



TIME TO GO ELECTRIC?

Jeff Pike explains the immediate benefits and logistical support implications of electrification on the battlefield

When walking the floor at the Defence and Security Equipment International arms fair last year, I was struck by the volume of conversation around introducing electricity as a power source into the battlefield – perhaps not so surprising with environmental factors being one of the dominating news items of 2019. When the topic is first mentioned it perhaps conjures unrealistic visions of fully electrified ships, tanks and aircraft, built as now

but without combustion engines, operating in combat environments.

But the same challenges of civil electrification of vehicles apply to battlefield electrification in terms of limited range, cost, weight and the fact battery technology has been slow in its evolution and hasn't kept up with aspirations. With this in mind, we are probably at least 10 years or more away from this eventuality. But the more realisable and often overlooked near benefit of electrification comes with the strategic change to

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battlefield support assets and unmanned vehicles (sea, land and air), coupled with a focus on logistics support and the military supply chain.

Military conflicts are becoming increasingly reliant on logistics to underpin the huge undertakings of maintenance and shipping personnel, equipment and supporting resources to often remote, difficult to reach locations and then trying to sustain them. An effective logistics strategy can be the difference between the success and failure of an entire military campaign and fossil fuels play a key role here. Did you know, for example, the United States Department of Defense is the largest consumer of fossil fuels in the world? While the Air Force is where most of the fuel is used, armoured divisions consume a surprisingly large amount, too.

For every tank there are three tankers chasing it. The US Army can use as much as 600,000 gallons of fuel a day to run an armoured division. The M1 Abrams tank gets about 0.6mpg and even a cargo vehicle such as the M-1070 semi-trailer, designed to haul fuel, delivers approximately 1.2mpg. To put this into context, in the Afghanistan war, Pentagon officials told the House Appropriations Defense Subcommittee a gallon of fuel cost the military about \$400 by the time a combat vehicle or aircraft arrived in the remote locations where US troops were operating.

All this 'logistics' comes with challenges the likes of which the average DHL logistics delivery doesn't encounter. Look at the successful modern conflicts of recent times – all the victorious sides had the benefit of air superiority. Gaining this superiority comes at a cost – air bases require a huge logistics footprint, which opens up attack vulnerabilities. But, without air superiority the logistics footprint is a massive vulnerability.

Consider fuel alone. Simply transporting fossil fuel to the forward-operating base requires a huge convoy of military vehicles. Moreover, fuel stored in remote bases is housed in vast flexi-tanks, can be difficult to hide and incredibly vulnerable to aerial attack. Then the convoy and broader logistics support machine itself needs security, feeding, accommodation and support, thus perpetuating the need for more personnel who, in turn, need supporting themselves.

WEIGHING UP THE COSTS

All this comes at a human cost. US Army Environmental Policy Institute figures indicate the casualty factor for fuel resupplies in Afghanistan was 0.042, which is 0.042 casualties for every fuel-related resupply convoy – or almost one casualty for every 24 fuel resupply convoys. When you take into account the number of US-only full-up fuel convoys required in Iraq in FY2007 was 5,133, the casualty count is quite alarming.

Making the transition to electric could deliver strategic battlefield advantages – limiting maintenance overheads and more importantly offering a direct benefit to reducing the loss of life.

QinetiQ, a multi-national defence technology organisation comprised of scientists and engineers at the forefront of research and commentary on the use of electric propulsion in the defence, security and aerospace sectors, has produced in-depth research on the state of military electrification. But the benefits of electrification are far more than simply going green – they can deliver huge logistical advantages in both the near and long term.

Battery life quickly becomes a limiting factor if we look at battlefield electrification in terms of entire vehicles. In

the short term, it is far more likely we will see – and are starting to see – point electrification of support and secondary systems as the initial military focus.

Forward operating bases consume vast volumes of electricity, often as much as 1000s of kilowatt-hour a day. This demand is currently met almost entirely by generators fuelled with diesel, which brings the supply chain concerns around efficiency and safety to the fore.

Take one use case from the US army in Nimoz, Afghanistan, called Operation Dynamo. The base installation mandated 13 generators, but many were running far below their capacity. The army changed to two generators and two 'hybrid sites' which included a trailer with a generator, battery pack and solar panel to provide power for very specific missions. If the solar-charged battery didn't provide a sufficient source of energy, the generator could kick on.

Total fuel savings for the project came to about 1,600 gallons a week. Labour hours have also been reduced, saving 30 man hours in the same period due to the lack of need to refuel. This was

ELECTRIFICATION CAN DELIVER HUGE LOGISTICAL ADVANTAGES IN BOTH THE NEAR AND LONG TERM

further complemented by an additional 20 hours of maintenance on the generators saved per week, enabling engineers to focus their time and efforts on more pressing maintenance concerns elsewhere.

We are already seeing electric unmanned aerial, land and sea vehicles entering service. Research from IDTechEx, expert provider of market intelligence in emerging technologies, shows that electric vehicles for military, security and police duty will make up 15 percent of the total market in 2022. The bulk of this demand has been for air (UAVs) and is now moving towards military vehicles on land; the water and airborne applications alone will become businesses in their own right worth well over \$1-billion yearly within the decade.

In fact, the US army has set out a 10-year goal for full electrification of its assets and equipment – witness its Next-Gen Combat Vehicle programme, a prototyping effort underway at the Army Tank Automotive Research, Development and Engineering Center, which involves the design and production of two prototype tanks over the next couple of years.

There is a considerably reduced logistics footprint associated with these electrified – often, but not always – unmanned assets. Electric vehicles in theory should weigh significantly less, are considerably less mechanically complex, use easily routed cables to deliver four-wheel power (not vulnerable drive shafts), are simpler to maintain, run on renewable energy and have much lower failure rates.

Combine this with the switch toward unmanned sea, land and air vehicles (UVs) in many operational functions and there is a distinct electrification opportunity that large, protected man-limited vehicles simply cannot realise. Most are genuine cases for realistic electrification. The result is that the already complex, multi-layered, multi-tiered, support model

across military operations and the broad portfolio of equipment and inventory types is about to broaden further and increase in complexity. Defence and in-service support organisations need to prepare for these eventualities in both the short and long term. There are significant advantages that come with battlefield electrification. For these benefits to be realised now and into the future it requires systematic change of supply chain and logistics processes, control of transformation through stages of implementation and the inherent ability to cope with variable equipment types.

AN EFFECTIVE LOGISTICS STRATEGY CAN BE THE DIFFERENCE BETWEEN SUCCESS AND FAILURE

It is essential that flexibility and transformational agility are driven into processes. While change management is something the military has not historically perfected, the reality is that information support systems are the key to success and optimisation. Supporting a wind or solar-powered farm in a deployed base is not the same as supporting the fossil fuel generator that preceded it, even if the maintenance objectives are the same. As such, it is key that military forces rely on enterprise asset management (EAM) solutions with built-in

adaptability for new assets and logistics principles – from procurement of the asset, all the way through to frontline maintenance and support. The last thing anybody wants is for the electrification of the battlefield to become an information security (IS) project overhead, so make sure you choose wisely.

LOOKING TO THE FUTURE

As the QinetiQ report clearly explains, the success or failure of electrical technologies in defence will be determined by the quality of the infrastructure behind them – not just charging points but the multi-faceted supply chain, the IS processes and equipment visibility and much more. As I have highlighted, we are probably some years away from effective, full electrification of major equipment or weapon systems – there are some major engineering challenges to overcome and battery technology needs to have an evolutionary moment.

But electrification of support, certainly secondary support, can deliver strategic operational advantages – programme efficiencies and safety being paramount – to any modern fighting force and will be essential in easing the fossil fuel supply hydra. Link this with the move of operational delivery toward unmanned capabilities means electrification is hitting the battlefield and things are changing now – and will continue to do so for good strategic reasons. Watch closely throughout the next decade as we see the most forward-looking defence forces seize this strategic advantage ●

Jeff Pike, Head of Aerospace & Defence Strategic Programmes & Initiatives at IFS has worked in A&D and IT for more than 30 years having spent some 20 years as a Royal Air Force senior officer specialising in a number of logistics areas. He is responsible for global IFS A&D strategy and supports global IFS A&D Marketing, Industry Marketing and Business Development.

Transporting fuel to the forward-operating base requires a huge convoy of military vehicles



Picture credit: US Department of Defense