



Planes, trains and drones (and all kinds of other E powered stuff)

As e-mobility becomes even more ubiquitous, the safety of the batteries that power them becomes all important. Ken Boyce of UL looks at all of the standards UL has produced in this field including a new one on Drones (UL3030) to be published at the of October.

Battery technology is enabling a new era of personal transport. Batteries power increasing numbers of aircraft systems, such as in the Boeing Dreamliner and in the Airbus E-Fan project. There are well over 1.5 million electric vehicles now in the global market, transporting people via 'e-mobility' with zero vehicle emissions.

After UL's standard **UL 2272** brought safety and security to support the second wave of hoverboard deployment, we are seeing them re-introduced around the world. Earlier this year, UL moved very quickly to introduce the requirements for hoverboard safety, which have made the new introduction

proceed dramatically better than the first wave, which resulted in fires, explosions and recalls around the world.

UL has worked with dozens of manufacturers to evaluate their products against the safety requirements and help them introduce safety products into the market. However, our work has not stopped there. The requirements have been moved forward as binational consensus requirements for the United

States and Canada, and are about to be published in that form. Countries around the world have pointed to compliance with **UL 2272** as a requirement or as a measure of due diligence in addressing safety. Further, these requirements have been cited by several countries as the proposed basis for development of a global standard for hoverboard safety by the International Electrotechnical Commission (IEC). These developments all support safe and sustainable deployment of personal e-mobility technology including rigorous assessment of the batteries and battery management systems.

Further, e-bikes are being deployed across the globe in pedal-assist form, where the battery enhances the effect of the rider's pedaling, or in pure electrified form. Scooters with electric power are increasingly popular, from products like the Vespa GenZe 2.0 to even more specialised options for urban use. For example, Gogoro's system allows for the batteries to be removed and swapped, which helps with addressing charging in cities where running an electric cord to the scooter can be



extremely challenging. E-mobility systems that use renewable energy such as photovoltaic panels for charging are even more effective in displacing fossil fuel, even in the electricity generation. Electric motorcycles are becoming more popular on a global scale. Even the icon of powerful gasoline-powered motorcycles, Harley Davidson, has developed an electric Project LiveWire concept and expects to introduce an electric motorcycle into the market in the next several years. All of these developments offer exciting new options for enabling personal mobility in a way that limits environmental impacts and noise pollution in densely populated areas around the world.

We know from past deployments of electrified transport that range is the primary concern, and range correlates directly to battery system. Consumers continue to expect batteries that have enough energy density to support their mobility in uninhibited fashion. They want convenient charging protocols— either fast or flexible— to allow them to move when they want to. These ever-rising expectations support more power delivery from the battery systems and innovative ways to deliver a charged battery pack. Ensuring

Flight path planning is outside the scope of UL3030 but... if one of these catches fire when surveying your thatched roof, or delivering your package from Amazon, it could be more serious than a little privacy.

that this happens safely, especially with these intense dynamics in the industry, is critical. Safety standards, including **UL 2849**, are essential to making sure the energy is governed and used appropriately through the thousands of cycles of e-bike and e-scooter charges and discharges. Designing, sourcing, testing and validating safety of the battery packs and battery management systems are the foundation for e-bike safety. Increasing complexity of some of the on-board systems also requires special consideration for minimising the risk of electric shock during charging over the life of the products, reflecting the real-world abuses and demands that occur to these products. This will necessitate the use of special strategies or protective circuitry to address those potential

electrocution hazards. The new requirements of **UL 2849** being published will address those critical safety issues to support safe use of e-bikes and minimise risks from battery fires or explosions and shock hazards.

Although we see many new forms of electrified transport for humans, a new wave of transporting cargo or specialised equipment is also unfolding around us. Unmanned Aerial Vehicles (UAVs), more commonly known as drones, are changing the way we interact with the world. We all have seen videos taken from cameras (or even smartphones) mounted on drones that offer fascinating new viewpoints. These are not just for entertainment, as the images can be important in addressing commercial activities such as real estate transactions or operating

conditions for a large-scale renewable energy plant. They can also fill important tactical roles, such as helping first responders deal with events such as wildfires in the most effective and safe manner. Uses for larger-scale drones are being explored in many sectors, such as agriculture. All of us have heard of Amazon's interest in using drones in the future to deliver packages to customers. While this may conjure visions of the Jetsons, the use of controlled or autonomous UAVs to perform tasks that are otherwise more dangerous, time consuming or inefficient will be a part of our collective future.

Drones may be powered by different sources, depending on the required uses. However, battery technology again is a key element in success of drones. Batteries offer benefits in terms of weight of the energy and drive systems, as well as eliminating byproduct emissions and noise. As with any battery applications, we see critical needs for assessing and validating the battery safety,

proving the battery management system is capable of maintain the battery in a safe mode, and evaluating the coordination of the charger, battery system and load as safe. These topics are the focus of a new standard being developed this fall, **UL 3030**, to address safety of commercial UAVs. **UL 3030** will lay out requirements for the electrical system of the drone, while aspects such as airworthiness, efficacy of controls, and similar topics will be out of scope; these must be addressed by regulations, user programs and other standards.

The technical community is also looking at holistic ways to optimise the battery resources that have been deployed. For example, as electric vehicle batteries reach the end of their useful motive life, we see opportunities for repurposing them into a 'second life' in stationary energy storage applications. This requires a thorough, scientifically based methodology for assessing the unique state of health of each battery to qualify it for the continued use in a new

application. UL has been working with leading automakers, battery experts, academic institutions, utilities and others to explore a standardised approach to this process and expect UL 1974 to be published in the coming months. We expect this to primarily affect EV batteries in the short term, but a similar approach may be scalable for LEV and other batteries as energy density increases and the battery population grows in the coming years.

Batteries continue to transform the world around us every day in many ways. Personal e-mobility is an emerging use of battery technologies, with many benefits and increasing appeal. However, putting a person in intimate contact with an advanced energy system, continually increasing demands for energy density, and adequately facing the rigors of real-life usage all present safety challenges that must be proactively addressed to support a safe and sustainable growth of these e-mobility solutions. Similarly, the exponential increase in the use of drones to fulfill commercial or tactical objectives will continue to

This is the sort of event that Underwriters Laboratories are working to avoid.

rely on battery technology as the key solution, and safe battery and electrical systems are needed. Work to develop new safety standards establishes a baseline that enables common expectations, safe use of technologies, and easier navigation of international trade. Most of all, they enable a future where batteries help our society solve one of its oldest challenges— **how can I get to where I need to be?**— in a clean, efficient, and safe way. +

