Heralding an era of automation

Does the launch of Kalmar’s Autoshuttle mean the end of the line for the automatic guided vehicle, asks Gavin van Marle in Antwerp

The era of the automated straddle carrier operating between quayside and stack has finally been born with last month’s launch of Kalmar’s Autoshuttle. The Finnish container handling equipment producer hopes the development will finally provide terminal operators with some sort of empirical evidence that will allow them to compare the automated shuttle – variously known as the sprinter or runner – concept with the more established automatic guided vehicle (AGV).

But will it? The only unit in existence so far is currently being trialled at the manufacturer’s test facility in the Belgian port of Antwerp – which, ironically, abuts a small PSA-HNN container yard where trainee straddle carrier drivers learn the ropes of their chosen trade.

The unit still has its cab – and, after trialling is complete, it is expected to return to manual operations. The SC250H model is identical to those that Kalmar delivered late last year to APM Terminals’ new facility in Virginia, where the first automated stacking cranes (ASCs) in the US have been operating since the facility’s opening in September last year. Originally the terminal operator placed an order with German straddle carrier Consens for 20 shuttle units, but this was later transferred to Kalmar after Consens found itself in financial difficulties.

Ilkka Annala, Kalmar’s VP of straddle carriers, says: "Basically, we have automated the Kalmar 50-tonne shuttle. The Autoshuttle can do all the stuff that the normal shuttle can: same speed and same turning circle, which is a nine-metre radius."
Jari Pirhonen, general manager of Kalmar Intelligence and Automation (KIA), adds: "The Autoshuttle concept takes the technology of APMT’s Virginia terminal one step further. "The logistics are very similar to using the manual shuttle carrier. But here we are talking about the shuttle carriers under the backreach, so you can compare it with the AGV. The buffer is at the front end of the ASC stack, which we are feeding with the Autoshuttles. This means that the area under the portal of ship-to-shore crane can be used for handling hatch covers and twistlocks, as well as for special containers like oversized boxes."

The unit seems specifically designed for a system such as that currently being deployed at the DP World-controlled Antwerp Gateway, where there are two ASCs on the same rails per module. One unit works on the ship side, and one on the yard and gate side. Pirhonen adds that the advantages of this high level of automation is not restricted to simply saving labour costs: "This is a concept that would also work well in a port where you have multiple cranes operating on a single vessel in a small amount of space. The Autoshuttle provides operators with a greater buffer capacity because it can go over boxes which are on the ground. Additionally, fuel consumption and maintenance would go down in comparison to a manual straddle carrier fleet, and there are obvious labour cost savings."

Nevertheless, Kalmar executives remain well aware how contentious an issue this is, especially in the US where unions are fiercely resistant to the idea of automation, but point out that across the developed world there is a serious problem with recruitment of workers into the port business. "Even on the US west coast, the average age of the labour force is 53 years old, which means there are fewer people coming through who will be able to operate straddle carriers as efficiently" adds Karel van Helsingden, director of Kalmar ACT. Advanced Cargo Transhipment (ACT) was acquired by Kalmar last summer in a bid to boost its R&D expertise in automation projects. It was part of Netherlands-based navigation systems developer Frog Navigation, and was hived off specifically for the acquisition. ACT is an expert in developing and marketing equipment navigation control, and terminal operation control hardware and software for complex logistics systems and processes using automated vehicles and equipment. Applications include straddle carriers, shuttle carriers, automatic guided vehicles, as well as traffic management and control systems, and the firm has since been integrated into KIA.

While the automation technology in the shuttle is drawn from the AutoStrad design that has been deployed at the Australian port of Brisbane by terminal operator Patrick – now known as Asciano, following its takeover last year by the Toll Group – the navigation systems will remain separate.

The AutoStrad navigation system was designed in a joint venture between Kalmar and Patrick, whereby the automated straddle carriers find their way round the terminal through a radar-based system with additional input from GPS and an ‘inertia navigation system’. In contrast, the Autoshuttle system, developed by ACT, employs a magnetic measurement system that sees magnets embedded in the terminal surface and magnetic readers that are placed on the Autoshuttle’s side frames. The technology draws on ACT’s previous experience in developing navigation systems for passenger bus transport system in Eindhoven, Holland.
Tirkkonen says: "The system is reaching an accuracy of 50mm. The navigation is based on a grid of magnets in the ground, technology which was developed by ACT. The acquisition of ACT was closed in early September. With it we bought some new products which we can use, and which are in the Autosholuttle system. The readiness level of us to bring this technology to the market was greatly enhanced by the acquisition of ACT."

Tirrkonen adds that the company decided against the use of transponder technology, which it believes is too expensive and not as reliable – as well as GPS, which it claims would not have enough operational consistency: "Due to the size of the vehicle, there would be a lot of GPS 'shadow' positions in the real terminal, and the accuracy is not sufficient for unmanned driving."

He adds that while the magnetic system has been tailor-made for controlling Autosholuttles, the AutoStradt system will continue to use that which was developed at Brisbane: "Actually, the AutoStradt system in Brisbane is using a radar-based navigation system, mainly due to better flexibility compared with magnets."

While the system appears to work seamlessly in the controlled environment of Kalmar’s test centre, with the machine swooping in across the empty surface in easy, quick parabolas, will it be able to cope with the innumerable exceptions that real-life operations constantly throw up? Richard Clarke, of port consultants Halcrow, raises the problem that has been encountered in automated terminals operating AGVs: "At a terminal I visited recently, there was an AGV unit that was about to turn down a row, but had to come to a stop because there was an obstruction in that row. This created a queue of the units behind it in the lane because there was no mechanism for the AGVs to be able to overtake the parked unit. Will the Autospluttles be able to overcome that?"

In response to this issue, van Helsingden says: "In the case of a gridlock situation, the system can re-route the Autosholuttles." This is partly because Kalmar has developed a terminal logistics system which sits 'underneath' the terminal operating system (TOS). "The terminal logistics system software is provided by Kalmar. It is communicating with the TOS like receiving job orders and updating the container map after each move."

Provided that the automation technology is sufficient, and given that all straddle carrier manufacturers have successfully demonstrated the ability of the shuttle carriers to perform between the quays and stacks, it only remains to be seen whether terminal operators come round to the idea that an automated shuttle carrier is more efficient in terms of cost, as well as operationally, than the traditional AGV.

"The capital cost of two to three Autosholuttles and five to seven AGVs is about the same. The selling point of the Autoshouttle is the productivity increases that can be achieved over the AGVs. It’s all about getting to that magic number of 40 moves per hour on the cranes – and to do that, the landside operation needs to be speeded up." says van Helsingden.

There are, naturally, those who disagree. Yvo Saanen, MD of Dutch consultancy firm TBA, a subsidiary of Gottwald Port Technology – which, of course, is the pioneer of AGVs – recently wrote in the pages of Cargo Systems: "The least interesting automated system, despite its ability
to fully decouple [the quay and yard operations] is the automated shuttle carrier, mainly due to its high price, and relatively high maintenance costs."

Certainly recent history suggests the AGV system remains the favoured automated quay-to-stack operation. Cargo Systems understands that ECT in Rotterdam invested £30m in its 96-strong fleet of AGVs that are to be deployed at its forthcoming Euromax Terminal – equating to £312,500 per unit. Jerome van Meel told CS during a visit to the port that the buffer zone between the quay cranes and AGVs would be created by the STS units' second trolley: "We came to the same conclusions as Altenwerder about the automation."

There may well be a willingness on the part of some operators to test the technology – but making the leap from that to employing a fleet of Autosshuttles and fully automating a terminal, even in high-cost labour regions, is likely to take some time. cs

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