MILITARY POWER SYSTEMS

GAINING A TACTICAL ADVANTAGE THROUGH EFFICIENT POWER MANAGEMENT

INTRODUCTION

Efficient power management could provide a key tactical advantage to expeditionary forces, as it would enable them to stay operational for longer in austere environments.

Ahead of the inaugural Military Power Systems conference, Defence IQ had the opportunity to gain exclusive insight from Tony White, Chief Technology Officer Land at Ultra Electronics and speaker at the event. He outlined what tactical advantages an efficient power management can bring to troops, what challenges militaries are facing when it comes to implementing fully integrated and interoperable power systems and how he sees power systems evolve in the next decade.

> *“Power management starts on the premise that there's never enough power”*

I'd like to start by asking you to explain what power management means in the military and what impact efficient power management has on troops.

I guess power management starts on the premise that there's never enough power. I like to use the parallel of the Starship Enterprise: Captain Kirk is the captain of the ship, and he has two tools available to him to protect it: the weapons and protection system, and the engines allowing him to move around and escape quickly. He can move the power around his ship, either to one tool or the other, thanks to engineer Scotty who enables him to do so. Unfortunately, in our military world we don't have a Scotty. There is no current way of managing the power consumed by equipment and it is taking more and more energy generation and storage.

Assuming that we have power management in the military, what we can do is improve troops' operational effectiveness because warfighters are able to do their job, which is fight, as opposed to carrying extra batteries or extra generators.

Power management also allows for a reduction in the logistics supply chain. Let's take an example of a generator in a forward operating base, which uses fuel like diesel to work. How does that diesel get there to the frontline? It needs to be brought to the base by a fuel tanker in convoy and protected by troops.

"Power management allows for a reduction in the logistics supply chain"

This is a dangerous and threatening position, because this convoy is a potential target; power management would help avoid these situations as the fuel would be better managed and therefore less would be needed.
If we take the example of a vehicle on silent watch, where the soldiers are running solely on batteries because the engine is turned off, a smart gage would be useful. It would show troops how much battery life they have left and would indicate how long they can remain on mission. Various power modes would ensure the running of critical equipment.

Soldiers would see the number of batteries they carry being reduced and their operational duration would be enhanced, as power would be optimised and distributed to the right equipment.

What tactical advantage can an efficient power management provide to the dismounted soldier and how do you see it develop in the next ten years?

Soldiers could charge up in platforms carrying them to the battlefield, either a vehicle or aircraft, so they're at maximum charge when arriving on the battlefield. Managing the power efficiently would enable them to decide which device uses power and when. I have heard that currently, soldiers turn their radios off to save energy, and turning them on every ten minutes or so to do a radio check. If we could manage power better, then they could leave their radios on all the time and sacrifice some other device that isn't so critical.

Battery technology itself is improving almost every year, and in the next ten years I see an improvement in batteries which will give us longer duration and renewable charging. The ability to recharge from solar, wind or some kind of thermal generator means self-sustainment for troops.

Moreover, at the moment power management is manually operated, so the soldier has to push a button to turn devices on and off. I think we can probably automate that a little to take advantage of artificial intelligence.

What are the three main challenges in implementing fully integrated and interoperable power systems on the dismounted soldier?

As it stands at the moment, we're doing integrated and interoperable power systems today. There are some challenges, typically around connector standardisation for example, as we don't want soldiers to end up with too many cables and adaptors to integrate other devices.

Related to that is ergonomics, meaning anything soldiers wear is always going to be in the way. Finding the best place to locate all this equipment will need to be done, not just for the power system, but for the overall soldier system. If we think about the push towards a centralised power source, where a single battery can power all the devices that the soldier is wearing, then the location, size and shape of that power source becomes quite important.

The third challenge is fast and efficient charging. Soldiers can't wait for eight or 24 hours for their power systems to charge before they can return to the battlefield.

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What solutions are currently available in the market which can help troops achieve a power generating base?

Microgrids and generator farms are becoming commonly available in the industrial and domestic market. These are now looking at being fielded into bases, and renewable energy will feed into the microgrid predominantly.

There is a new standard for bases called Generic Base Architecture, which is Defence Standard 23-013. That standard helps define, amongst other things, how the power system should be connected up on the base and how it could be made scalable, to add and remove power capability as the base grows or decreases during the time in theatre.

What are the main challenges that militaries are facing when it comes to building independent power generating infrastructure in austere environments?

The first one is not only related to bases, but it is around the operating environment. We need power-generated equipment to work all the time and in various environmental conditions which will drive rugged design. The challenge is putting together a generating infrastructure that runs across a set of globally difficult environmental conditions, and making it cost-effective.

"Microgrids and generator farms are now looking at being fielded into bases"

Militaries have to balance the investment and the requirement for a system that can be operated globally in all difficult environmental conditions.

The second challenge is standardisation, as uniform parts and interfaces would allow two things. Firstly, the integrator or the

MOD could buy components from a variety of sources and would not be locked into one vendor, as it is the case today. Secondly, the interoperability in a coalition environment would be well improved as troops could charge their power systems from another troop's system.

What advantages do electric or hybrid vehicles provide to the military?

Currently, hybrid vehicles are so new in our domestic life that it is quite difficult to cite an advantage we realise today. The obvious one is stealth, because an electric vehicle is not noisy and therefore, it's stealthier. The dependency on diesel decreases and even becomes null, reducing the logistics burden, as I explained earlier. This could become an interesting advantage but this is speculation only, as there are no electric or hybrid vehicles currently in operation.

Could these vehicles potentially provide power to either soldiers or bases and act as an energy generating hub?

Yes, I mean, that's exactly what they do already. As I mentioned earlier, they can provide power to soldiers and that is certainly one of the future uses of a vehicle. A base, in its crudest form, can simply be two vehicles parked up with a tarpaulin cover between the two. In fact there is a very well-known configuration known as the crucifix, consisting of four vehicles parked in a cross, back to back and covering the centre is a tent, producing a small operating centre. They generate the power they need locally to themselves.

All our UK vehicles, and certainly vehicles in Europe, have what is called a NATO charging socket, which provides the ability to access the vehicle power from outside the vehicle, to export power from there. We already use it for inter-vehicle operations and I see no reason why it could not be used to provide power for soldiers and bases.

How do you see these platforms develop in the next ten years?

In the next ten years, hybrid vehicles will take advantage of the commercial domestic market. When we see improvement in distances between recharging and lighter battery packs at home, then it will get reflected in the military market. At the moment the 100 miles range between charges is not enough on a military vehicle.

Why is the military market led by the civilian market and not investing in R&D?

There's not enough of a budget for the military to invest in R&D.

Elon Musk is currently investing billions in lithium battery technology for electric cars and there is no way the military market could generate that kind of investment. There is currently a big push towards the green element in the civilian market, so we have to take what's happening in the larger automotive market and use it.

How far are we from achieving hybrid vehicles in the military? Do you have any timeframe estimate?

If we mean achieving as in they are in service and ready to go into battle, then we are probably looking beyond ten years. There is a significant piece of work happening in the United States called the Next Generation Combat Vehicle. That platform promises to be at least a hybrid, if not an electric vehicle and it will replace one, if not two of their main battle tanks. This is a five to ten year programme and should be one of the first steps towards having an operational hybrid vehicle good enough to go into service.

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