

## Connecting the Missing Links

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***The Raymond Corporation  
Greene, N.Y.***

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As warehouse management systems (WMS) have tied warehousing operations together, one critical device has stayed largely apart. Lift trucks — whose performance ultimately drives material throughput — have worked essentially as islands.

Of course, lift truck operators carry electronic clipboards that feed orderpicking data to the WMS. But information about the trucks themselves, such as mechanical condition, hours of service, maintenance status and modes of operation, remains locked away on board. The only way to collect such information is to visit the trucks, one by one.

Now, technology is bringing lift trucks into the network. The ***iWarehouse™*** enterprise fleet management solution, developed by The Raymond Corporation, creates new and powerful ways of using information to improve warehouse performance. The technology collects near-real-time data on critical truck parameters and transmits it wirelessly to a central databank, accessible by any browser-equipped computer or PDA. Used intelligently, this data can help warehouse owners:

- Get more productivity from lift truck operators and service technicians
- Diagnose potential lift truck issues remotely, thus preventing costly downtime
- Reduce the risk of impacts
- Benchmark and compare multiple sites' performance and develop best practices
- Optimize lift truck capital and reduce maintenance costs

Because the ***iWarehouse*** technology is built on an open architecture, it can integrate with a wireless networking environment, bringing lift trucks entirely into the fold of assets that can be managed optimally. The technology holds potential as the next big step forward in warehousing performance and productivity.

## ***Another Raymond revolution***

The concerns of the modern warehouse differ greatly from those of a half-century ago. Then, issues of space and physical equipment were paramount. The Raymond Corporation helped revolutionize the warehouse environment, starting in the 1950s with the invention of the narrow aisle concept.

The industry embraced narrow aisles almost overnight, and warehousing became more efficient by a quantum leap. Over the next 15 years, Raymond pioneered new lift trucks to take full advantage of narrow aisles. Reach trucks, pallet trucks, orderpickers, sideloaders and turret trucks all helped redefine the moving, storage and retrieval of goods in a more compact storage medium.

In the 1960s, Raymond began introducing new electronic technology to the forklift industry with the first advanced motor controls. Then came wire-guided navigation systems, height positioning and the first totally automated vehicles in warehousing. Now, sophisticated control systems, sensors, scanning devices and communication systems are universal in lift truck designs.

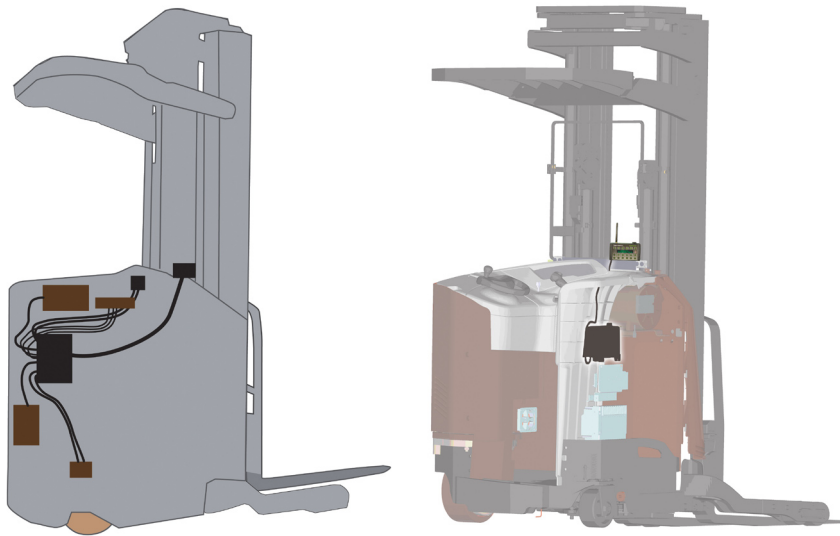
With so many basic productivity concerns now well-addressed, today's owners of intelligent warehouses are seeking ways to boost speed and accuracy, increase inventory turn rates, and improve customer service so they can compete successfully.

Already, the WMS ties multiple functions together, helping operators keep accurate inventory, reduce errors, shorten lead times, increase on-time deliveries, place and locate items quickly, and track employee efficiency. These systems are highly automated, linking data from multiple devices in a wired or wireless network. A logical next step is to bring lift trucks — those missing links — into the warehouse automation and communication fold. That is what *iWarehouse* does.

The concept is simple: deliver information that helps warehouse owners make sound decisions that affect every area of lift truck operation, from fine-tuning maintenance and service to maximizing operator performance to defining the optimum size and composition of the lift truck fleet.

## ***A new approach to vehicle communication***

The seeds of the *iWarehouse* technology were planted with the advent of the on-board vehicle manager — an electronic brain that controls the truck and therefore constantly monitors multiple truck functions, including alert codes that help simplify truck diagnostics and repair.



### **Octopus wiring**

The *Raymond iWarehouse* system connects to the lift truck vehicle manager with a single connector — the *iPort* — in contrast to the “octopus” design that has eight to 12 wires connected to switches, contactors and other external sensors.

### ***iPort* system**

From there, it was a natural progression to access the vehicle manager data remotely, so warehouse personnel would not have to collect it by literally going from truck to truck. That challenge is met by plugging a communications device directly into the vehicle manager by way of an *iPort*™ connection and exporting the data wirelessly to a central databank. The communications system is enabled through an exclusive relationship with ShockWatch®, an industry leader in usage monitoring and impact detection in the handling of goods across a full range of industries.

The data travels on a third-party, open-standard, commercial communication network. As such, there is no separate wireless infrastructure for the user to

install, support or service. Information is reliably accurate because it comes directly from the truck operating system. Data is transmitted at one-second intervals, essentially enabling real-time monitoring

The information is available not just to warehouse management, but also enterprisewide to anyone in the organization to whom it might have value. For example, maintenance technicians, service technicians and operators can all review the information in making fleet decisions. A service center dispatcher can utilize alert code and lift truck information to help ensure that service is completed on the first call. Notifications from the vehicle manager help ensure proper vehicle operation by lift truck operators and keep them informed when their license requires renewal. A regional warehouse manager can utilize fleet information to compare one facility to another in their region for benchmarking purposes, while a national organization can generate a fleet overview across multiple regions. The ability to monitor fleets regionally or nationally aids in truck replacement, right-sizing fleets, employee staffing levels and budgeting.

The information collected from lift trucks can have compelling value when collected from an entire fleet and analyzed intelligently. The mere ability to collect data remotely and to transmit certain instructions to the trucks can have major benefits.

## ***Putting data to work***

Lift truck data can help managers optimize labor costs, which by various estimates account for 70 percent to 80 percent of lift truck operating expenses. The information also can help improve operators' productivity, reduce maintenance costs, and limit costly, unplanned downtime. The iWarehouse system offers a variety of modules, each of which uses vehicle manager data in specific ways to enhance warehouse operations. Companies can choose any or all of the modules that best suit their needs.

1. ***iAlert™* monitors the health of the fleet.** Service alert codes are traditionally used by service technicians working directly on a truck. Now, these same codes enable trucks to signal when something is wrong — in effect summoning help automatically.

At the early onset of trouble, such as an abnormal temperature or pressure, the truck generates an alert code, time-stamped and tied to the truck serial number, hour-meter reading and battery state of charge. The data system then automatically e-mails the alert code to a dealer or in-house service technician, who uses the information to diagnose remotely. The technician can better prepare for the service call, assembling all necessary tools and the parts most likely needed. The truck is pulled out of service before a failure occurs, and the technician typically fixes the problem on the first attempt. Extended downtime is avoided, and the repair itself costs less because it is executed efficiently.

The capability of *iAlert* also can help streamline regular truck maintenance. Managers can monitor hour-meter readings remotely and schedule maintenance at the optimum times, servicing trucks while they are off-shift.

2. ***iMetrics™* deploys the fleet to the maximum potential.** Lift trucks generate major capital and operating costs, and the efficiency with which they are used has a major effect on facility performance. Warehouse managers often ask these three questions: Are we making the best use of the fleet? Do we need more or fewer trucks? A different mix of reach trucks, order pickers and pallet trucks? Data from the trucks themselves can help lead to answers.

Through *iMetrics*, the vehicle manager reports parameters such as run time, deadman time, travel time and lift time, providing clues to how trucks are being deployed. For example, high travel time and low lift time may indicate a high-value reach truck being used for jobs that a less costly pallet truck could do.

More broadly speaking, truck usage data, keyed to each truck's serial number, enables compilation of individual truck histories. These, in turn, can be used to compile custom reports on truck productivity and utilization, which provide evidence to be applied toward optimizing operations and the fleet itself.

For example, managers can:

- Compare operators' efficiency within a site and across an enterprise
- Compare efficiency among distribution centers
- See opportunities to adjust truck utilization to better balance workload throughout the day
- Right-size the fleet and make better-informed truck purchase decisions

3. ***iControl™* adjusts truck performance to fit operator skill.** Not every lift truck operator is the same. Newer operators generally are not ready to use a truck at the top of its capability. It is prudent to restrict the truck's performance for these operators until they improve their skills through experience and training.

Modern lift trucks can be programmed on the console to restrict travel speed, lift speed and acceleration to account for the operator's ability.

The *iControl* module takes that feature an important step further, allowing operator profiles to be entered on the central server and transmitted to all the trucks in a fleet. When an operator signs on for a shift, his or her settings wirelessly download to the truck. Therefore, it is not necessary to visit each truck to manually make on-dashboard adjustments for operators at shift changes. Managers also can update operators' profiles as they advance in capability. In addition, *iControl* also verifies that operator licenses are current and ensures the operator is certified to operate a particular type of lift truck.

4. ***iVerify*<sup>™</sup> ensures completion of daily inspections.** Preshift inspections help head off equipment issues that can cause downtime or compromise safety. The *iVerify* module lets managers program trucks so each operator must complete an inspection checklist at the start of the shift.

Checklist questions can be programmed according to priority: For failure on critical items (brakes inoperative, oil leak), the truck will not start; for failure on noncritical item (tire worn, dashboard light out), an e-mail notice is sent to maintenance for follow-up. The system also records and stores inspections with the date and time stamp as well as operator's name — extremely valuable for compliance with the Occupational Safety and Health Administration (OSHA).

5. ***iImpact*<sup>™</sup> detects lift truck incidents immediately.** Lift truck collisions with walls, racking or other vehicles indicate imprudent operation. At present, minor incidents that cause no visible damage often go unreported. The *iImpact* feature ensures that all such events are reported so management can take appropriate actions.

A sensor on the truck detects the impact and conveys the information to the central server, which sends an e-mail notification to a responsible party. The system can even be programmed to limit truck travel speed after an impact. Electronic reporting of the event's location is even possible. When operators know any incident will be reported, they tend to drive more carefully.

Tools like these can be complemented with *iTrack*<sup>™</sup> asset management software linked to the central databank. Here, warehouse personnel use a personalized Web portal to track parts and labor by truck serial number, and generate custom reports that reveal opportunities to save time, improve maintenance and cut costs across the enterprise. Vital information like best-practice presentations, special warranties, truck specifications and contact information also are available on the portal

## ***Deploying the technology***

Data collection and analysis tools like these are clearly beneficial. The logical question then is: How hard is the *iWarehouse* system to deploy? Current technology makes deployment quite simple.

In recent years there have been various efforts to collect and manage lift truck data with on-board sensing technology. The traditional approach has been to install sensors in as many as a dozen locations on the truck and connect them to a central module. This "octopus" configuration includes not just the sensors themselves but many wires, switches and contactors, each one a potential point of failure.

Users must decide which parameters they want to monitor. Installation can take hours per vehicle. In operation, reliability may be compromised. Components can be knocked loose in vehicle impacts, disrupted during service and maintenance, or worn out

in the normal course of work. A failing sensor may report data only intermittently. Replacement — assuming the problem is even detected — requires time.

Extraction of data directly from the vehicle manager through the *iPort* connection is more practical and effective: It requires only a single connector and installation requires only minutes per truck. Data collection capability is easily built into new lift trucks on the manufacturing floor, and retrofit kits enable easy installation on existing trucks. The data from lift trucks equipped with *iWarehouse* is not inferred from contactors and sensors, but comes from the vehicle manager itself, for improved accuracy and data quality.

## ***Looking down the road***

Beyond the benefits already available, *iWarehouse* has opened a portal into the operation data for the full range of *Raymond*<sup>®</sup> lift trucks. Capabilities that can be added in the future are limited only by the imaginations of users and truck designers. In essence, whatever data the vehicle manager collects becomes available for use toward the larger goals of improving facility performance and maximizing profit. New *iWarehouse* capabilities already envisioned include:

- Condition-based maintenance. Actual severity of duty is a better measure than an hour-meter reading for determining the optimum planned maintenance intervals. With additional sensing capability, and with algorithms derived from observed wear patterns, lift truck dealers will have information on which to proactively recommend maintenance intervals longer or shorter than those found in the truck owner's manuals.
- Failure avoidance. An understanding of failure mechanisms, derived from data, may enable predictions of when key components may require replacement and provide notification to service technicians. This will head off disruptive truck breakdowns and allow repairs to be scheduled so warehouse productivity is not affected

More opportunities are sure to emerge as researchers talk directly to customers and warehouse managers about their needs and work with WMS suppliers to integrate lift truck data with their systems for best advantage. Rapidly growing technologies such as navigation, radio frequency identification (RFID) scanners and voice over Internet protocol (VoIP) also may come into play as enablers.

Information and communications technologies are critical to achieving excellence in warehousing. Connection of the missing links — lift trucks — to the network with the *iWarehouse* system opens a new frontier of possibilities for great strides in warehouse and distribution center performance. ■

## ***About The Raymond Corporation***

The Raymond Corporation is the leading North American provider of materials handling solutions that improve space utilization and productivity, with lower cost of operation and greater operator acceptance. High-performance, reliable, ergonomically designed *Raymond* products range from a full line of manual and electric pallet trucks and walkie stackers to counterbalanced trucks, *Reach-Fork*<sup>®</sup> trucks, orderpickers and dual-purpose (pallet handling/case picking) *Swing-Reach*<sup>®</sup> trucks.

The *Raymond iWarehouse* system is available exclusively through authorized Raymond dealers. For more information about *iWarehouse* or to locate a Raymond dealer, visit [www.raymondcorp.com](http://www.raymondcorp.com) or call (800) 235-7200.