

The robots are coming

THE IDEA OF MECHANICAL SERVANTS GOES RIGHT BACK TO ANCIENT MYTHOLOGY, BUT THE PAST FEW YEARS HAVE SEEN ADVANCES IN THE TECHNOLOGIES THAT ARE MOVING FROM AUTOMATION TO ROBOTICS. **Malory Davies** EXAMINES THE ISSUES.

Just as our children can't picture a world without computers, it is likely that their children will feel the same way about robots. That slightly disconcerting thought comes from Clemens Beckmann, head of innovation at Deutsche Post DHL's letters and parcels business.

Robots, so long the stuff of science fiction, are developing rapidly – so rapidly in fact that Beckmann felt able to predict: "Developing the next generation of robots that can work around and among people will take a substantial investment to advance the technology, but at DPDHL Group we believe that soon supply chains will see humans and robots working side by side to handle goods faster and more economically."

DHL is currently testing two collaborative robots on co-packing and value-added tasks in its warehouses. The robots, called Baxter and Sawyer, have been working on a number of tasks, including: assembly, kitting, packaging and pre-retail services. In particular it is looking at how to integrate the robots into a number of operational sites globally.

"Historically, the distribution environment has been difficult to automate using traditional industrial robots, which do not respond well to variability," says Matthias Heutger, SVP strategy, marketing and innovation, DHL customer solutions and innovation.

When Amazon revealed plans for a new distribution centre at Tilbury on the eastern edge of London, it highlighted the fact that it would be equipped with robot technology when it opens in Spring 2017.

The online retail giant sees innovation in its fulfilment operations as critical to driving the growth of the business. It is determined to get costs down and sees robots as part of that process.

It acquired US-based robotics specialist Kiva in 2012. Now rename Amazon Robotics, it is developing machines that help speed order processing time and reduce walking time by moving the shelves to employees, as well as saving space with 50 per cent more items to be stowed per square foot. The technology is already in use at its Dunstable and Doncaster facilities.

John Tagawa, Amazon's vice president of UK

The EiraTech solution targets the 70 per cent of a picker's time that is wasted walking around a warehouse or searching for an item. The EiraBot v4 has a lifting capacity: up to 500kg, and a maximum speed of 14 kmph.



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operations, says: "The Amazon teams are dedicated to innovating in our fulfilment centres to increase speed of delivery while enabling greater selection at lower costs for our customers. The introduction of Amazon Robotics is the newest example of our commitment to invention in logistics on behalf of our employees and our customers."

And it is not just in the warehouse that robots are being tested. The first Starship delivery robots are set to take to the streets in the Germany, Switzerland, the UK, and USA in the next few weeks.

They will deliver groceries and online purchases to consumers starting in August/September. The robots are specifically designed for deliveries within a two to three mile radius and are expected to deliver goods in 15 to 30 minutes.

The robots can drive autonomously while being monitored by human operators in control centres.

Starship Technologies was established in 2014 by Skype founders Ahti Heinla and Janus Friis. Allan Martinson, COO of Starship Technologies, says delivery robots are cheaper for last mile delivery than ordinary carriers costing between 50 cents and \$1 per delivery. The cost of a van and driver means that the comparable cost of a conventional scheduled delivery \$1.50 to \$3.

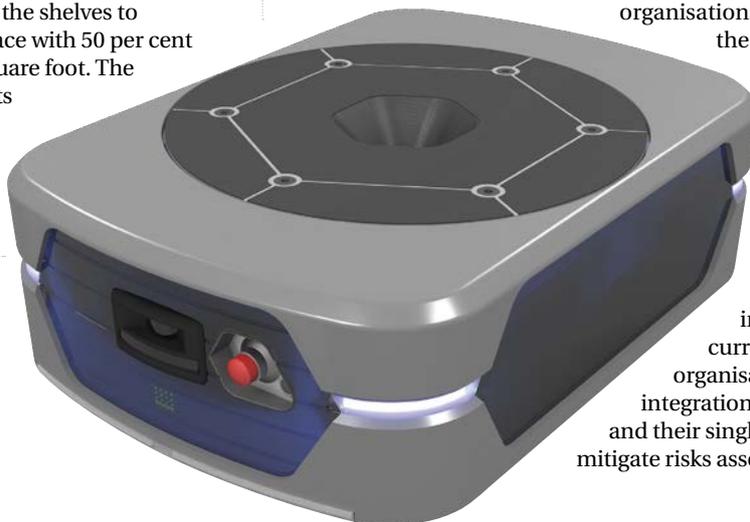
STARSHIP

The Starship robot weighs 15 kg and can carry goods up to 13 kg. It runs at a top speed of 6 km per hour and is almost entirely self-driving. It drives autonomously using computer vision and GPS, but in the short term, needs to be human-assisted when crossing the street or passing areas with road construction.

Jochen Brunstein, head of engagement management retail & logistics DACH at SQS Group, says: "When working at its best, automation not only benefits employees, but also drives the bottom line of organisations within the industry. Yet, with

the emergence of robotics, organisations find themselves weighing up the pros and cons when the reality is there is little difference between the two.

"It's not a choice of one or the other; robotic systems must integrate into the existing automation model, essentially introducing robots into the current system. This means logistics organisations need to focus on this integration to maintain smooth operations and their single-data stream. However, to mitigate risks associated with the integration of





Introduction of robotics reflects Amazon's commitment to invention in logistics, says operations chief John Tagawa.

systems, quality assurance must be embedded throughout the entire process. This will ensure security remains at the core of the process from inception, rather than treated as a bolt on at the end," says Brunnstein.

Duncan Boyd, senior consultant at Crimson & Co, points out that traditionally, automated systems in warehouses are 'fixed'. "This means that the machinery only operates within strict parameters, performing largely repetitive tasks. With robotic technologies, a greater deal of flexibility can be achieved across a number of tasks. The small, difficult, complex and repetitive tasks that humans have typically performed could soon be performed by robots, who are less prone to error or tiredness."

Within the logistics industry, the AGV is the most mature and proven of robot technologies, says Alexey Tabolkin, chief executive officer of EiraTech.

"Among the best known exponents of this robot technology is Amazon, who famously bought robotics firm Kiva, which is now part of Amazon Robotics. And a recent note by Deutsche Bank reported that Amazon's purchase of Kiva has turned out to be a very wise investment indeed. According to reports, it is only since 2014 that Amazon has been really using Kiva's robots in their warehouses, but that in the short two-year period since, Kiva robots have cut operating expenses by about 20 per cent, adding that it would translate to roughly \$22 million in cost savings – for each fulfilment centre.

"Furthermore the report estimated that Amazon could cut another \$800 million in one-time cost savings once it deploys more Kiva robots across the 110 fulfilment centres that don't have them yet. Amazon uses Kiva robots in only 13 of its fulfilment centres currently. Even for those of us working in the same industry and taking the scale of Amazon's operations into account, these are pretty

OPERATIONS

Where can robots make a difference?

DHL recently produced a report "Robotics in Logistics" which found that 80 per cent of logistics facilities today are still manual due to the complexity of the operations but suggested that as technology improves, the logistics industry will benefit from the adoption of collaborative robots to improve efficiency. The report highlighted five areas: home delivery, stationary piece picking, mobile piece picking, co-packing and customisation, and trailer and container loading and unloading.

Alexey Tabolkin, chief executive officer of EiraTech, says: "Identifying which area of the logistics and supply chain to which robotics solutions are most suited is key. We look at this problem as an 'analogue' vs 'digital' question – which tasks are humans better at, and which are robots better at performing? – and then allow each element of the workforce to work to their strengths. It is estimated that 70 per cent of employees'

time in a non-automated DC is actually spent walking and searching for goods. It is also estimated that robots will increase accuracy of picks up to 99.9 per cent – and with each return costing significant sums to reintegrate and replace this too is an increasingly targeted area for improvement. Meantime, no robotics handling technology has yet been developed to deal with the range of goods that need to be picked and packed for dispatch.

Tabolkin believes that picking should be left to the people in a workforce, while time consuming and repetitive tasks such as searching, retrieving, and carrying should be the task of robots. The software used to control robots can also analyse the 'big data' of incoming orders, and thus organise and prioritise orders on an on-going basis," says Tabolkin.

However, Brian Whale, senior logistics consultant at Swisslog, says: "The picking of good quality and uniform items, or cartons, at a consistently high pick rate is ideal for robot technology. Robot technology is highly suited, and in fact built around the automated picking and placement on to an automated packing line or machine, or palletising / de-palletising and storage. Robots are

now capable of operating in a wide range of environments with all manner of applications, but they are perhaps best suited to operations where a highly repetitive task is to be undertaken repeatedly over long hours."

Bruce Bleikamp says: "At Cimcorp, we've seen an increase in automation adoption in dairies, bakeries and consumer products warehouses that use totes or bins to move their product. We can use our MultiPick solution to stage and then pick store orders in a specific sequence. Additionally, our layer pick system has been widely implemented in large distribution centres that pick more than 1,000 layers per day from 50-500 SKUs and can be applied in any distribution centre shipping volume in layer quantities. Bleikamp also sees growth in automatic truck loading. "As technology advances and robots can unload trucks in a reasonable time frame safely, it will be more widely adopted."

TGW already has robotic solutions that can de-palletise and palletise a wide variety of unit loads including cartons & tote bins. Phil Steeds, Northern Europe sales director at TGW says: "Future plans include automated collation of mixed goods inside a carton and single piece picking, working alongside human operators in existing warehouses."

Jochen Brunnstein, head of engagement management retail and logistics DACH at SQS Group, says: "The introduction of robotic technology within logistics and supply chain will completely transform the industry as we know it today, with a potential emphasis upon the final part of the supply chain – delivery. UK trials for driverless lorries are expected to commence in 2017 and are set to take over the logistics and supply chain sector worldwide.

"Driverless lorries have greater potential than delivery drones, as these drones currently carry a higher security threat to the public than that of autonomous vehicles. Due to government concerns with terrorism and a plethora of local laws that drones will need to comply to, it is unlikely they will be fully adopted as a core means of delivery," says Brunnstein.

“Introduction of robotic technology within logistics and supply chain will completely transform the industry...”



POLITICS

Will the public accept robots?

The challenges presented by the development of robots and drones are not all technical – if they are to be used in public places then they will need to gain political acceptance.

Cimcorp's Bruce Bleikamp says: "Realistically, the use of robots and drones in cities faces a lot of obstacles. Safety is the number one concern. Robots and drones have to be tested in real-life scenarios and proven to be safe to operate in busy, public areas before they will be more accepted. Companies could try delivering packages to secure roof tops near consumers' homes in the beginning stages of testing.

"Mobile robotics, driverless trucks and cars face the same challenges. I believe we will get to that point someday, but the technology has to be vetted before people want to see large delivery trucks coming down the road without a driver," says Bleikamp.

Swisslog's Brian Whale points out that it could be said that robots are already in public areas, "take theme park rides or cruise control, monorails and automated home appliances, for example, but it is all a question of

perspective. In terms of the supply chain, security and privacy issues have to be resolved first for drones, and as we are seeing with self-driving road vehicles, where there is a will, there is a way. If business sees a cost benefit and the public sees a performance benefit, the political winds will blow with the prevailing mood."

EiraTech's Alexey Tabolkin highlights the potential for injuries and possible litigation, whether it is by accident or by some act by the person themselves. "Currently cars are regulated by traffic lights to ensure their safe operation with responsible people driving them. A similar form of control may be needed to facilitate the use of robotic solutions in people dense environments. Time segregation is probably the most suitable way of letting them share a work or general area. Security is another issue of paramount concern. The potential for unregulated use of such equipment could lead to serious threats to both personal and national security.

Ultimately, says Andy Keith of Total Logistics: "Complete assurance of safety is the most important single factor."

astonishing figures, and these advances in the technology now mean that similar advantages – albeit on a smaller scale – are now available to enterprises of all sizes," says Tabolkin.

Cimcorp manufactures turnkey robotic gantry-based order fulfilment solutions. Sales manager Bruce Bleikamp says: "When we think of mature products we think of the hardware that makes up a solution, such as the robotic arms and gantry robots. What's new are the sophisticated software controls and end effectors that are making robots faster and more flexible while providing complete product traceability. The recent popularity of robotic technology relates directly to the

consumer needs of receiving products faster, a demand that manual systems or even older technologies can't handle."

Brian Whale, senior logistics consultant at Swisslog, highlights the widespread use palletising and de-palletising technologies. "They have also been used for many years on production lines, to the extent that this is no longer considered particularly unusual. However, the transition into the distribution world has been a little slower. Perhaps the issue relates to the perceived variability in load sizes or throughput demands, or the integration with manual processes. This is where KUKA and Swisslog's AIP robot is offering a step into the future, by allowing human-robot collaboration. The Automated Item Pick solution is the first of its kind to bring human-robot interaction into the smart automated warehouse. The sensitivity and speed of the collaborative lightweight robot, LBR iiwa, allows people to work side-by-side without cumbersome protective barriers or fear of injury. LBR iiwa can work continuously and repeatedly with simple or heavy picking tasks, as the 'human partner' carries out other complex operations."

Phil Steeds, Northern Europe sales director at TGW says: "The most mature areas of robotic technology are in the areas of automatically delayering and layering pallets. Mainly in areas of single SKU, standard carton size loads. These applications still exist but are tending to move towards a requirement for the building of multi-SKU pallets which requires a higher level of robotics to handle different sized cases."



“Robotics will become more popular where there's a high level of employee turnover and risk of injury...

Bruce Bleikamp

Steeds points out that an automated storage and retrieval system (AS/RS) can maintain 100 per cent accuracy 24/7. "AS/RS improves business processes and increases efficiencies at low operational cost, but it can only go so far. There are still human elements within the supply chain process that can adversely affect the delivery of the finished product and the quality of the product itself.

"The increase in buying and delivery channels, a wider variety of SKUs and tighter and tighter time scales invariably increases the physical and the mental strain on warehouse teams. These pressures may create unwelcome health and safety issues and can also result in corners being cut to achieve targets. The results may be damaged product or cases, returned stock, staffing problems and the consequent administration, recruitment, service, financial and reputational costs to the business," says Steeds.

"Currently, AS/RS dominates the market, although Automated Guided Vehicles will witness double-digit growth over the next five years. The impact of and applications for robotics are yet to be fully determined, but have the potential to help address the issues outlined above and outperform the other two technologies in a similar time frame," says Steeds.

BUSINESS COST

As always in logistics, cost will be a key issue in the adoption of robots, but availability of labour is also a consideration.

Cimcorp's Bruce Bleikamp points out that there are some jobs that people just don't want to do. "Because of this, automation and robotics will continue to become more popular in markets where there's a high level of employee turnover and risk of injury. Financial considerations will come down to the return on investment element and not simply the burdened labour cost. Many retailers are highly cyclical, but there is a stronger benefit to automation compared to hiring and training temporary workers because it is very costly. Additionally, costly hiring and training can lead to management and operational issues. These issues can be avoided if automation can pick up part of the burden. Automation often leads to higher order accuracy, which is always a goal and can sway more retailers to analyse their operations and consider automation," says Bleikamp.

Crimson's Duncan Boyd says that a single robot working in a picking and organising environment could cost as much as \$34,000, with an extensive development process required prior to purchase.

"However, it's worth looking the bigger financial picture that robots present. When compared to an average payroll of an employee in a picking environment, \$34,000 doesn't seem all that much especially when considering total cost of ownership over a number of years. Given how much easier it should be to make quick changes to robots compared to large-scale automation processes, they make a sound financial choice over more traditional automated systems.



"Additionally, it's worth considering the other costs that are off-set by integrating robotic technologies. The costs of error, repetitive non-value adding activities and costs of harm are completely removed with a robotic workforce. These factors together point to robots posing an interesting capital investment proposition for modern businesses," says Boyd.

There is also the issue of dealing with the demand peaks that are common in many logistics operations. "It may not be possible to justify investment in automation up to the absolute peak, so alternative strategies for peak handling must be found," says Andy Keith of Total Logistics. ■

Cimcorp's MultiPick solution is designed to stage and then pick store orders in a specific sequence.

THE FUTURE**Technologies on the horizon**

Large-scale adoption of robotics depends, to some extent at least, on the level of maturity of the various technologies involved.

Fully automated item picking of a complete range of products is still fairly new, points out Brian Whale of Swisslog. "If you walk through a supermarket and look at the variety of packaging that is on the shelf, it is quickly evident that today only a limited range can be consistently picked."

KUKA and Swisslog are developing item pick technology with the KUKA LBR iiwa robot, but, says Whale: "Full automation does not necessarily mean greater efficiency. When we handle the basic throughput via robots and add people to the process in peak times, we raise flexibility to a whole new level. With the benefits of higher accuracy and efficiency, flexibility and mobility we're able

to bring unbeatable levels of performance, throughput and systems integration."

Phil Steeds agrees: "When one considers that grocery retailers may often carry 28,000-32,000 SKUs then one can see that for these to be picked at unit level will demand robotic manipulators and vision systems that are complex."

And EiraTech's Alexey Tabolkin says: "To date there hasn't been a picking solution that can accommodate the diverse range of shapes/sizes and weights that would be required, particularly in an e-commerce environment. A lot of investment is going into this currently and it is only a matter of time until a realistic solution emerges. Once such technology can be proven it could transform warehousing and fulfilment dramatically."

Another area is the

development of robots to work alongside people in a warehouse.

"A number of companies have been developing 'cobots' (co-workers). The developments in sensors and camera technologies that allow these robots to see has meant they can be 'safer' to work alongside humans. The problem with them is that they end up working at the pace of humans rather than at their true potential efficiency levels. The need to keep them moving at a pace slower than human is due to health and safety considerations. The single biggest challenge in this regard is the inability of robots to predict illogical actions of humans," says Tabolkin.

Andy Keith believes that the growth of vision systems, to enable the robots to respond to their environment and "self-teach" is the most exciting application area at



Andy Keith

the moment. "We expect vision systems, whether on a robot or a person, to be coupled with analytical tools that will also scan the background environment while supporting regular tasks, comparing the real world with an expected "map". When discrepancies are spotted, this will trigger parallel tasks such as stock checks and housekeeping."