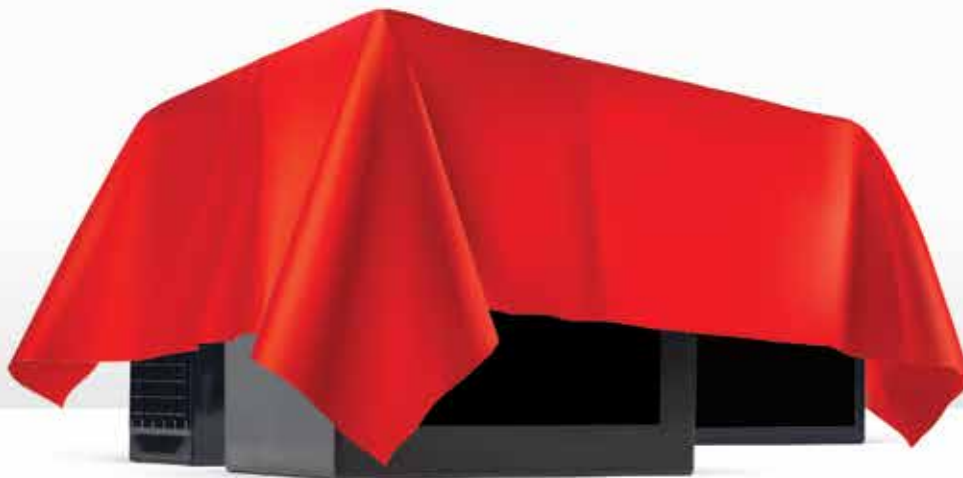


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# Which battery?

In terms of battery technology, the lead acid battery is a dinosaur. Invented in the mid-1800s it was the first rechargeable battery on the market. Although revolutionary back then, it has barely changed in the 150 years since, and still remains the primary choice for many applications, primarily due to its low purchase cost and solid reliability. However, this appears to be changing, with a number of credible alternatives gaining traction in recent years, such as AGM (Absorbed Glass Mat), Gel and most recently Lithium with several manufacturers offering variations on the theme. Although more expensive these newer batteries claim a lower overall cost of ownership.

The traditional flooded lead acid battery has powered the majority of self-propelled aerial work platforms since the industry's earliest days, mainly because it was the only option, relatively cheap and 98 percent recyclable. However, they do have issues in that they require regular care and maintenance, they emit flammable hydrogen gasses when recharging and so must be properly vented. They also need topping up periodically and have to be kept upright to avoid spilling the electrolyte.

Although the introduction of single point watering systems on full traction battery packs overcame this issue, it is a costly option and not always practical for the installation. Given all of the above however, with proper maintenance and charging, flooded batteries can provide years of reliable service in many applications.



A typical flooded lead acid battery

## But what of the alternatives?

### AGM battery

The AGM battery is a sealed unit designed to recombine the hydrogen and oxygen within the battery rather than being vented with a built in valve releasing excess gas in case of severe overcharge. The battery also uses a compressed glass fibre mat between each plate which holds the electrolyte in place like a sponge as well as supporting the plates giving good resistance to shock and vibration. It can be mounted on its side, can charge and discharge at high rates and it performs well at low temperatures. However, it is very important that AGM batteries are not severely overcharged as this causes rapid dry out and the battery charger must have an AGM setting to avoid damaging the battery.

### Gel battery

The Gel battery is another type of vented battery and like the AGM is sealed. While the basic internal structure is similar to a flooded battery, the electrolyte has been thickened and has more the consistency of petroleum jelly. It can also be mounted on its side and doesn't release hydrogen during normal operation. In deep cycle applications Gel batteries are generally more resistant to being over discharged, however Gel is not ideal for high-current applications



A flooded lead acid battery set up



A Dry Cell AGM set up

such as aerial work platforms. Like the AGM battery the charger needs a specific Gel setting to avoid overcharge damage. And the charger and charge algorithm should support temperature-compensated charging.

### Lithium ion battery

Lithium power arrived about 12 years ago with the launch of Hinowa's first lithium powered spider lift, almost as a saviour of the fossil fuel/emissions problems. It has become increasingly popular with many access manufacturers offering a lithium option for the smaller platforms as well as being fitted in many smaller telehandlers. Lithium batteries are more expensive than lead acid equivalents but can have increased usable capacity and longer run time, faster charging and are much lighter.

But there are new entrants to the market that offer many of the benefits of a lithium battery at a much-reduced cost.



Lithium batteries in a JCB scissor lift

### Dry Cell AGM alternative

A recent addition to the mix are Dry Cell batteries from Canada-based

company, Discover Battery. Its Dry Cell range is based on a modified AGM featuring a thick plate traction battery construction combined with a Hydro Polymer technology which is said to resist battery dry-out - one of the most common reasons for AGM failures - that typically happens from the heavy and prolonged use of battery and hybrid powered access platforms.



Discover Dry Cell batteries are now being fitted as standard to Sinoboom booms, scissors and vertical lifts.

### Common failures

In developing the range, Discover Battery data logged the typical use of batteries within the access industry while evaluating batteries reaching the end of life or that failed prematurely. The three most common causes of failures were continuous operation at partial state of charge, high current deep discharge and high operating temperature. To help overcome these issues, the batteries were designed with increased electrolyte saturation levels, an ultra-absorbent separator and improved battery



Using Hydro Polymer technology Discover says its Dry Cell batteries resist the battery dry-out that typically happens from heavy and prolonged use



Lead acid batteries in a Skyjack mast lift

charge acceptance. Rigorous tests simulating real-life battery conditions revealed its Dry Cell range not only delivered 15 percent more capacity, but also lasted longer than other Dry Cell batteries without the Hydro Polymer Technology. Even batteries nearing end of life delivered more consistent runtimes when subjected to sub-optimal working and charging conditions. They also offered faster recharge times, with platforms spending less time on charge and more time on hire.

"Most battery manufacturers test or validate products in a controlled lab environment or under 'ideal conditions', said Jimmy Au, Discover Battery product & business development VP. "The actual use and treatment of batteries within the access industry couldn't be more different. Used on large or remote sites, sometimes with limited access to power, batteries end up half run, used intermittently and topped up with a mixture of chargers etc. Our latest Dry Cell battery range looks to provide both users and equipment owners with a more robust battery, designed to withstand and protect against

common battery challenges that are all too often encountered by the access industry."

"As with all our Discover batteries we are focused on maintenance-free solutions for motive power applications. Our product portfolio includes Dry Cell AGM, Gel Cell and Lithium Professional. Our products are available in a wide selection of sizes, suitable for all platform types from the smallest low level platforms right up to the largest boom and scissor lifts. As well as offering significant benefits and improved safety over traditional flooded lead-acid batteries, they also deliver higher operating voltages, longer runtime and the ability to withstand deep discharges compared with standard maintenance-free batteries."

**Hidden costs?**

Everyone accepts that regular lead acid batteries are the least expensive to purchase. However, many are oblivious to the fact that caring and maintaining the battery correctly does add significant costs throughout its life.

Discover Battery maintains that there are also significant indirect

costs associated with the total cost of ownership of a traditional flooded lead acid battery.

"By choosing a Dry Cell AGM battery there are the obvious savings of not having to carry out the routine maintenance of topping up the water etc however there are a lot of indirect savings associated with the total cost of ownership when using a Dry Cell AGM battery," said Alex Marotz, Discover Battery's product and business development manager for Europe. "These include less equipment repairs due to corrosion damage from acid spills and off gassing, and reduced equipment failures because of battery malfunction due to improper maintenance in the field. There is also no risk to operators and sensitive areas such as food processing facilities and hospitals because of an acid spill or fumes. Dry Cell batteries also charge faster because they have a higher charge acceptance due to a lower battery internal resistance and there is low self-discharge resulting in lower maintenance requirements during storage."

"By eliminating battery maintenance

costs and premature battery replacement there is a significant lower total cost of ownership. Yes, the initial purchase cost of the Dry Cell battery is slightly higher, but it may well save between 20 to 50 percent over its total service life over a lead acid battery. Dry Cell batteries are an Original Equipment part for the largest AWP OEMs for many years."

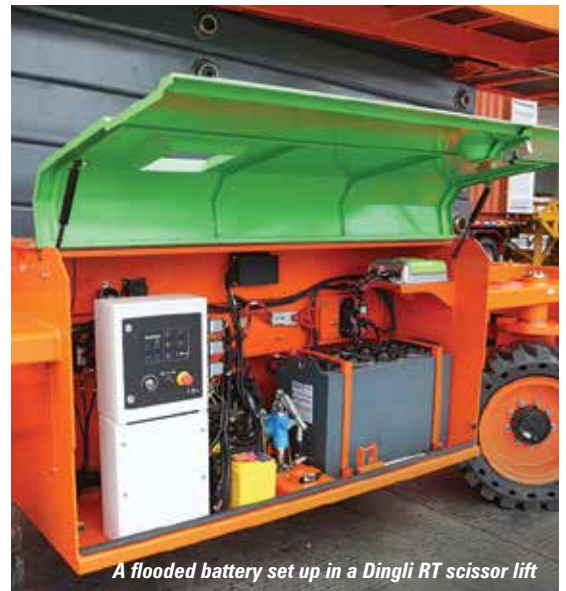
**Changing demand**

The benefits of the Dry Cell AGM appear to tie in with customer requirements. Stuart James, managing director of UK-based DC Battery Technologies says customers are increasingly looking for relatively maintenance free batteries, saving them manual labour time or increased speed of recharge.

"For access platform equipment, we supply either flooded 6 and 12 volt, or the same in AGM versions from some of the world's leading battery manufacturers. However, we are now seeing a demand for Lithium options such as our new Predator 24v Lithium battery, which offers reduced space and a smaller footprint," he said. "In

**Comparison between FLA and Traction Dry Cell AGM batteries**

	Traction Dry cell AGM	Flooded lead-acid deep-cycle
Chemistry	AGM	Flooded
Maintenance-free	Yes	No - Requires periodic watering
Non-spillable	Yes	No
No-gassing	Yes	No
Roundtrip-Efficiency	80-90%	70-80%
Recharge Time	Shorter - No equalisation	Longer
Self-Discharge	Lower - 2-3% per month	Higher - Up to 15% per month
Storage Length	Longer	Shorter
High Current Discharge	Higher	Lower
Initial Cost	Higher	Lower
Total Cost Of Ownership	Lower	Higher



A flooded battery set up in a Dingli RT scissor lift



terms of new developments going forward, Lithium batteries are always upgrading with features like low temperature operation, CAN bus connections and future developments with GPS tracking. With a focus on the issue of a battery's end of operational life, the longer it can last, the better it is for sustainability. Recycling batteries

does require many processes that effect CO2 emissions, from transport to smelting."

The company has also launched the 4,000 Series of Lithium Iron Phosphate LiFePO4 batteries featuring triple-safety protection, fast charge performance and long life. Other features include CAN bus communication, a patented

inbuilt heating element in the low temperature version and automatic cell balancing for both Series and Parallel connections. Prismatic cells help to achieve a high level of consistency, especially for deep cycle applications.

The 4,000 Series has Bluetooth technology and claims to be 50 per cent lighter and its cycle life is 20 times longer than conventional SLA batteries. Available in 12v, 24v and 48v, with capacities varying from 6Ah to 300Ah, the range is also available in a low temperature option which is specifically designed to operate in sub-zero weather conditions.

Every cell within the 4,000 Series is certified according to IEC62133, UL, UN38.3 standards, while the entire system is UN38.3 CE certified and the batteries come with an optional anti-thief system and GPS.

Vanessa Human, marketing director at DC Battery Technologies said: "Our new 4,000 Series range provides exceptional cycle and calendar life. They simplify installation, are maintenance free and lower the total cost of a typical battery system installation."



A MEC  
1332 scissor



The 4,000  
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Lithium Iron  
Phosphate  
LiFePO4  
batteries from  
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# Sustainable rental model revisited

In 2018 we visited a start-up rental company in the Netherlands - Hoogwerkt - to find out more about its totally different 'disruptive' rental model. It had just ordered 800 high specification lithium powered booms and scissors with the aim of renting them out purely online with customer's collecting them from strategically located yards. (See C&A August/September 2018 Vol 20.6)

The radical initiative from two individuals who knew nothing about the access rental market, raised more than a few eyebrows, but may have been a tipping point for manufacturers undecided on lithium power. Three and half years on, Mark Darwin spoke once again with managing director Arnold Grootveld to find out how it has worked out.

"It was fun to re-read the article recently, comparing what we planned at the time and what we are doing today," says Grootveld. "We were pushing the boundaries of equipment technology so perhaps we were somewhat naïve

to start a business like this. It has been challenging but I am more than delighted having started the company. Looking at the overall results we have achieved we are very happy."

"We have not reached the turnover we anticipated in 2018, however, the biggest compliment we get is the recognition of customers when they are happy with our approach and the value that we add."

Over the past four years Hoogwerkt has slowly established itself in the Dutch rental market but many customers still are unaware of the company and what it offers.

"The industry is still very traditional



and even though we invest a significant amount in marketing and promotion, the major contractors already deal with established rental companies, so it is difficult to break into this set-up."

However, Hoogwerkt has done exactly what it planned to do - with a few changes...

The fleet size today is around 500 machines, far less than even the original order and options for 1,400 machines, due to growth being a lot slower than anticipated with revenues substantially less than predicted. The goal was to achieve 10 percent market share by now, but last year it was somewhere in

the region of one percent.

"We now need to grow the fleet and customer base to start to increase revenues, however we are now cash flow positive which is great milestone for a new company. This means we are now entering a phase where we can increase the fleet size and also make the fleet fit demand."

## Machine numbers

At the time of the last interview, Grootveld had placed an order for 800 machines - 420 JCB scissors, 150 Hinova spider lifts and 230 Niftylifts including 150 trailer mounts and 80 HR12 articulated booms. He also added another 600 unit order shortly afterwards, however only 500 have been delivered so far and these make up the current fleet.

"Initially we ordered a number of each machine with further deliveries to be taken when demand increased. However, we are only now seeing utilisation reach a point where we need to add popular machines and sell some less utilised machines because of the varied demand," says Grootveld. "We have just set up a sales business to sell the underutilised machines and reinvest in more popular machines."

Currently around 40 percent of the fleet are scissor lifts, 20 percent spider lifts, 10 percent trailer lifts, five percent truck mounts while the rest - around 20 percent - are booms. It also has seven spider



Hoogwerkt currently has 500 lithium machines in its fleet



cranes and oddly these have some of highest utilisation rates.

"We chose to work with fast moving equipment such as scissor lifts from six to 16 metres, but our biggest customer also requires very big Holland Lift scissors that we are now looking to purchase. Our biggest challenge is to convince some of the specialist manufacturing companies such as Holland Lift to build Lithium powered models. I am reliant on manufacturers, but they are not keen to build in small volumes."

#### Truck mounts

"With truck mounted platforms Iveco already makes a fully electric chassis however at €100k they are four times the price of its diesel chassis. We simply cannot cover the increased costs with a higher rental rate, so at the moment we are offering the diesel chassis. What we

have tried to do is reduce emissions as much as possible and will go full electric when viable."

"Being a sustainable company is something that you need to work on every day - we have an ambition to cut emissions in everything we do, such as ensuring that all our electricity to charge the machines is green energy - wind/solar etc... - but we can still make improvements. We are working hard to reduce the distance between our storage areas and the building sites. If we have another 10 delivery hubs by next year this also will mean shorter transport distances and is a major aspect of our sustainability. We will then have more locations than any other access rental specialist in the Netherlands - the next biggest has six."

What we see now is increased utilisation overall, but some

machines are still standing while others are in short supply. This is what we are now addressing.

We will still want high specification machines - unlike our competitors - which impact our customers' bottom line.

#### A change in model?

One of its main differentiators in 2018 was its customer pick-up model, it hopped to have 80 locations by the end of 2019. But today it only has 15 locations where

you can pick up machines.

"A year ago, we realised that while the pick-up model was ideal for the occasional rental users who may hire a machine perhaps five to 10 times a year, we have also calculated that to double sales with this model we needed to increase our customer base by 1,000. However, by adding delivery we could achieve the same result with just 10 decent customers."

"Offering delivery is commercially easier but it also serves as added value to customers as you take on their logistics. So, we made



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the choice to downsize the pick-up locations and focus more on delivery hubs. The first was opened in January 2019, shortly after the article and since then we have opened two other locations. We aim to open another three this year and expect that to grow to between eight to 10 hubs in total. We still believe that being local is very important with machines as close to customers as possible. And we still believe in the pick-up model, but it was a commercial decision to add delivery hubs and outsource the transport."

### Online booking

"We still have online booking, opening new accounts, credit checks and identification checks etc which is all done online and automated," he says. "Although the inhouse-designed booking system works we are thinking that we should have used a proprietary software package designed specifically for this use. However, from an IT point of view I still think we are ahead of the market but very few large customers use online booking tools, so this is still aimed at the small users."

From the start Hoogwerkt has had a hire desk which supports the online booking. However around 40 percent of its employed staff of 14 are involved in sales which it believes is about three times more

than most competitors.

"In 2018 we wanted to impact the bottom line of our customers and so we focussed on cutting costs, cutting emissions and increasing safety - the three pillars of our business and we still stick to these today."

### 25 percent savings

One of Hoogwerkt's biggest customers - an established electrical installation company - started using the company about two years ago. Its previous supplier had visited the company several times trying to lure it back with discounted hire rates. However, the main reason why it remained with Hoogwerkt is surprising.

"Initially they said that we were the most reactive rental company they had dealt with, which is a nice compliment, however they then pointed out that the lithium machines give them a 25 percent reduction in operational costs on their projects it was a no-brainer to stay with us," says Grootveld.

"It turned out the company was completing projects 25 percent quicker than when using machines with lead acid machines and that was purely down the energy efficiency of the lithium machines. Lead acid batteries become slower and slower through the day once the machine is switched on, whereas



*The company will now also deliver equipment*

a lithium battery maintains the same power output throughout the working day."

"Today our fleet fits 90 percent of its demand and for the final 10 percent - large scissor lifts - we re-rent, but these machines use lead acid batteries. They are now asking us 'when are we going to buy these machines with lithium power'? One aspect of hiring electric machines that should also be taken into consideration is that some rental companies ship machines directly from site to site and do not have a chance to charge the batteries. For a lead acid battery this means a 12 hour charge time before it can be used. While we only ship machines with full batteries, if by chance one was shipped with a flat battery it would only take two to three hours to fully charge and it could be used after 30 minutes if needed - a big advantage for the customer."

### Lithium teething problems

When the original order was placed, JCB, Niftylift and Hoefflon had never

manufactured a lithium machine. However, there were several sizeable challenges that needed to be overcome early on and shortly after delivery.

"The lithium powered machine has a different driving character - it has more instant power and the machine tends to move off very quickly," explains Grootveld. "This would cause a spike in the power and the battery would incorrectly register that it was empty. The solution was to modify the software to the lithium pack. Also, a lithium battery pack cannot be charged when the temperature is below zero degrees so a heating system needs to be installed before it can start charging. All these are modifications that we did not anticipate when we started, however the manufacturers were very good at finding solutions."

"If you want to be innovative being the first with an all lithium powered fleet there are risks of course, but I appreciate that all our suppliers fully supported us in sorting these problems out and getting the product right."

### Another challenge was telematics.

"We initially worked with one telematics company but after a year or so we were not getting the information we required - such as fault codes, machine position, the ability to turn machines on and off etc. We had two years of disputes but are now in the pilot phase with Trackunit which can supply all the features we wanted. Currently we have 10 machines fitted with the new telematics system however it has taken more than two years to get to this point."

"We still believe that rental can be carried out without personnel like car rental and that is the next step. If you can put a central stock as close as possible to where it is being used - for example on an airport where there are lots of customers - then telematics are essential."



*One customer is completing contracts 25% quicker when using lithium machines*



Niftylift supplied the booms and trailer lifts

### Current performance

"We have now completed 10,000 machine hires, of which 5,000 were in the last 12 months and this is about half of what we were targeting. We are now heading for full utilisation and therefore we need to increase the fleet to continue the predicted 70 percent growth this year."

"As a start-up company we have a really good risk and reward balance

for our investors and banks. All our different stakeholders - and this includes suppliers - are committed to the same goal and this ambition has helped the business succeed."

"When customers ring up, they talk about adding value, they don't talk about working height and reach but about impacting their primary processes, so I think we are a completely different company to the

traditional rental companies. I only have three people from the industry in the original 14 hired including myself. From a HR point of view, we didn't want to be a copy of our competition. Had I hired six salesmen from the competition, the company would probably have higher revenues by now, but we would then have a similar offering, dealing with similar customers however our approach would be different."

### Sustainability

"When we first started in April 2018, we couldn't qualify to support the big contractors in the Netherlands with a sustainability offering, as we were a new player in the sector. However, a year ago we were approached by two of the major companies looking to use sustainable companies on their projects. We have just signed a contract with one of them as they recognise what we offer to the market."

"There have been several development sites in the Netherlands that have been stopped because they were exceeding the emissions for that area. Now we are being recognised as a solution to their

problem and there are construction projects that need to be 100 percent emission free, so they need to redesign the way they work."

### Increased growth

We are growing so fast now to the point where if we take one day last week as an example - the 15th of February - we had the same revenue on that day as the whole of February last year!"

"Personally, it has been exhausting. It has been a tough couple of years, but we are financially stable and have a good team that is starting to take responsibilities without my direct influence. We may have changed the rental model ... slightly, but I think we have pretty much stayed true to our original ideas."



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# Boom battery conversion



With the growing demand for low or zero emission equipment, a question that comes to mind concerns the impact on the economic life of existing diesel powered machines, especially the larger more expensive models. JLG has developed a possible solution in the form of a retrofit kit to convert diesel powered boom lifts - starting with the 66ft 660SJ telescopic - to battery electric power.

The kit uses full traction forklift-type batteries made up of 24 two-volt cells to feed the 48 volt system, and includes automatic monitoring and electrolyte top up. However, a lithium ion option will be available shortly. Surprisingly the overall weight is not affected as much as you might expect, although of the two battery types, the lead acid option is clearly heavier, but the battery locations have been designed to ensure that machine stability is not affected.

The 'Conversion Kit' covers two versions of the diesel powered JLG 660SJ - those built between 2015 and 2017 and post 2017 models. The conversion involves removing the engine, fuel tank and fuel lines etc. The engine is replaced with a 30kW permanent magnet AC motor which connects to the existing hydraulic pumps. A new motor controller, inverter and control system connects into the machine's



JLG battery conversion kit

CAN bus system, interpreting controller movements to operate the functions selected, while adjusting the motor speed to match the demand on the pump, providing smooth operation and maximum efficiency.

The battery condition is fully monitored with a battery data display screen installed within the lower control panel, to show a wide range of information including battery charge levels and energy usage chart.

The conversion has been fully tested and CE certified by a notified body and is pitched as a way to



The electric motor connects to the machine's existing hydraulic pumps

The lead acid battery option



extend the working life of existing boom lifts, with some seeing this as a more environmentally positive solution than selling and shipping diesel machines half way round the world to less environmentally conscious markets. The company says: "This is intended to provide an option for our customers, it is not for everyone."

The company chose the 660 to launch the conversion pack as it came out on top in the research the company carried out. The kit will be

offered on other models, including larger booms.

So how much will this kit cost? Roughly a third of the cost of a new boom lift. Its take up will depend on how rapidly demand for all-electric machines grows, and the lead time for new electric models. While it does not offer the direct electric drive benefits of the latest all-electric boom lifts, it does offer an interesting option for fleet owners with young diesel models as their utilisation starts to fall away.

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