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~ Tom Finton, Parts Manager,
H&E Rentals, USA



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Innovation is in the air

Each year we take a look at the battery market, reporting on a variety of topics from proper maintenance to new products and recycling. Deep-cycle, semi-traction and full-traction batteries are of course widely used with aerial lifts and industrial pick & carry cranes - not to mention industrial fork trucks. The vast majority of them are traditional 'wet' lead acid batteries whose basic technology has barely changed in more than a 100 years. Meanwhile battery technology in the consumer electronics market has developed at a furious pace in mobile phones, cameras and laptops. In the mobile equipment business the most exciting development has been the arrival of sealed gel batteries, whose price and performance relegates them to the outer fringes of the market, where they meet regulatory or specific commercial requirements.



So some six years after we launched this annual feature we are delighted to be in a position to highlight some really exciting developments with the arrival of the industry's first lithium ion batteries and improved gel products, at a time when battery powered vehicles are becoming de-rigueur. Battery innovation is finally looking as though it might impact on our industry.

No change for the masses

While these developments are truly interesting, Europe's 150,000 electric scissors are not likely to suddenly switch to lithium ion power, at least not for many years. Over the past 15 years electric powered aerial lift and crane drive technology has developed dramatically, with most equipment now using motor controls and other electronics to conserve battery life, while the major battery suppliers, such as Trojan, US batteries and Crown, have significantly improved their deep cycle products.



JLG introduced direct electric drive 7 years ago

This progress from both ends of the spectrum has been so significant that some seven years after JLG introduced the first direct-electric drive mini-scissor, no other major manufacturer has felt pressurised to follow suit. In fact only Iteco has followed JLG's lead while Aichi, entering the global electric scissor

Aichi's new electric scissor lifts use AC wheel motors rather than DC.



The JLG E600 is the first large production boom with battery power

lift market for the first time two years ago, went one step further with direct electric AC drive motors.

Genie, Skyjack, Haulotte and UpRight/Snorkel have felt little commercial pressure to follow suit and adopt the technology which does clearly extend battery life, while simplifying the hydraulic circuit.

Why not? Simple scissor lifts with hydraulic drive motors offer sufficient battery life for a full day's work, so customers are rarely faced these days with battery life

Lithium ion will take battery power into new areas

In spite of this the arrival of more cost effective lithium ion batteries, driven by the push for zero emission cars and trucks, will have a major impact on some aerial lifts and cranes where battery power has been totally impractical until now. Later on in this feature we look at two lithium ion installations, the first is the new Hinowa 14.70 Goldlift, where a lithium power pack has created a practical battery powered tracked spider lift. Tracked machines have always been a challenge to convert to battery power, due to the 'drag' created by the tracks and the fact that so many of these units are as narrow as 600mm and so have little space for large battery packs. It is likely that this breakthrough - which adds around 5,000 to the price - will soon be taken up by



There is nothing on the horizon to trouble the lead acid battery's domination of the small scissor market

problems and are therefore not demanding their current suppliers to upgrade. Meanwhile manufacturers shy away from a technology that costs more and that requires a total redesign. While lithium ion batteries would not require a redesign, costs will keep lithium power at bay and none of the experts we spoke to expect lithium to match that of a lead acid unit in our lifetime!



Could Lithium batteries and AC motors rekindle interest in rubber tracked mini scissors?

spider cranes, larger spider lifts and maybe cause some manufacturers to look again at the viability of rubber tracked scissor lifts?

The other installation that is arguably even more interesting is semi or all electric powered truck and van mounted lifts. Versalift is leading the way here, although Altec has also been doing a good deal of work on developing the technology in the USA and Tadano introduced an all electric lift over 10 years ago. Versalift is so confident of its semi electric units - where a battery powered aerial lift is mounted to a diesel truck or van - that it is predicting that within a year or two around 70 percent of its shipments will use this technology.

The other big potential is for larger electric powered self-propelled booms. Electric power is already common place in the 12 metre market with companies such as Nifty and UpRight and with the 30/40ft industrial products offered by Genie, JLG and Haulotte, not to mention mast booms.

There are a few semi electric boom lifts above this including Niftylift's HR21 'Hybrid' - a 21 metre articulated four wheel drive Bi-Energy platform which is fitted with a small three cylinder Kubota diesel engine and exhaust purification system which uses the electric drive motor to boost power on steep grades or rough terrain.

When operating as a diesel under normal conditions the motor turns into a generator/alternator charging up the machine's battery pack. JLG's 60 ft E600 uses an automatic engine cut-in to support the limited battery power. The unit has also been designed as a lightweight unit for electric power and does not therefore compete head to head with the company's regular 60/66 ft models. As pressure grows in the West for cleaner and quieter job sites, so will the interest in larger battery powered boom lifts.



MEC is having some success with its battery powered RT scissors

Big scissors are going electric

The trend towards electric is already beginning to be seen in the large rough terrain scissor lift market where more space is available for the huge power packs required. MEC has pioneered this development in recent years with true four wheel drive Rough Terrain versions of its big scissors and has had significant success with its recently launched electric Speed Level which uses large deep cycle semi-traction batteries.

Holland Lift - which has produced large electric scissor lifts for many years - has more recently blended its four wheel drive/steer technology with battery power using large full traction batteries from the forklift industry - the benefit being that the batteries



Holland Lift uses full traction battery packs on its larger units



Niftylift HR21 Hybrid

are made to fit the space available. While this solution works well it is more expensive, although not in comparison to lithium ion. These massive machines also require a lot

of low-down counterweight which these batteries handily provide. The same is generally true of self propelled pick & carry cranes, largely produced in Italy by the likes of Valla, Ormig, Galizia and more recently JMD. However Spierings has recently announced an 'Eco Power' semi electric City-type self erecting tower crane which one assumes will use advanced battery power along the lines of lithium ion? One thing is for certain, battery power is on the rise and the latest technology will create new possibilities and a new lease of life for some market sectors, while taking some traditional products into new market areas.

Trojan launches new heavy duty gel battery

Trojan has announced two new heavy duty deep cycle gel batteries, the 135AH 5SHP and the 210AH TE-35, the latter being well suited to aerial lift applications given its 210AH rating. Both batteries feature a new gelled electrolyte containing sulphuric acid, fumed silica, pure demineralised, deionised water and a phosphoric acid additive which, the company claims, delivers consistent performance and dramatically longer cycle life. Patented calcium copper lead alloy grids provide a longer shelf life and superior corrosion resistance, while Trojan's heavy-duty grids lock active material onto the grid network to efficiently deliver more concentrated energy to the terminals. Premium grade, double-insulated separators allow maximum charge flow between the plates for optimum performance.

Trojan has launched an improved deep cycle gel battery for aerial lifts



Gel slow

Maintenance free batteries have been around for many years with the first units fitted to aerial lifts in Germany in the late 1980's. Since then prices have come down, and some of the high volume American manufacturers such as Trojan have entered the market. In fact Trojan has just launched its latest generation of Gel batteries designed for the aerial lift market. They have proved popular in some fleets, but most importantly for specific applications such as food production facilities, hospitals and airports. In spite of the appeal of no leakage and no maintenance, they have made little impact on the mainstream market. Why? In a

IPS is now offering US battery products.

word price. In two words price and performance. Gel batteries simply do not offer the same life in terms of output power storage and overall longevity. Given that few rental companies monitor the cost of battery maintenance - and many do no maintenance at all - the extra cost (possibly double) and benefits do not interest too many managers.

Given that many companies will switch battery supplier for five to 10 percent price differential and it is easy to understand the challenges of selling the benefits of gel.

A gel or not a gel?

There is also a widely held misunderstanding of what a gel battery is - not all sealed batteries are gel batteries and not all are suited to deep cycle applications. China in particular produces

a large number of AGM (Absorbed Glass Mat) sealed batteries which are often mistaken for gel but do not

offer the performance characteristics required for deep cycle work and are best suited to starting and light duty deep cycle standby roles. It is possible that lithium ion batteries will eventually take over the regulation driven sealed battery market, given their power to weight ratio, fast recharge times and longevity? Before that happens their heat instability issue needs addressing, obliging them to be designed into a product rather than simply retro fitted. Gel batteries can be easily retro fitted, although in most cases the battery charger will also have to be changed.

IPS offers US batteries

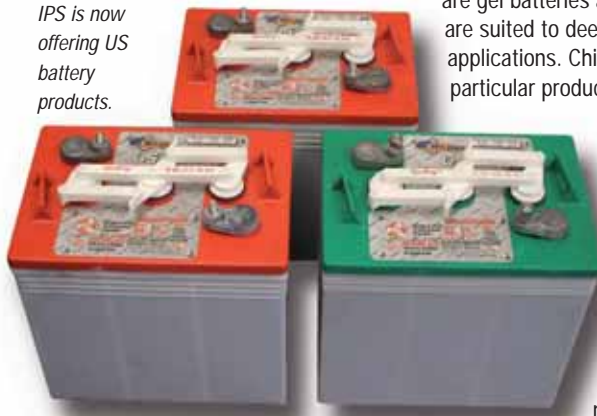
IPS the international parts and service company, has agreed a new deal with Manbat, the importer of US Battery to distribute the popular deep cycle batteries to the aerial lift

Industrial cranes use full traction battery packs.

replacement battery market. The most noticeable feature of the US Battery product is its quick remove cell tops, one squeeze and three caps are removed or replaced for easy electrolyte checks and top ups.

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batteries



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Manbat has launched the new Lucas Traction XC deep cycle battery for aerial lifts

And Lucas makes a comeback

Manbat is also introducing a heavy duty deep cycle battery carrying the famous Lucas brand name. The product the Lucas Traction XC - is designed for deep discharge, heavy duty cycling conditions, with fortified plate construction.

Maintenance free alternative to sealed

While price, if not performance, will continue to curb the take-up of Gel batteries there is a simple 'half way house' that only a few canny operators are currently adopting. Why? When a product seems too good to be true then you can almost always be sure that is too good to be true. When we first reported on Thermoil's battery demister we referred to it as "snake oil" that works" Since then the product, which like all good 'snake oil' comes from the USA, has arrived in Europe and been used by a number of fleet owners for almost a year.

The response from those that have tried is amazing, with most if not all, of those who have tried it going on to install it in all of their batteries and insist on it in all new machine

deliveries. They all confirm that it does 'exactly what it says on the tin'. And what does it say on the tin? That topping lead acid wet batteries with the product will dramatically reduce battery gassing, cutting down electrolyte evaporation and extending battery life. Feedback suggests that batteries equipped with the product have not required topping up at all. Given these tough times and the high cost of breakdowns and changing-out abused batteries you'd think that every company in the land would at least be trialling it? As far as we can tell that is not so... a case of being too good perhaps?

In spite of the reports of its effectiveness it seems many rental companies think Thermoil's battery demister is too good to be true.



PSE offers free battery upgrades

Dutch-based aerial lift specialist is offering a free upgrade to Zenith sealed maintenance free batteries and high frequency lead acid/gel compatible battery chargers on sales of its MEC electric scissor lifts while stocks last.



PSE is offering free upgrades to Zenith maintenance free batteries.

Power pack

In last month's issue we covered Versalift's new range of all-electric vehicles mounted on a Smiths Electric Vehicles' chassis unveiled at the Bright Green fair in Copenhagen. The company has however been very busy working on other battery powered projects. Mark Darwin met with Versalift UK managing director Steve Couling to find out more.

The Copenhagen show in December was the first public glimpse of a number of environment projects that Versalift has been working on for more than a year. The project was initiated by the new chief executive of Electric Supply Board (ESB) in Ireland - which runs a 300 strong, Versalift insulated boom fleet. He has promised to reduce company vehicle emissions significantly over the next 15 years down to net zero emissions by 2025.

"The whole ESB Versalift fleet is made up of 10 and 12 tonne diesel trucks, so one area we started looking at was battery packs to create a semi electric vehicle," says Couling. "We had already looked at this, but with batteries weighing up to a tonne it was totally unviable. The introduction of lithium ion batteries weighing around 100kg has changed all that."

Versalift currently has a couple of semi-electric units on evaluation with ESB they use the truck's diesel engine to drive to site and then switch to the battery pack for working during the day, installing/maintaining live overhead electric cables. While travelling the diesel engine can replenish rather than fully recharge the batteries, putting back about 30 to 40 percent of the total power, reducing the need for a full overnight charge to every two or three days.

"We then spoke to some of our

The battery pack and racking on the Smiths all-electric Edison chassis.



other major customers such as Scottish and Southern Energy and Amey and they also expressed interest in an environmentally friendly product. However one major benefit we did not initially consider is that the almost silent operation allows the platforms to be used at night in residential areas without disturbing anyone."

All R&D work relating to the electric vehicles has been carried out by Versalift UK's sister company in Denmark - Time International - while the vehicles are assembled at Versalift's Northamptonshire head office and recently extended facility in Burton Latimer.

Versalift has three environmental electric products, the first is an all-electric chassis mounted platform, ideal for inner cities and particularly suitable for the stop/start cycles of street lighting contracts. The second product is the semi electric vehicle mentioned above, which uses the chassis engine for road travel and the battery pack for platform operation. The third product is to retro-fit the battery pack to any reasonably modern Versalift platform.

"For the all-electric platform, we spoke to several electric vehicle manufacturers and have concentrated on Smiths Electric Vehicles on Tyneside and Allied Electric Vehicles in Glasgow who between them appear to be more advanced than most in this area," says Couling. "Allied has a Peugeot Boxer van which at 4.2 tonnes is particularly interesting to us in that we can mount an 11 or 12 metre platform and still have a good payload. The other option is Smiths Edison Transit conversion. With the Copenhagen summit looming we entered into a joint venture with Scottish and Southern Energy to produce a platform on the Smiths chassis. This was one of five vehicles - two platforms the rest support vehicles - at the summit."



An 'under the bonnet' view of the Smiths Edison



The new lithium ion battery pack weighs about 100kg



Smiths 13 metre working height Transit-based Edison chassis and its lithium ion batteries provide a 160km range. Given that in a typical day the platform consumes around 10 percent of the battery power, the truck has a practical range of 140 to 150km.

"Iveco is very close to launching an all electric 5.2 tonne Daily which would give us more payload," says Couling. "The van in diesel form is one of our biggest sellers at the moment." Around 75 percent of Versalift's 400 unit production comprises 3.5 tonne van mounted lifts - 95 percent of which use the Transit chassis. The rest is divided between the 5.2 tonne Iveco Daily and Mercedes five tonne Sprinter. Insulated truck mounts for the

Versalift estimates 70% of its van production will be semi electric in the next year or two.

utilities markets account for the remainder.

Using the all-electric chassis means mounting the platform is a slightly more complicated and expensive process, because the chassis batteries are also used for the platform, but the main cost premium is the chassis which is currently in the order of £50-£60,000, resulting in a five year payback. However, many all-electric lifts will be bought because of their zero emissions and silent working and not on a straight cost analysis.

"I am not sure what demand there will be for all-electric vehicles over the next few years but major cities

are looking more and more at this technology. I personally believe that in 12 months time, 70 percent of our van production will be semi electric and will be very well accepted by the market. As a retrofit kit it currently costs around £6,000 although we hope that figure will be closer to £5,000 as volumes increase."

"One area that needs more analysis is the battery capacity for each application," says Couling. "Applications depend on the number of cycles - a cycle being raising or lowering the outriggers, raising boom to full height, rotating and then retracting it all for travel. For instance a CCTV application, installing cameras, has very little boom movement so a small battery capacity might be sufficient for a day's work. On the other hand, a busy street lighting application with 50 cycles a day will need a bigger

battery pack. Switching batteries to suit the application is also a possibility. We are currently looking at sourcing batteries and have been evaluating two or three Chinese suppliers of Lithium Ion batteries. Although not cheap they are said to have a 20 year life span and are virtually maintenance free for the first 10 years."

The semi electric product has not yet been launched and will be shown to potential customers - utilities, rental, telecoms and contractors - in mid March. After that, Versalift will be working with ESB to develop electric packs for the larger truck mounted platforms. "Our main objective was to maintain the same performance as the current product and we have achieved that,"



The new VST 40i - a 15 metre working height 46,000 volt Category C insulated boom for a Unimog chassis

says Couling. "We are also moving towards a fully electronic, Canbus PC logic control system which should be more reliable, using more standardised components."

The all-electric vehicle has now gone into full evaluation with Scottish and Southern Energy. The semi electric vehicle has been used at Versalift's premises for IPAF training and several more will be used in field trials with various

contractors. Another semi electric variation on the horizon is the VST 40i - a 15 metre working height, nine metre outreach, 46,000 volt Category C insulated boom mounted on a Unimog chassis. Features include single joystick operation and full wireless remote control to reduce the high proportion of accidents caused by falling off the vehicles. For Versalift the future for electric vehicles looks very bright indeed.

Lithium spider

Last October Hinowa introduced the world's first lithium ion battery pack on an aerial lift in a new battery powered version of its Goldlift 14.70. The unit is equipped with a 2,000 watt, 48 volt AC motor in order to provide the same performance as a diesel or 240 volt AC model, while being as economical with the battery power as possible.

The concept of a battery powered tracked spider lift that can run all day was totally impractical with lead acid batteries because of space and weight reasons. So Hinowa has used 15 units of the latest generation LiFePo 4 - 90AH batteries. The combined pack is more than 60 percent lighter and substantially more compact than traditional batteries and takes up no more space or weight than a small diesel engine. In spite of this it provides more than three times the battery life of a typical battery pack (4x 6volt/220AH). Hinowa says that its tests indicate two hours of continuous travel or four hours non-stop operation of the lift functions.



The lithium ion battery powered Hinowa Goldlift 14.07

Another benefit of the lithium batteries is that recharging time from empty to full is said to be almost half that of lead acid batteries, although the extra capacity means that they should rarely be fully depleted. The batteries take two hours to reach 80 percent from empty and are fully charged in four hours. They also require very little maintenance and are said to last at least five years and possibly much longer, depending on how many recharges they are subject to and how deep those charges are. Hinowa says that its pack will give 2,000 complete charges from empty

or 4,000 charges from 50 percent and so on and do not develop a 'memory'.

Battery charging is important - as always, Hinowa uses a Battery Management System (BMS), to control the charging and discharging

phases, balancing the absorption of the single cells and controlling the temperature while communicating with the other components in the system.

The battery powered spider lift project was generated by customer requests for more environmentally friendly equipment and was no easy task. Once power unit and controls had been designed and the lithium batteries selected, there were still a number of challenges. One problem with lithium ion batteries is dissipating the heat that they generate without wasting their extra capacity on cooling systems. The

maximum temperature for the batteries is 90 degrees Celsius, so first and foremost Hinowa concentrated on air circulation in the battery box to prevent heat building up. It then fitted a forced air cooling system to cut-in before the critical temperature is reached and finally a thermal cut-out if things do get too hot.

In a series of heavy tests last summer the battery temperatures did not rise above 50 degrees and the fan did not cut-in. Based on this solid margin of safety the company is confident that it has got it right. The extra cost of the lithium machine is around €5,000 which, based on the current price levels for diesel and electricity, equates to a five year pay-back. As of mid January the company had taken firm orders for 27 units and is confident that the product will become one of its more popular machines.



Hinowa put a good deal of effort into the battery box design to dissipate heat