

White Paper

# Reducing the Logistical Burden Posed by Disposable Batteries

September 2016



“An army marches on its stomach” is one of Napoleon Bonaparte’s best known maxims. While current military technology bears little resemblance to the muskets and lances of the eighteenth and nineteenth centuries, the issue of sustaining deployed forces is still the chief preoccupation of expeditionary forces worldwide.

Modern generals share Napoleon’s burden of equipping their soldiers with clothes, rations and ammunition. Modern warfare brings considerations not seen in the Napoleonic era, yet somewhat surprisingly it is one of the smallest items in a soldier’s backpack that presents one of the largest challenges. The growing impetus on modern soldiers gaining enhanced capabilities through technology and innovation requires greater attention on how this can be supported. As new electronics become standard issue equipment for modern soldiers, is it sustainable for a modern army to rely upon on disposable batteries?

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## The financial burden of technology

Modern militaries are under significant pressure to find an optimal balance between cost and capability for troops. In domestic life, batteries can be seen as a minor by-product in the cost of running electronics. However, in theatres of battle a battery represents the vital power needed to ensure the equipment providing a soldier with an edge on the battlefield continues to operate. Running out of power is simply not an option when batteries power mission-critical equipment such as radios, GPS receivers, electro-optic sights and night vision goggles.

The UK currently spends around a third of its defence budget on new military equipment, a third is spent on personnel (civilian and military wages) and a third is spent on other goods and services. However, while the UK is allocating an increasingly smaller proportion of its resources to defence the cost of the components of defence expenditure (personnel, equipment and services) have been increasing. Batteries can be seen as a key component of this trend. The US Army Research Laboratory reported in 2011 that a typical infantry battalion spends more than \$150,000 on batteries alone each year, the second highest expense next to munitions. Examples of the extent of this dependence on batteries can be seen across most modern militaries. The UK MOD figures show over 5.6 million batteries issued to the Royal Navy, RAF and Army in the three years to 2015 alone. In 2013 this represented a cost of approximately £2.9 million for AA and AAA disposable batteries, with many other types also in use. This represents the annual wage expenditure equal to approximately 85 infantry soldiers just for these two types of primary cell.

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As the level of technology supporting troops on the front-line at present continues to develop, the innovation behind powering this equipment has not necessarily kept pace. With the cost of sustaining the equipment a soldier carries exceeding that of sustaining the soldier himself it is up to industry to consider more sustainable solutions.

## Batteries by the tonne

While the unit cost of batteries highlights a significant expense, the cost of procuring the batteries needed is considerably multiplied by the need to ship them into theatres of operation, placing additional strain upon already-stretched supply chains. Armed forces operate in the most challenging and often difficult to reach areas of the planet and the logistical task of supporting these efforts presents a significant challenge. It was reported in 2015 that the original purchase cost of a single AA battery is increased one hundred-fold by the time it arrives in a soldier's hands. Whilst this figure almost certainly relates to the most extreme cases, it does illustrate the impact of cost escalation beyond the initial purchasing price. Given that the procurement cost of batteries represents millions of pounds, it is easy to see the scale that the true cost of disposable battery dependence may have once shipping, storage and handling have been considered.

Financial cost is just one consideration when exploring the overall implications of disposable batteries. It is estimated that battery weight is a fifth of the total weight a soldier typically carries in theatre. Space and weight are a premium when getting supplies to front-line troops with difficult decisions to be made over prioritising what is included within this restricted capacity. At the height of UK operations in Afghanistan the Commons Public Accounts Committee revealed that in the six months to November 2010 more than 40% of deliveries were a month or more overdue in 2010-11 yet some 130,300 individual deliveries were still made to Afghanistan in 2010-2011 alone. The logistical expectation on modern militaries is immense; despite being initially designed to handle no more than 12 aircraft movements per week, Camp Bastion grew to become one of the top 5 busiest UK-operated airports due to extensive demand. Amidst these challenges, DE&S report that the MOD issued over 2 million AA and AAA batteries to frontline commands in 2012-13. This represents a weight of approximately 20 tonnes before packaging – equivalent to 42 Watchkeeper Unmanned Aerial Systems.

## The true charge of batteries

Given the described limitations of primary cells in terms of cost, weight and logistical burden, the question may be raised as to how this method of providing power to dismantled troops has become so prevalent. The disposable battery as we know it today has developed through many iterations and innovations since the 1800s and has grown to become a staple item of modern militaries. Disposable batteries have been seen as reliable, easy to use, sufficient shelf-life for stockpiling, and requiring no training to use. The power density of primary cells increased through the 20th century suiting defence forces deploying new technologies. Therefore disposable batteries, mass-producible and cheap, became standard. Little was done to break this trend as the addition of a rechargeable battery to equipment such as radios represented an additional upfront cost – while often requiring further outlay on manufacturer-specific charging cables – and the need to recharge such equipment brought operational challenges.

**“The MOD issued over 2 million AA and AAA batteries to frontline commands in 2012-13”**



Figure 1: The weight of batteries shipped in 2012-13 by the UK MOD is the equivalent of 42 Watchkeeper UASs.

**“The opportunity cost of packs of disposable batteries is foregone ammunition and water, vital to completing an objective”**

As dismounted soldiers have been issued with more and more technology, these previous assumptions have diminished. Soldiers have now reached maximum carrying load, with the increased weight from equipment and batteries enforcing a trade-off against the soldier's mobility, effectiveness and long-term musculoskeletal health. The opportunity cost of packs of disposable batteries is foregone ammunition and water, both vital to completing an objective. Moreover, the demand to be re-stocked with disposable batteries has begun to impose a limit to the operationally effective range of dismounted troops as they are unable to operate independently for in excess of a couple of days because of their supply tether. Effectiveness in tactical situations, such as operations in enemy territory, is at risk when a dismounted soldier is limited by carrying capacity, required to change batteries every few hours and requires resupplying every few days.

So what is the true cost of disposable battery dependency? It must be argued that the up-front procurement savings of disposable batteries are in fact dwarfed by the detriments of the true through-life cost of an enforced commitment to disposable batteries. This manifests itself in significantly greater procurement costs throughout the equipment's lifecycle, increased logistical strain from the stream of batteries required and risks to the tactical effectiveness of deployed troops. NATO figures reveal that 3,000 US soldiers were killed or wounded from 2003 to 2007 in attacks on supply convoys in Iraq and Afghanistan. There is a growing consensus that reducing battery dependency is vital to operations, financially prudent, and mission-critical.

It is clear then that reducing the logistical and financial burden associated with supplying batteries to deployed forces requires a nuanced solution. Momentum is building with some militaries beginning to deploy new equipment specifically designed for power efficiency. As the trend continues, it is imperative that an impetus on reduced weight for the soldier, reduced logistical strain and increased tactical flexibility are maintained whilst reducing the through-life cost. For equipment such as soldier radios, a rechargeable battery that is small and light, while still being rugged, is an ideal starting point. Add a useful life in excess of 24 hours, and the option to scavenge power from almost any USB-equipped power source such as a laptop, solar panel or a vehicle's cigarette-lighter socket and one has a compelling alternative to supplying disposable batteries to soldiers.

## About Thales Group

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Figure 2: Light-weight, long life rechargeable battery

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