

Feel the power – why the Li-ion battery is currently the undisputed king of the jungle

It seems like only yesterday when Li-ion batteries started being introduced into the market, replacing Ni-Cad batteries. Three years later, the march of the Li-ion seems unstoppable as its benefits – which include 18 to 22-hours of power – become widely recognised. Dan Worth investigates some of the benefits these batteries are bringing to the emergency services – and hence to public safety.

Public safety relies on the emergency services being able to communicate effectively with other units on the ground and with their control rooms. Few would say that the widespread implementation of new technological devices has been anything but beneficial to increase the quality of this communication. However, that is not to say there have not been new problems encountered with this increase in personal technology.

With officers now equipped with devices that require regular use, the potential for battery failure at a critical

time is increased. Carrying spare batteries is limited in its feasibility by issues of size and weight, so devices need to be able to last an entire shift, often being used for the majority of the time.

Instead of carrying additional batteries the solution is to provide batteries with higher capacity and to ensure that systems are implemented to ensure batteries provide longer life spans. A major new development in increasing battery technology has been the recent implementation of the Lithium Ion battery known more commonly as the Li-ion battery. They have been quickly introduced to the emergency services across the UK as they were the first power devices for the digital handsets used for TETRA, and each of the terminal manufacturers settled on Li-ion as the standard battery.

Around two to three years ago the industry began to introduce Li-ion batteries to replace Ni-Cad batteries. Motorola, a supplier of batteries to a large section of the emergency services, were one such company – along with many others – to bring them in due to the variety of benefits and features over Ni-Cad batteries. Graeme Loughrey, TETRA product manager, explains. “It’s all about getting more power but with a smaller power source. The benefits of Li-ion batteries mean the terminals can be smaller and weigh less which is very important for the emergency services.” Motorola also issued public safety officers with information to explain why they had undertaken the change to Li-ion batteries, outlining the benefits. The advantages of the batteries are numerous and Graeme believes they are a significant step forward from traditional Ni-Cad batteries. “The charge densities are higher for Li-ion batteries so they can last for a lot longer in a shift. Traditional Ni-Cad batteries could last for about 700 charge cycles but would only just squeeze through a shift with about eight or nine hours of use. Li-ion batteries might last about 450 charge cycles but the advantage is they last between 18 and 22 hours on a single charge.”

Li-ion batteries have a longer charge time than the older Ni-Cad batteries, but the final 20 percent of the charge takes almost the same amount of time as a Ni-Cad battery

Right, Hampshire Police Constabulary has just used Multiplier UK to install a battery management and maintenance system called Cadex.

Far right, from the top, batteries from Motorola, Nokia and Sepura.



and it is only the first 80 percent, which is the easiest part to re-charge, that has a different time length. However, Li-ion batteries have a tough chemistry and so are able to cope with being recharged, even if they are not fully drained, far better than Ni-Cad batteries. This is another benefit of Li-ion batteries that is of enormous assistance to the emergency services.

Luca Fiore, sales director of Advanced Charger Technologies (ACT), a company which provides charging and conditioning regimes, also use Li-ion batteries and he explains why they are becoming so widely used. "Every blue light service makes use of portable electronic devices that obtain their power from an integrated source. The main advantages of the Li-ion battery are the high power densities ensuring that the additional features that TETRA offers can be utilised in a compact terminal."

However, there are still issues with these new batteries. As Luca points out, "with technological advances often come some new problems. The batteries require a protection circuit to stop them over-heating." The consumer market witnessed this problem when Sony had to recall over a million laptops with batteries susceptible to over-heating.

Battery recall is often an area suppliers are forced to confront. Nokia recently issued a warning about an over-heating risk on 46 million copies of the BL-5C battery manufactured between December 2005 and November 2006 that are used in a range of their products, including wireless GPS modules and a range of phones, and so were forced to offer a recall system. Obviously, for public safety this is not something the emergency services forces can afford to have happen, and it would be a disaster if it did. Luca concurs, "For the emergency services poor battery performance isn't an option and purchasers tend to only specify cells and battery pack assemblies from companies with a proven track record."

Luca explains that ACT have demonstrated that Li-ion batteries show enhanced performance, and battery life of up to three years has been observed. With more emergency services forces adopting further digital devices such as PDAs, energy dense and compact battery packs are needed to meet the power demands they make. Because of this, Li-ion battery use will most likely continue to increase within the emergency services.

Sepura specialises in the design, manufacture and supply of secure TETRA digital private mobile radios for emergency services across the world. Its radios use Li-ion batteries to meet the power demands required by the emergency services. The Enhanced Standard Capacity battery has 1230mAh capacity, providing up to 15 hours of operational use, while the Enhanced High Capacity battery is 1900mAh, offering 22 hours of service. Both contain embedded circuitry to manage charging cycles and to protect the battery from over heating.

Sepura also offers a wide choice of battery chargers including 12-way and 24-way chargers, a personal rapid charger and a rapid charger for in-car use. The chargers provide top-up power and back-up batteries that ensure ample power is always on standby during times of heavy and extended operational activity.

Multiplier UK is a supplier of after-market batteries to the emergency services in the UK for modern TETRA

Airwave radios as well as for older analogue radios. General manager for Multiplier UK, Paul Baker, explains how the company operates. "We provide high quality aftermarket batteries that generate significant operational cost savings but also provide after-market services for emergency services to ensure they optimise the performance of their batteries. They use our service because we offer comparable quality to original manufacturer's batteries at a lower price, a strong warranty program that assures satisfaction, and because we are specialists in the battery industry."

The performance and capacity of batteries is very important for first responder officers as they must be able to rely on them to last an entire shift while they are out on the beat; "If you're involved in a fire arms situation and suddenly your battery goes dead it's not what you want to happen so now the issue is about capacity," Paul notes. "Our new Nokia batteries have a capacity of 2,200 mAh, which represents a 16 percent increase on older technology. The importance of having a battery that lasts an entire shift is vital for all officers and so by increasing capacity we can help meet the demands of the modern emergency services worker."

The other major issue for batteries is wastage. Hampshire Police Constabulary has just used Multiplier UK to install a battery management and maintenance system called Cadex. The benefit of this is that it can, within three minutes, analyse the batteries and decide if they can be saved or if they are too old. "Recovering batteries thought un-usable is an important cost-saving device and is a major way to reducing operating costs," explains Paul.

There is one final area in which Li-ion batteries are bringing benefits to the emergency services which in turn benefits public safety: cost. Because Li-ion batteries are so much easier to produce and economies of scale are able to help producers and suppliers lower their costs that they can pass on to the emergency services. Where before, a police force may have had to purchase 60,000 batteries and 30,000 chargers, it would have been a huge expense. The old Ni-Cad batteries would cost around £40 for a battery and £100 for a charger but now with Li-ion it can be just £20 for a battery and £20 for a charger. The cost saving means the police can provide their officers with personal chargers and batteries. It is important though to make sure that the batteries that are handed out are used, as Graeme from Motorola points out, because they are no good sat in a locker going unused. 'Li-ion batteries are like pearls – you need to use them. Because they are easy to produce it is much better to use them and re-order than to over-order and have them sitting at the backs of lockers. Before long they can become unusable.'

As technology continues to improve and the emergency services are able to benefit from these advances, the future for batteries and chargers will continue to improve too. This is an area that is ever evolving and where technology changes rapidly. What the future will hold no one can be entirely sure of and, as Luca of ACT says, "maybe one day communication and mobile devices will be topped up by the kinetic energy generated by police officers as they walk the beat." An idea that perhaps isn't as far fetched as it sounds.

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➔ Graeme Loughrey, Motorola.

