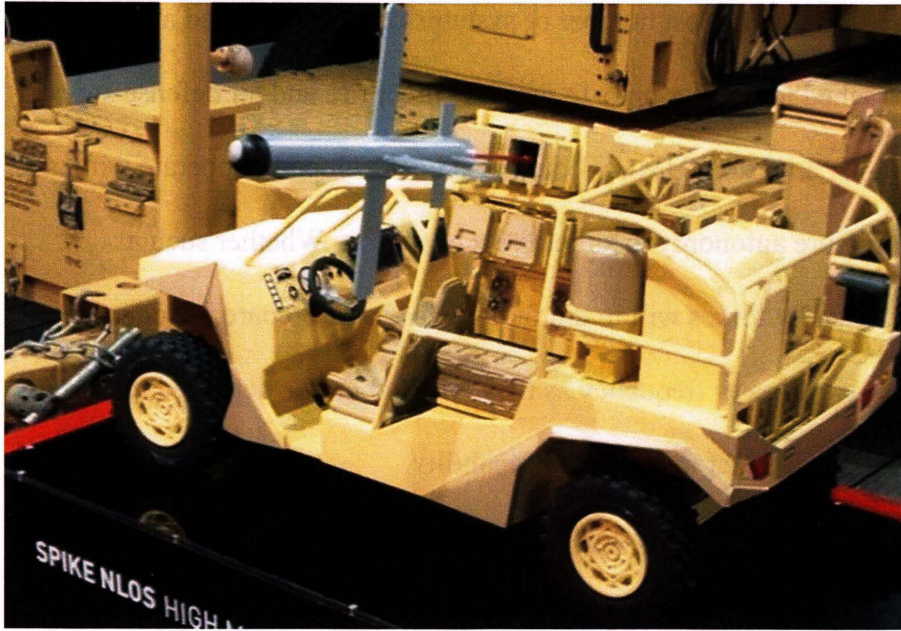


Figure 7. A model of a SPIKE NLOS high-mobility launcher on a Polaris MRZR 4 on display at Eurosatory 2016, Paris.

The U.S. military had a similar missile system in development under the NETFIRES program, but it was cancelled by the Pentagon in 2010 due to cost overruns and performance concerns. With a 25-mile range, the NETFIRES system was to be based on an entirely self-contained, ISO container launched PGM, independent of its transport vehicle.⁹ While developing a new NLOS missile may not be required or cost effective for light forces at this time given their existing market availability, working with industry to develop a platform universal container launcher could produce a useful weapons system that is air deployable, expendable and able to be easily concealed in environments such as urban areas.

While western ethics and military paradigms have imposed limitation on the degree of autonomy of robotic systems with lethal weapons have been afforded, human-machine teaming could allow targeting, swarming engagement, and withdrawal from extended range before an enemy is even aware that it is under attack by light forces. Semi-autonomy in such systems, could allow a limited number of light forces operators to control multiple unmanned ground combat vehicles from a concealed attack positions.

IV. Protection.

Events, such as the July 2014 pairing of Russian Unmanned Aerial Systems (UAS) and rocket artillery to render two Ukrainian mechanized battalions combat ineffective in only a few minutes, should make plain the risk of an army's over reliance on massed heavy forces. To avoid UAS observation and targeting, Ukrainian military units have been forced to expand unit frontages significantly and disperse.

Conducting ground operations without air supremacy and the problems generated by advanced air defense systems protecting long-range surface-to-surface capabilities should be addressed to improve land force protection. While this is certainly an issue for the joint force to resolve as a team, without at least range parity in surface fires, ground tactical units may be too concentrated based on force employment concepts and therefore too targetable for the modern battlefield. Distributed lethality, lower density of forces, a higher density of fires and observation is the future requirement for battlefield survivability. This is at odds with the recent trend toward increased protection at the expense of stagnating mobility and firepower resulting from combating low capability adversaries. This desire to protect friendly forces against a different nature of threat has restricted dispersion and concentrated sections of soldiers into vehicles such as MRAPs, which while highly protective against mines and small arms, make more light forces targetable should the next conflicts be against a more capable enemy.

The Joint Light Tactical Vehicle (JLTV) should address some of these issues, with its armor being modular in nature, the JLTV offers protection comparable to the MRAP but for roughly 11,000 less pounds of weight. As the JLTV is designed to be sling-loaded beneath a CH47 or CH53 and moved internally in a C-130, (unlike the MRAP), light forces can integrate the JLTV into future tactical employment concept. While the JLTV may not be appropriate for all light forces missions, as its use would limit mobility in certain terrain, it may prove useful to perform

some command post and weapons platform functions at the company and battalion level. Future iterations of the JLTV may prove a more flexible and capable vehicle platform for the integration of some of the previously mentioned systems such as UAS, loitering air munitions and NLOS systems with higher capacity missile racks than those designed for ULCVs.

While the new wheeled JLTV will enhance protection and may be appropriate for motorized infantry, it will lack the mobility to operate in terrain where medium weight wheeled Stryker and heavier armored forces cannot go. To be capable of operating in swamps, bogs, heavy snow and in the mountains, light forces should have regular access to a protected extreme terrain vehicle such as the BVS10 MkII or a similar substitute.

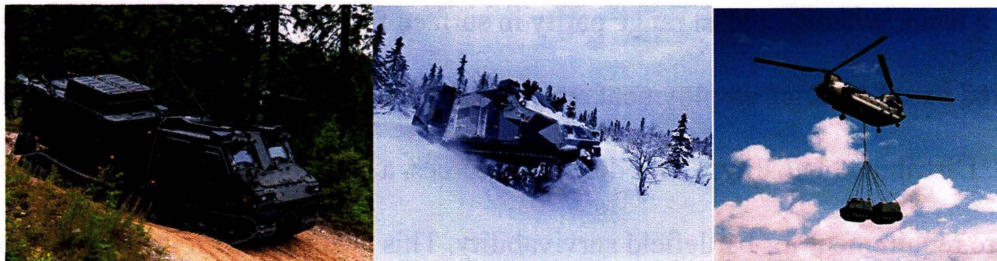


Figure 8. The BAE BVS10 "GOANNA" moving over terrain and being slung beneath a CH47.

While often thought of in association with medium weight forces, the BVS10 is already in service with the Royal Marines and the French Army. What the BV series offers is an extremely mobile vehicle that can carry four soldiers in the front section or an additional ten soldiers in an armored personnel (APC) variant trailer. The versatility of this system exceeds the JTVL (with the important exception of internal CH47, CH53 and V-22 loading) with a wide selection of possible trailers configuration: command post, ambulance, logistics, mortar, radar, power generation, and desalination variants. The ability to build to purpose trailers which can be rapidly attached and detached for specific missions offers the potential to have UAS, Counter UAS, ISR, Short Range Air Defense and PGM (NLOS/LAMs) strike capabilities deployed forward either at the battalion or brigade level to support light forces. Fully at home in the water,

land and air, with its dual articulated drive, protection against small arms, blast and shell splinter, the BV type vehicle offers a combination of protection and mobility unlike either a ULGCV, the JTVL or a Stryker.

Similar to the MRAP's limitations as a tactical vehicle, from a human performance perspective- heavy and bulky personal protective equipment (PPE) presently limits the light infantry's performance. Given the politicized nature of even relatively small numbers of friendly casualties in recent conflicts, the level of personal protective equipment issued to soldiers has become highly sensitive. This has resulted in the inability of many commanders to manage risk to force by tailoring protective equipment use to optimize soldiers' performance for mission success. Notably the British Army is resisting this trend with several programs aimed at improving their future light forces performance. In a study analyzing dismounted load carriage during Op HERRICK in 2013, British researchers observed that soldiers typically carried 58kg with 20.9kg dedicated to avoiding personal injury.¹⁰ Under Project HERCULES, the British Army is trying to reduce the average dismounted combat load from 58Kg to 25Kg, to avoid significant degradation in soldier performance. In order to rebalance the lethality, mobility and protection mix, as of 2015 British commanders will have a choice of three versions of PPE to allow them to customize PPE to the mission requirements.¹¹ While the most effective way to reduce PPE requirements is to avoid being seen or targeted by enhancing fires and mobility capabilities, more resources should be devoted to developing a more modular, lighter weight, customizable PPE specifically for light forces.

V. Sustainment.

Human-machine pairing between UAS and ground based systems could be used to deliver resupply forward to caches or redistribution points. If a more autonomous flight mode were to be developed for the ARES, it could be possible to enable pull logistics whereby forward

operators, might simply submit a request for a particular type of resupply and ARES could autonomously fly pick it up from a rear staging area with various pre-packaged cargo modules and drop it off to the forward unit in a designated location. With refinement ARES or the next evolution of UAS might be capable of micro aerial delivery of small payloads using sling loads, speedballs or parachute delivery.

As an example of a possible system of future combat resupply, a platoon on a mountain ridge several kilometers away from a company resupply point might be running low on ATGMs due to a recent contact, while another two platoons on key terrain over a dozen kilometers away could also have urgent needs. Using networked tablets and a simple drop down menu, the soldiers could select their needs having simultaneously passed to the company quartermaster and onward the battalion service support company. Once the quartermaster selects what he can fill from his forward position, the request would be updated and the battalion supply section would appropriately load an ARES cargo flight module with the specific resupply. ARES would then fly into a suitable landing zone in the vicinity of the forward platoons, where a limited number of soldiers could use semi-autonomous systems like the General Dynamics robotic Multi-Utility Tactical Transport (MUTT) systems in armed and cargo variants to transport the supplies back to their platoons via a miniature robotic convoy.¹²



Figure 9. The General Dynamic MUTT can be configured to carry a weapon system or cargo saving on manpower when executing resupply. In the future a simplified pallet loading system with a winch could speed you field loading of prepackaged resupply from airdrops, UAS deliver and ground convoy.

Once achieved, reliable on demand logistics will significantly enable light forces conducting operations either on foot or with limited vehicle support. Multiple studies indicate that the infantryman may be carrying far too much to be effective, and that much of the reason for this overloading is not the immediate requirements of combat, but rather a lack of confidence in the ability to resupply class I, V and VII items in a timely manner.¹³ A system such as the one highlighted in the previous vignette would likely go a long way towards enabling commanders to assume some risk and travel lighter, lowering water consumption and leaving soldiers less fatigued, generally more alert and ready for combat.

In situations where it may not be advisable to risk a medical evacuation (MEDEVAC) aircraft, with an aircrew, it may be possible to evacuate soldiers who might not survive long waits for the situation to become permissive enough for MEDEVAC. Another often overlooked,

but currently resource intensive requirement is the proper handling and rapid rearward movement of soldiers who are killed in action. UAS and human-machine teaming could be available in the near future to extract KIA in high risk areas.

Disaggregated operations with platoons and sections separated by tens of kilometers poses another significant hurdle to C2 not typically experienced by conventional light forces. Presently, if tactical satellite communications cannot be used to provide voice and data, the degree of physical separation between a unit and its next echelon of command is often imposed by the range of communication to coordinate tactical actions via radio. While the increased availability of ULCVs on certain missions may allow the use of amplified communications at a higher transmission wattage than handheld radios, ULCV may not always be present and dismounted communications will probably remain challenging.

Airborne radio rebroadcasting (RRB) both manned and unmanned, are already being used to enable or extend the range of UHF/VHF radio in communications challenged or contested environments, but its practicality and availability to small units is limited due to the high demand for, cost and the size of, the platforms required to execute the task. Due to size, weight and power requirements UAS RRB packages have typically been limited to larger UAS such as the GlobalHawk or Predator. Developments in electronics miniaturization are now enabling RRBs such as Harris' small secure data link system to be installed in small UAS. Weighing only 18 ounces and measuring 3 by 5.3 by 1.6 inches, this system was tested by the USMC in the RQ-11 Raven UAS and significantly improved squad VHF/UHF communications well beyond line of sight. While the RQ-11 and similar systems may only be useful as an RRB for short durations due to flight endurance limitations, small VTOL UAS could be adapted in the future to temporarily establish communications during pre-designated time windows or in emergency situations.

Conclusions.

By examining the nature of current and near future technological development in the context of warfighting functions, a picture of future ground combat where dispersed light forces are able to play a more credible role by decisively engaging larger formations from significant distance emerged. Light Infantry with its current short range weapons systems, lack of integral mobility and ISR assets will not survive tomorrow's fight. Many technologies exist today that could dramatically change the way light forces are resourced and employed, but institutional inertia within many western armies must first be overcome. While the infantry platoon attack and other fundamental infantry tasks are unlikely to disappear in the near future, it appears tactics, techniques, and procedures will be due for a rapid change in the undesirable event of a near peer conflict.

Mutual support between units is likely to be executed in a very different manner than it is today with platoons being able to communicate with and provide organic fire support to other units many kilometers away. As technologies mature and are fielded, the frontages and minimum force packages for certain missions will likely change significantly, with platoons augmented by unmanned ground combat vehicles and semi autonomous systems executing tasks that might currently take double or triple the manpower. While careful thought and experimentation are required, it is clear that to be ready for tomorrow's fight light infantry units should begin significant evolutionary changes today.

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