Case Study

Linfox Kellogg's.

Award winning technology.

DEXION®

"Pallets of finished product are uploaded onto an automated pallet conveyor, taken over the airbridge and delivered to the distribution centre."

The new Linfox DC for Kellogg's recently won the inaugural 'Award for Excellence in Supply Chain Management and Distribution' at the SMART 2007 Conference in Sydney.

The award winning state-of-the-art facility was commissioned to manage the warehousing and distribution of all Kellogg's cereal products manufactured at its Botany manufacturing facility. Linfox originally gained the Kellogg's business when it acquired Mayne Logistics in 2003.

Prior to the new facility being commissioned, Linfox engaged a 24-hour shuttle service between the Botany facility and the Linfox Minto warehousing operation. On a daily basis, a significant number of pallets would be loaded onto articulated vehicles, transported to Minto, and then manually handled in and around the warehouse.

The Minto warehouse accommodated 28,000 pallet positions and was 27,000 square metres in size, with no automation to speak of.

Collectively, Kellogg's and Linfox identified the need to manage the distribution centre processes with less manual involvement and more automation. The challenge was to create an environment that could automatically process high demand volumes whilst also achieving high storage density. The decision was made to co-locate the new Linfox facility alongside the Kellogg's manufacturing facility to achieve this goal.

Design for flexibility.

The new distribution centre was designed to provide Linfox with flexibility on how the building may be used over its useful life. As a result, the Kellogg's solution had to meld with the 'general purpose' configuration of the building.

The solution design and concept were complex as it was necessary to maintain the best storage density and maximise volume throughput. Dexion worked with Linfox and Kellogg's to develop this design. The system had to incorporate Kellogg's requirements to receive product from the

"Linfox has experienced about a 10% reduction in pick error rate with the new system, and product damage has reduced by 85%."

manufacturing facility 24 hours a day, 7 days a week, and to minimise any disruption to manufacturing by the warehouse operations.

Throughout the design process Dexion worked with Linfox and Kellogg's, confident in the knowledge that the final design concept would be both acceptable and competitive. As the design process evolved, Dexion continually researched the supplier market and identified 'best of breed' equipment for the overall solution. This included pallet conveyors, robotics, storage and retrieval systems, and IT hardware.

The chosen solution saw the production facility connected with the distribution centre by an 'airbridge' placed over the dividing road. Pallets of finished product are uploaded onto an automated pallet conveyor, taken over the airbridge and delivered to the distribution centre. Previously, stock was transferred by semi-trailers travelling approximately 40 kilometres from Botany to Minto, so the amount of product handling has been significantly decreased by the automated airbridge, with vehicle movements reduced to exceptions only.

The new Botany distribution centre can hold a total of 32,000 pallets within the automated storage component and the conventional section of the warehouse.

The automated storage and retrieval system (ASRS) enables pallets to be stored in five aisles, six-pallets-deep on either side. Each aisle is serviced by its own automated crane. Each crane has a satellite carriage unit that drives into the racking to deposit or pick up pallets. The ASRS can put away up to 90 pallets per hour and retrieve 120 pallets per hour.

The system presented a number of challenges for the Dexion project management team. Fundamentally, they had to engineer an advanced integrated system for a building designed for conventional warehousing. The system was selected due to its reliability and proven technology, but it is the innovation in the design of the overall system that makes this project so interesting.

A unique feature of the system is a component of Dexion's 'Real-time Distribution System' (RDS), which is the command-and-control centre. The RDS drives the ASRS from a logical viewpoint and interfaces with the Linfox warehouse management system, which in turn communicates with the Kellogg's ERP system.

The command-and-control centre provides a pictorial view of the ASRS operation and enables the operator to see what the system is doing in real time. It is designed to reduce the amount of time taken to resolve a particular issue since the operator is able to see where the problem is and fix it quickly.

The goal.

Linfox and Kellogg's required a new warehouse design that would provide a true 'win-win' for both businesses.

Some of the key deliverables sought were:

- reduced reliance on labour and manual handling of stock,
- a long-term partnership solution,
- increased responsiveness to customer demands,
- minimal stock movement.

An automated system solution was superior to a labour-based solution in meeting these requirements. Linfox has experienced about a 10% reduction in pick error rate with the new system, and product damage has reduced by 85%. The company has also been able to reduce its labour requirement - indicative of this is the ability to halve its forklift requirements in the new facility.

The time from when the product is packed to it being available for picking in the warehouse has reduced from two days to being received and ready for picking within one hour.

How it works.

At the end of the manufacturing process, Kellogg's cartons are automatically palletised and then wrapped by a shrink wrapper. Each pallet is checked at the profile checking station for pallet overhang on all four sides, to ensure the bottom

"Ideally, to optimise the operation of the system, only the fastest moving lines are stored in the ASRS. To maintain a constant flow of pallets to the cranes, each pallet transferred into a crane aisle is preceded by an occupancy check of the crane's infeed conveyors."

boards are present and that loads do not exceed height restrictions. The profile checker also ensures the SSCC number (within the bar-coded pallet labels) isn't missing.

Pallets that fail any of these criteria are flagged for local rejection. A circular log is created for all rejected pallets in the programmable logic controller (PLC), which details what is wrong with each pallet.

Rejected pallets are transported by conveyor through a return path to an existing Kellogg's turntable and reject lane, where they are unloaded via existing methods controlled by Kellogg's.

Pallets that pass the profile-check are transferred from the infeed turntable conveyor onto an accumulation conveyor. This conveyor mechanically accumulates pallets before discharging them onto the elevator turntable. The elevator raises the pallet to the airbridge conveyor level, and holds the pallet until the airbridge conveyor is ready to accept it.

Pallets travelling along the airbridge pass through an automatic roller door onto another pallet lift. They are then lowered to the warehouse floor level by the frame lift and discharged onto the conveyor system that accumulates each pallet before discharging it.

The induction conveyor is the primary 'decision point' location on the crane conveyor loop. The EXE warehouse management system provides the corresponding receiving task to the Dexion RDS prior to each pallet arriving at this induction conveyor. Pallets are check-weighed to confirm that the weight is less than the crane rating, and pallets exceeding this weight are redirected to a reject lane.

On confirmation of a good label scan and weight check, the pallets are inducted into the RDS control system. The warehouse management system looks at the SKU information to see if it is to be stored in the ASRS, i.e. if it is in the 'top 40'. If so, it hands the order over to the Dexion RDS

"To maximise performance, the closest pallet positions are selected, and to maximise storage utilisation, like batch-numbered pallets are stored within the same six pallet-deep location and across all cranes."

which puts the pallet away in the ASRS. The pallet will then move to one of the five crane aisles.

If it's a pallet destined for manual racking, it will be moved to this area and put away into the conventional racking. If the ASRS is full, the system will automatically move pallets to conventional racking also, or store them in block stack.

Production pallets destined for the conventional racking are moved to an exit conveyor where they wait until the forklift take-off conveyor is free. An indicator light announces that the pallet is ready and safe for taking off by the forklift operator.

Ideally, to optimise the operation of the system, only the fastest moving lines are stored in the ASRS. To maintain a constant flow of pallets to the cranes, each pallet transferred into a crane aisle is preceded by an occupancy check of the crane's infeed conveyors. If they are all full, the pallet is redirected to another crane.

The conveyor loads a pallet onto the crane, which takes the pallet to the correct location. The pallet is picked up by the satellite cart, which drives into the rack and deposits (or collects) pallets.

There are five automated stacker cranes operating within the ASRS system. Each crane is controlled by its own dedicated PLC located in the crane's control cubicle. Crane operational commands are fed to the crane PLC as required by the crane's SCADA system. This system acts as the interface between the Dexion RDS control system and the individual cranes.

To maximise performance, the closest pallet positions are selected, and to maximise storage utilisation, like batch-numbered pallets are stored within the same six pallet-deep location and across all cranes.

When retrieving pallets, the system selects the closest available storage locations, taking account of Kellogg's FIFO batch code philosophy. To maximise storage space utilisation, the system retrieves all six pallets from a selected location, and like batch-numbered pallets are retrieved evenly across all cranes. Once a pallet is retrieved it is then sent to despatch.

"The cranes are designed to work in the dark, further reducing lighting requirements."

Despatch.

At despatch the system features a robotic de-palletising and container-loading system, which is a self-contained operational unit not connected with either RDS or other conveyor controls. It consists of two identical robotic units, each capable of delivering cartons to one of two container positions.

Before de-palletising can commence, the telescopic boom conveyor is driven to the appropriate container loading door and activated, and the associated carton conveyor system is started. The container-door delivery lane is selected automatically by the position of the boom conveyor, and the required pallet stacking patterns are stored in the subsystem with their corresponding Global Trade Identification Numbers (GTIN).

A new pallet arriving at the de-palletising position is detected automatically by the robot control system and the carton GTIN is scanned. The system checks the GTIN against valid stacking patterns and then proceeds to remove cartons from the pallet, generally three at a time.

Cartons placed on the take-away conveyor flow automatically away from the robot area, then divert onto the lane conveyor associated with the boom conveyor position. Sensors on the conveyor check for jams or a natural build-back of cartons, and stop and start the conveyor as required to ensure an even flow onto the boom conveyor.

If cartons bank up to the robot put-down area, depalletising will stop until the carton conveyor is free again. Cartons discharge onto the boom conveyor, which transports them up to the working face within the container.

Workers unload and stack the cartons in the container with the boom conveyor moving backwards or forwards, up and down, as the container is filled. All orders are pre-ticketed before the truck arrives to avoid congestion at the loading dock, as it is critical that there are no delays in turnaround time.

Safety first!

General access to the ASRS pallet racking is prevented by a full perimeter fence without access points. Each crane run-out area is fully enclosed by a safety fence. Access to each run-out area is controlled by key and electrical interlocking of the respective access gates. Entry is restricted to authorised maintenance personnel who are fully trained to operate under approved procedures.

The pallet lift conveyor is fully fenced and protected by a light barrier system. Breaking of the light barrier will cause a general pallet conveyor system emergency stop. Each of the two de-palletiser robots is fully enclosed by a safety fence, and access to these areas is controlled by key and electrical interlocking of the respective access gates.

Entry is once again restricted to authorised maintenance personnel who are fully trained to operate under approved procedures.

Unauthorised opening of the gate during automatic operation causes the respective robot to immediately shut down. The pallet entry opening of these safety fences is protected by a light barrier to guard against unauthorised access by personnel climbing over the pallet conveyor. Unauthorised entry at these points will immediately shut down the respective robot.

Access to the robots' pallet stacker is protected by automatic doors. These doors remain shut at all times except when the completed pallet stack is being removed.

OH&S levels have been greatly enhanced with the new system. There are 32,000 pallet positions in the ASRS and conventional racking, so every time a pallet is picked from a high level bay there would be the potential for product, pallet or racking damage.

However, there is no issue with the ASRS because the cranes are the only equipment touching the pallets.

"This state-of-the-art Linfox distribution centre is a first for the Australian third-party logistics industry, and marks a new direction in relationships between customers and third-party logistics providers."

Environment.

Environmental issues were a key consideration during the design and awarding phase of the Botany distribution centre. The distribution centre is lit by lights that emit the lowest possible amount of greenhouse gases.

The cranes are designed to work in the dark, further reducing lighting requirements. The construction of the warehouse also accounted for environmental factors, such as insulation and the use of sky-lights. There are also recycling programs in place at this facility.

Product close to its use-by date is donated to charities nominated by Kellogg's rather than being sent to landfill, further reducing the impact on the environment.

The greatest environmental benefit achieved by Kellogg's and Linfox with the new facility is in reducing the number of semi-trailers travelling on the arterials between Botany and Minto. This is estimated to have eliminated approximately 11,200 loads of greenhouse gas-producing vehicle movements each year.

An award-winning achievement.

This state-of-the-art Linfox distribution centre is a first for the Australian third-party logistics industry, and marks a new direction in relationships between customers and third-party logistics providers.

It is the first facility where a third-party provider has implemented a fully automated system on behalf of a manufacturing customer. This is important for Linfox and important for the Australian manufacturing industry. Australian manufacturers increasingly recognise that their expertise lies in manufacturing and that logistics should be left to the experts.

Increasingly, they look to logistics partners such as Linfox to mirror their organisation. Many are international companies seeking partners that can support them across the Asia-Pacific region.

Dexion began this construction in May 2006 and Kellogg's then gave Linfox until the end of September to prove that the system was 100% operational, which has now been confirmed beyond doubt.

The system was delivered in full, on time and to the operational specification resulting in the facility winning the prestigious "Award for Excellence in Supply Chain Management and Distribution" at the inaugural SMART 2007 Awards for Supply Chain Excellence.