



### Using Real-Time Work-in-Process Tracking Systems to Jump-Start Profitable Growth in Manufacturing Organizations



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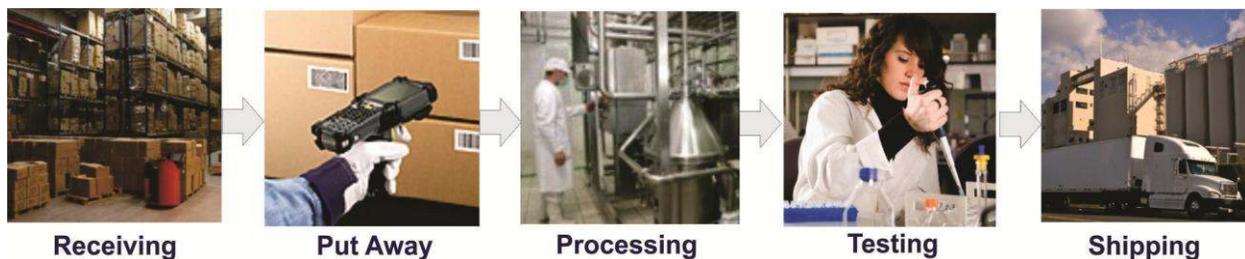
#### Introduction

In this white paper we will look at how manufacturing organizations can jump-start their growth and profitability through the use of technology. In particular we look at the use of real-time work-in-process tracking technology.

Work-in-process tracking is currently performed, in most manufacturing organizations, using paper forms and manual keyboard data entry into Excel spreadsheets. This is an area that is ripe for automation; but the benefits of implementing a real-time work-in-process tracking system go way beyond simply improving the efficiency of data collection, as we will explore in this white paper.

Some of our clients have managed to profitably double or quadruple their sales within a few years through the implementation of real-time work-in-process tracking systems. Others were able to dramatically increase their profit margins. In this white paper we will examine some of the ways they were able to do this.

#### What are Real-Time Work-in-Process Tracking Systems?



Real-time work-in-process tracking systems track and monitor the receipt, testing, processing, transformation, labeling, picking, packing and shipping of materials, as well as tracking the people and equipment involved in these processes. They replace the use of paper forms and manual keyboard data entry with technologies such as mobile computing, barcode and RFID scanning, and distributed real-time computing and decision support.

These tracking systems are expensive and time consuming to implement. A manufacturing plant will typically spend between \$25,000 and \$250,000 on such a system, depending on the size of the plant, and take anywhere from 2 months to 2 years to fully deploy such a system. But the benefits in improved sales and profitability can often be an order of magnitude greater.

Real-time work-in-process tracking systems are often used in conjunction with ERP (Enterprise Resource Planning) systems, which do the production planning and the post-facto financial analysis. The real-time work-in-process tracking systems typically automatically exchange data with these ERP systems, as well as with process control and test systems, to avoid the need for duplicate data entry.

## Jump Starting Change

This white paper is based on the authors experience with his clients, who are primarily mid-sized manufacturing plants and include food and pharmaceutical processors, defense contractors and other regulated industries. These plants typically have between 25 and 100 employees and annual sales or throughput of between \$5 Million and \$100 Million a year.

There are four major reasons that drive such a manufacturing plant to implement a new, technology based, real-time work-in-process tracking system:

1. **Company Growth has Stalled:** Sales and profit margins have reached a plateau or are declining and management decides the time has come for a major change.
2. **Sales and Market Pressures:** A major customer, or a group of customers, or the Government, or an industry standards body imposes requirements that would otherwise require hiring a small army of people to manually process all the needed paperwork.
3. **Operational Mistake Prevention:** Someone makes an expensive mistake that could have been prevented if the right systems were in place. These mistakes often lead to the loss of one or more major customers or very expensive recalls or other expensive and heroic efforts to correct the after effects of the mistakes.
4. **Technological Obsolescence:** Existing tracking systems or their underlying technologies are no longer supported by their manufacturers. This causes the information technology department to seek new, modern solutions to the organizations tracking needs.

## Removing Impediments to Growth

We see manufacturing organizations where, when they are small, the senior management has direct operational control of the machine operators and material handlers who produce the company's products. At this stage mistakes are easy to spot and correct and senior managers can prioritize work to ensure that customer orders get out on time, at a profit, without mistakes.

As the company grows in sales it becomes necessary to break the organization into departments and to appoint department managers and shift supervisors, just to handle the volume of work. If the underlying systems do not change, senior management loses visibility of what is going on operationally.

At this stage we see:

1. Customer orders being increasingly shipped late to customers who, despite having cost a lot of money to acquire, place their next order with competitors.
2. Expensive operational mistakes are being made. These range from using the wrong or defective components to make products to putting a customer order on the wrong truck.
3. Inventory levels start increasing and yet the company still has stock-outs
4. Profit margins dropping due to increased overtime, increased scrap and rework, and expedited shipping costs and late deliver penalties

5. Sales growth stalling because lead times for delivering products keep growing and manufacturing operations cannot make more products without dissolving into a total melt-down.
6. An increasing number of people are required to get the same unit volume of products made and shipped. The company starts to acquire expeditors to make sure products get out of the door on time, materials managers to make sure that the needed materials are on hand, and customer support people to explain to customers why their order was shipped late or is missing.
7. An ever increasing amount of time spent by managers in coordination meetings with other departments and with people within their own departments.
8. An organization in which everyone is working harder and longer hours and yet is failing to produce improved results or, in some cases, producing worse results.

So, what is the cure?

1. Use technology to give everyone real-time visibility as to the status of customer orders, inventory, jobs, equipment, and people. Now everyone, and especially senior managers, can see what is going on and have the tools to spot mistakes and take corrective action before, and not after, expensive mistakes are made. Once again senior managers will have the real-time visibility they had when they worked closely with the production workers. They will also have the tools to monitor the actions of their mid-level managers and supervisors in real-time.
2. By having the machine operators and material handlers capture the tracking data using mobile devices, we can eliminate much of the need for the overhead labor cost of expeditors, materials managers, and customer support people who previously managed this process.
3. Use technology as a decision aid to prioritize what tasks people work on to ensure that customer orders get out of the door, when promised, without excessive overtime. Such decision aids need to recognize that planned work schedules can be disrupted by machines that go down, delivery trucks getting lost or breaking down, and people who are out sick. So these decision aids need to dynamically prioritize the work to be performed as things go wrong and customer order priorities change.
4. Use technology as a decision aid to warn material handlers and machine operators when they are about to make an operational mistake. Also use technology to alert managers and supervisors when problems occur that they need to pay urgent attention to.
5. Use technology to ensure that operational information collected in one departmental system is automatically relayed to other departmental systems so as to avoid the need for endless coordination meetings about what is happening in other “silos”. Also use technology to generate management alerts based on data that is cross-departmental in nature, such as the impending late shipment of a critical customer order, and so is stored in the different systems used as their primary source of information by different departments.

6. Use technology to electronically capture materials traceability data in real-time such that the cause of defects can be quickly determined and recalls minimized before they critically damage customer relations or bankrupt to company.
7. Use technology to capture materials, labor and equipment costs in real-time as jobs are running and compare this with the planned expenditures. Then generate alerts for managers if cost over-runs are starting to occur so they can take immediate corrective action. This is much better than learning that you lost money on a job days or weeks later when it is too late to take corrective action.

All the above technology is integrated into real-time work-in-process tracking systems, such as those available from BellHawk Systems Corporation.

Re-engineering a company to jump start its growth used to be a management “fad” with its own gurus and proponents. These re-engineering projects largely failed because of the resistance of employees to changes that could threaten their own livelihoods. Managers and employees alike saw a team of external consultants who knew little or nothing about their operations playing “God” with their future wellbeing.

When we implement a real-time work-in-process tracking system, we give managers and their employees the tools to re-engineer their own operations. While some initially feel threatened, most recognize that the changes are needed for their own economic survival and growth. While we have had a few employees who have lost their jobs because they could not cope with the needed technology changes, in most cases good employees whose jobs were eliminated were quickly reassigned to other roles opened up by the resultant rapid increase of sales volume.

### **Responding to Sales and Marketing Pressures**

Most of the author’s clients are tier 2 manufacturers; that is they sit in the middle of the supply chain. They do not mine raw materials nor do they sell to the end customer. Instead they take raw materials from some producer and convert them into products that are used by another manufacturer or distributed by another organization to end customers.

These mid-sized tier 2 manufacturers depend on repeat orders from the same customers for most of their business and usually purchase their raw materials from a limited set of suppliers. Their success depends on maintaining long-term relationships with these external organizations.

The first requirement for success in this type of business is to be able to get customer orders out of the door on time with high quality at a competitive price, as described in the previous section, otherwise customers will quickly cease to be repeat customers and sales will fall.

On the other hand, if you are able to consistently deliver high quality products, delivered on-time, at a competitive price then your sales will grow.

Most tier 2 manufacturers have to respond requests for quotation for new or follow-on business. They need to bid low-enough to win the business but not too low so as to lose money. A number of the author’s clients use the detailed cost data, generated by their real-time work-in-process tracking system, as the basis for generating bids. This is especially critical where there is a pilot run of a new product and then a much larger follow-on order.

By using this detailed work-in-process cost data, manufacturers are able to accurately price their bids so that they are able to win profitable orders but give the “dogs” on which they would lose money to their competition. They are also able to closely monitor the manufacture of the orders then win to ensure that the planned profit margin is achieved.

By forcing sales people to take into account the known cost of prior production, this avoids the sales trap of “winning the business at any price” and hoping to make up the losses on volume.

Another critical sales factor in regulated industries, relates to materials tracking and traceability. Most tier 1 manufacturers and distributors have woken up to the fact that responsibility for product defects does not start on their receiving dock but extends all the way back through their suppliers manufacturing processes and their vendor supply-chain. As a result many tier 1 organization are imposing requirements on their tier 2 suppliers to have electronic materials tracking and traceability systems in place.

This is so that defects can be rapidly traced back through their tier 2 suppliers manufacturing process to the tier 3 raw materials suppliers. In this way the cost of recalls can be minimized for the tier 1 companies (what the lawyers refer to as the “deep pockets”) as well as their tier 2 suppliers. Real-time work-in-process tracking systems capture this materials traceability data in such as way as to facilitate rapid detection of defects and to enable the rapid recall of just the effected products.

As well as preventing problems, a real-time work-in-process tracking system can aid in the sales process by giving customers a real-time view over the Internet of the status of their orders as these flow through the manufacturing process. This additional benefit results in improved customer service by providing the needed information without the customer needing to call up a customer support person to find the status of their order. This can be extended to providing Emails or text messages to customer personnel when shipments occur or alerts if there is an unexpected delay for some reason.

## **Preventing Operational Mistakes**

Murphy’s Law states that “if anything can go wrong, it will go wrong”. This seems to especially apply to mid-sized manufacturers who are under continual pressures to get more products out of the door in less time with less resources. Machines break down, materials fail to be delivered on time, employees are out sick or quit, and yet products still need to be shipped to customers on time without mistakes. Also customers change their minds about their orders and when they want products delivered, with what custom features, and where.

Operations managers have to continuously juggle production schedules as well as the allocation of people, inventory and machine time resources to minimize the effect of disruptions. To do this they need the real-time visibility that real-time work-in-process tracking systems give to them. They also need decision aids to help them dynamically schedule operations as well as alert messages when things start to go wrong, which are provided by these systems.

But this is not enough. Employees can make mistakes due to not paying attention. These include:

1. Using the wrong, contaminated or defective materials for a job.
2. Running a manufacturing process with the wrong parameters.

3. Not ensuring that the products have passed all needed quality control inspection tests.
4. Picking the wrong products or the wrong quantities for a customer order,
5. Loading a customer order on the wrong truck.

These can all have potentially very expensive and far reaching consequences. Fortunately they can all be prevented by using a real-time work-in-process tracking system to detect when employees are about to make a mistake and to warn them before and not after they make the mistake.

Real-time work-in-process tracking systems also prevent data collection mistakes. All too often data written down on paper forms and then subsequently entered by someone else into a computer can lead to mistakes with significant consequences. A mistake made in writing down and then entering a part number into the computer for an inventory withdrawal can lead to failure to reorder critical inventory with a resultant hold-up in production and the late shipment of a customer order.

By providing real-time point-of-action validation of data as it is entered, operators and material handlers can be warned by their work-in-process tracking system and the error corrected before any harm is done. This is far better than discovering the error after you have run out of inventory which was critically needed for a customer order.

### **Avoiding Technological Obsolescence**

Over recent years Microsoft has declared end-of-life for its Windows XP and Server 2003 operating system, its FoxPro database/language and many features of its Access database software that were used to implement client-server applications. As a result, Sage declared end of life for their Pro and PFW series ERP systems and BellHawk Systems declared end-of-life for its older Access front-end based client-server version of its real-time work-in-process tracking system. Previously, with the demise of DOS, we saw a large number of products cease to exist.

These changes all present a significant challenge to IT managers as they try to keep the systems used by their manufacturing organizations working 24x7 to support their operations. These challenges are exacerbated by security concerns, “bring-your-own-device” challenges, and the increasing use of “Cloud” based and E-Commerce applications.

As a result of all this upheaval, BellHawk Systems has transition the user interfaces for its BellHawk real-time work-in-process tracking software to be websites that can be accessed anywhere, anytime there is an Internet connection, using a wide variety of web-browser equipped devices. This does not mean that BellHawk must be operated in the “Cloud”. On the contrary, most of our clients operate the BellHawk software on a Windows Server computer using a SQL Server database within their own manufacturing plant.

But, for the IT staff, this does offer a real-time work-in-process tracking system that is easy to deploy and maintain as it does not need any special software to be loaded on the data collection devices or the wide range of other devices used to access the tracking information. Updates can be done remotely and are typically constrained to happen on a single server computer.

We believe that the web-mobile technology, on which the BellHawk software is based, will be a stable technology platform for probably the next decade as this technology is based on the .Net technology adopted by Microsoft as it moves more and more of its technology to the Cloud.

An important factor in implementing real-time work-in-process tracking systems is the ability to automatically exchange data with legacy ERP systems as well as with Cloud-based applications and process automation equipment. BellHawk Systems has made a substantial investment in its Bell-Connector technology over the past few years. This technology provides, or automatically generates, over 90% of the needed code for implementing these interfaces working out-of-the box. This .Net code can then be augmented by clients or by BellHawk Systems' personnel to rapidly implement robust and reliable automated data exchange interfaces.

As the data exchange is hidden from the users of the real-time work-in-process tracking system, this enables other systems components, such as obsolete ERP systems, to be swapped out and new systems, such as E-Commerce websites added, without impacting day-to-day operations. This helps isolate the critical real-time work-in-process tracking activities from the technological obsolescence which might otherwise occur.

## **Commentary**

Real-time work-in-process tracking systems play a critical role in ensuring the ongoing success of mid-sized manufacturing operations. They are a potent competitive weapon, especially against competitors still relying on paper forms and manual keyboard data entry. They also help guard against mistakes that could seriously damage the financial status or market position of an organization. They can even prevent an organization from going bankrupt or being driven out of business by a massive recall.

Real-time work-in-process tracking systems are, however, expensive and time consuming to implement and require a high level of commitment from senior management to ensure successful deployment. The key ingredient in this success is the willingness of the organization to change and a sense from everyone in management that the time has now come to make that change.

## **Author**

The author of this white paper is Dr. Peter Green who has been implementing real-time information systems for industrial organizations for over a decade, with a special emphasis on work-in-process tracking. His team at BellHawk Systems has implemented nearly 100 systems for clients including manufacturers, food and pharmaceutical processors, biotech labs, and defense contractors, as well as systems for the US Navy and Air Force.

Dr Green received his BSEE and Ph.D. from Leeds University in England. He was previously on the research staff at MIT and was a Professor at WPI.



Today, Dr. Green spends most of his time coaching, training and assisting implementation teams in manufacturing companies to enable them to successfully deploy real-time work-in-process tracking and monitoring systems.

For more information about implementing real-time information systems, contact BellHawk partner and system integrator, Inovity at 800-452-7418 x9052, [www.inovity.com/software/work-in-process-software/](http://www.inovity.com/software/work-in-process-software/) or email [info@inovity.com](mailto:info@inovity.com).