Taking Year-End Inventory Made Easy

A White Paper by Dr. Peter Green

Introduction

Taking inventory at year-end is the annual ritual whereby we attempt to convince our auditors, our bankers, and our investors that the inventory value we place on our year-end balance sheet is accurate. It is also an opportunity to make sure that we have an accurate count of inventory in stock and possibly to sell off unused inventory.

Classically, taking inventory has meant shutting down operations between Christmas and New Year, and then paying a team of people overtime to come in and count inventory in warehouses, stock rooms, and in the production area. Then, in early January comes the process of adjusting inventory counts in the ERP or accounting system, followed by valuing the inventory.

In this white paper, we will look at the alternative of container-based tracking and how it can reduce the time to take inventory from days to hours, as well as to improve accuracy of both counts and valuation.

As one inventory manager stated in an email to me “Thank You, Thank You, Thank You! I just got my family Christmas and New Year back. We used to start the day before Christmas and have a team of eight people work right through Christmas and New Year to take inventory in our three huge warehouses. By switching to a BellHawk® [container based] tracking system taking inventory took less than 8 hours, in total, including adjustments.”

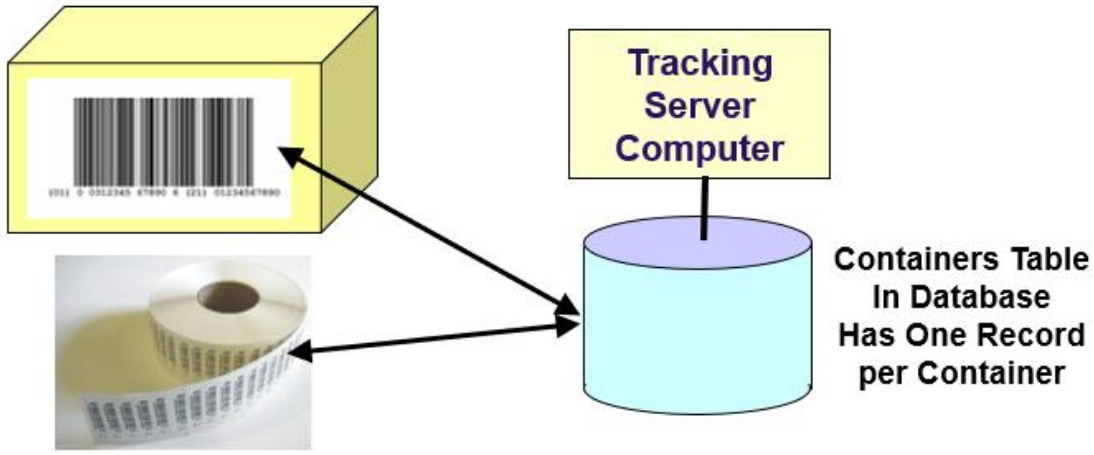
Traditional Inventory Tracking Methods vs. Container Based Tracking

ERP and Accounting Systems track the quantity of inventory by location. They are known as item-locator systems, because they track the quantity of materials at a location. These systems are sometimes assisted by traditional inventory tracking or warehouse management systems, which are also item locator systems. These inventory tracking systems typically use barcode tracking methods to record quantities of material received and their put-away locations, as well as the picking and shipping of products to customers.

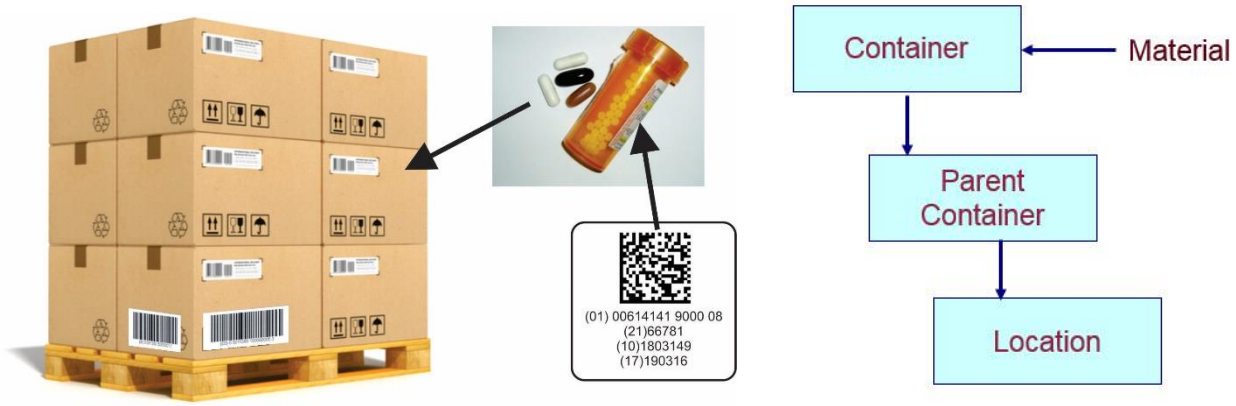
Container-based tracking systems, by contrast, place a tracking barcode number on each container of materials and then record the receipt, put-away, movement, picking and shipping of inventory by scanning the tracking barcode on each container. This may seem to be a small change but one that has great impact on keeping track of inventory.

Container-based tracking is used by organizations such as Amazon, FedEx, and UPS to track containers of material in their supply chain and is also the GS1 standard for global tracking of materials.

In an item-locator system, inventory is tracked by an Inventory table that contains the item number, location, and unit cost, which is an accounting-based method, and can be easily incorporated into a year-end balance sheet.



In a container-based tracking system, each container has a record in a Containers table, which is referenced by the tracking barcode on the container. In this record we track the barcode (or RFID) tag, the item number (in the container), quantity, unit cost, location, supplier, lot number, serial number, expiration date, quality control status, dimensions, item category, material type, as well as user defined parameters for the material in the containers. For manufactured products, the unit cost can include not only the cost of the input materials but also the cost of the needed labor and equipment time used in their manufacture.



Each entry in the containers table can have a parent container. This enables a container-based system, such as BellHawk, to represent nested containers, such as different serialized parts placed in boxes, which are stacked on a pallet, with each box and the pallet having its own tracking barcode. This nested container representation is also used for kits and assemblies.

Each entry in the containers table can also be a virtual entry, with no tracking barcode of its own, but referenced by the barcode on its parent container. This enables a container-based system, such as BellHawk, to track mixed parts, such as nuts, bolts, and washers in a barcoded box, without the need to individually barcode these items.

It is relatively easy to compute the quantity and value of inventory at a location from the contents of a containers table but impossible to compute the contents of a containers table from an inventory table (except under trivial circumstances).

How Container-Based Tracking Solves Inventory Taking Problems

Need to Shut Down Whole Warehouse and/or Factory to Take Inventory

Inventory moves within warehouses. This is especially true as pallets of material are moved from one location to another to get at materials behind them. In an item-locator system there is no record of what materials are on a pallet, only the quantity of materials at the location of the pallet. As a result, recording the movement of a pallet requires individually recording the movement of each individual part on a pallet, which can be a very cumbersome process for mixed pallets. As a result, with an item locator system, such moves are not recorded or the warehouse is treated as just one big location so materials moves do not have to be recorded.

With container-based tracking, all that is necessary is to scan the tracking barcode on the outer container and the location barcode of where it is moved to and all the materials on the pallet, or in the parent container, are automatically recorded as being moved in the containers table. Even then, however, material handlers sometimes do not record the pallet movement as they just "temporarily" move the pallet and forget to put it back. As a result, is not unusual for a pallet to "walk" across a complete warehouse over a period of a few weeks, as it is moved and moved again, without the moves being recorded.

Because of these issues, with an item-locator system, it is necessary to shut down the whole of a warehouse, when counting inventory. This inventory is then compared with the inventory in the item locator system to determine any discrepancies.

In a container-based inventory tracking system, it is only necessary to shut down one location at a time, which is typically one shelf, or a rack section, or a designated floor location, to take the inventory at that location. The entry and removal of inventory from other locations can take place while this is going on, as with a system like BellHawk, these material movements are recorded in real-time, until it is time to audit a location, when inventory movements in that location are temporarily suspended.

This enables inventory taking, and adjustment to take place incrementally throughout the year, and in the last few weeks before the year end, without a year-end "crunch". It also enables statistical accuracy validation whereby, if a sufficient accuracy is achieved throughout the year, then the annual year-end inventory taking can be avoided all together as the real-time inventory maintained by the container-based inventory system has been proven accurate to the desired percentage level, which is often better than that achieved by manual year-end inventory takers.

Ease of Taking Inventory

With a container-based tracking system, all that is needed for sealed containers is to scan the barcode on the box to record that it is still on the shelf. For example, all the information about a box of 25 washers still in its original packaging has not changed since it was received. The inventory taker does not have to re-enter any of this information (under most circumstances) as a simple visual conformation with what is presented on the screen of a mobile device, after scanning the tracking barcode, is all that is needed.

The same applies to sealed pallets, where the contents of each box on each pallet have previously been recorded, and it is not necessary (in most cases) to break-down each sealed pallet to record its contents.

Where boxes have been opened, or bins that contain parts are used, the parts have to be counted. For small parts such as washers, or to estimate the length of wire on a reel, then the parts count (or length remaining) can be determined using a weighing scale. With a container-based tracking system like BellHawk, with an attached weighing scale, the tare weight of the box or reel and the unit part weight or length per foot are already known to the system and so the count can be computed without taking the parts out of their container or wire off the reel. This can be done by simply placing the box, bin, or reel on the scale and having BellHawk record the weight and compute the quantity.

When scanning the barcodes of containers at a location, when taking inventory, some containers that are supposed to be at a location may be missing (because they were moved) and other additional containers may be at this location. A Container-based tracking system such as BellHawk can automatically match up missing and found containers and automatically record their new locations, thereby solving the problem of "walking" pallets, without shutting down the whole warehouse to take inventory.

All of this enables a container-based tracking system to use very fine-grained location tracking, which, in production, enables finding and picking parts very easy, even when the same part is stored in multiple different locations within the warehouse(s) or on the factory floor (as floor stock).

Inventory Valuation Issues

The same parts are typically purchased at different times, often from different suppliers, at different prices. These are often stacked as boxes of parts, at the same location, with an item locator system tracking the average cost of those parts at that location. This works reasonably well for tracking the value of the inventory provided that the parts are withdrawn at the average value and that the price is reasonably stable.

But, in times of high inflation (or deflation) this may not be an accurate representation of marginal costs of parts. As a result, some item locator systems use the artifact of first-in, first out, assuming that the parts withdrawn were at the purchased cost of the first parts added to inventory and adjusting the average cost of remaining parts appropriately.

To support this accounting artifact, materials handlers are instructed to use the oldest parts first, whose age the item their locator system cannot track. As a result, the materials handlers ignore this edict and simply use the easiest parts to get at.

As an alternative, item locator systems sometimes use an estimated value, which is computed by a person, rather than a computer, as the value of parts in stock, as well as those entered and withdrawn. This can work well if parts are valued at market value by weight, such as for hot-rolled steel or gold, but this feature has, in some cases, been used to “adjust” inventory values to reduce taxes or increase loan value for the organization.

In a container-based tracking system, each container of materials is normally valued based on its per-unit purchase price. When materials are withdrawn from a container, the barcode on the container is used to fetch the unit cost for that material in that container, from the containers table, and that is used to pass the value on to the container, such as a tote, in which the withdrawn materials are placed. Note that this is the actual purchased cost value and not some artificial value based on a FIFO or other algorithm.

If parts, which are identical, are mixed in a bin or tote, then a system like BellHawk computes the average cost based on the purchased cost of the containers from which they were drawn, again maintaining cost accuracy.

When parts are used to make an intermediate part, the value of the intermediate part is based on the actual cost of the parts used plus the cost of the labor and equipment time used in its manufacture. The same applies when the intermediate part is used in making a finished product, thus giving a system like BellHawk an accurate cost for each container of finished goods in inventory.

This may result in different products, which appear identical, having a different value, based on the materials from which they were made and how long it took to make them, which may give

some discomfort to accountants, even though the costs are accurate. This, however, does give cost accountants a very accurate measure on the profit (or loss) made on each customer order.

For this reason, some products, even in a contained based tracking system, may be valued at a standard cost, typically estimated as the sales price less the expected gross margin, a valuation on which I will not comment, because this is straying into the world of forensic accountants who investigate corporate fraud.

A container-based tracking system such as BellHawk can use material type, and other materials characteristic, to value raw materials at "spot" market value. Thus, earrings made from 24ct gold can be valued at a different cost from those made from 18ct gold, based on the daily spot price for the different grades of gold from which the earrings were made.

Valuing Work-in-Process Inventory

Most item locator systems, have great problems with valuing work-in-process. They can record the withdrawal of materials from inventory when they are picked to go to the production floor and record the entry of finished goods into inventory. In between there is a "black hole" where inventory value disappears from the balance sheet when raw materials are used and which does not reappear until finished products are entered into inventory. If production takes days or weeks to complete, this can result in swings of hundreds of thousands of dollars in inventory valuation inaccuracy.

To counter this problem inventory is often not considered withdrawn in an ERP or accounting system, until finished products are made or, even worse until they are shipped. This inventory withdrawal is then based on the assumed bill-of-materials (BOM) for the finished products made or shipped. Needless to say, matching this up with the inventory taken using an item locator inventory tracking system, is problematic at best.

With a container-based tracking system, the value of work-in-process inventory is tracked throughout its manufacturing process, adding up all the actual materials, labor, and equipment time consumed. There is a mini black-hole between the time that materials are consumed on a manufacturing operation and when the output work-in-process or finished product is produced but this is typically resolved by the end of each production day. Also, if an input part to an operation, such as a sub-assembly, is not consumed by the operation then its value is retained for the duration of the operation, eliminating the black hole.

As a result, this eliminates big swings in inventory valuation, accurately values work-in-process, and can have the materials (raw, intermediate, work-in-process, and finished products) in sync with the accounting system inventory, without any accounting artifices.

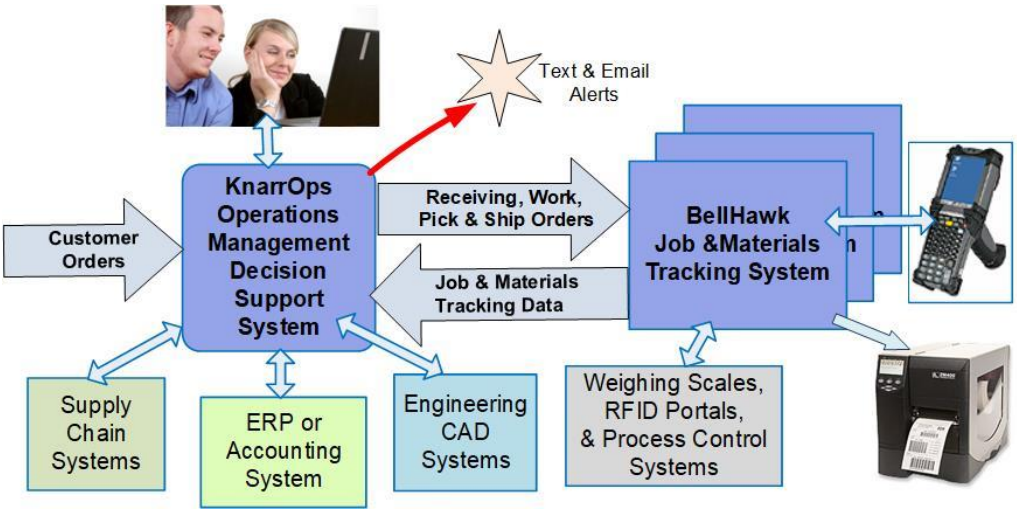
Auditing the Audit

As auditing takes place in the BellHawk container-based tracking system, BellHawk is building an audit history file with what should have been found in a location, what was actually found, what actions were taken by the materials manager to resolve any discrepancies, plus actions taken by BellHawk to match up "missing" containers.

Actions taken by the materials manager may include using a BellHawk mobile device to subsequently adjust the inventory count, "writing off" missing inventory, or simply accepting BellHawk's inventory count as accurate.

BellHawk tracks when containers of items were entered into inventory, their expiration date, and when specific parts were last used. This can then be used by the materials manager, using a mobile device, to scan the barcodes on specific containers or items, and declare that they are now scrap. This may involve a change in part number from steel brackets, for example, to scrap steel with an accompanying change in inventory value.

Updating the ERP or Accounting System



When inventory is taken using a traditional warehouse management or inventory tracking system, the system produces an Excel export that contains the part number, its location, and the inventory count. Smaller organizations simply prepare this directly using manual keyboard data entry into Excel.

These Excel sheets are then manually imported into a special table in the ERP or accounting system and a reconciliation process takes place in which the accounting department accepts, changes or rejects the inventory count adjustments from taking inventory.

Please note that, until reconciliation is completed, all activities involving inventory, such as production and warehouse operations, cannot take place (or more often can take place but are noted on paper forms until the ERP or accounting system can take entries once more).

While a container-based tracking system, such as BellHawk, can produce a similar Excel spreadsheet, the preferred approach is to use KnarrTek's KnarrOps™ operations management support system to automatically update both the cost and value changes of inventory in the ERP or accounting system on a nightly basis.

This changes the focus of responsibility for being the inventory tracking "master" from the accounting or ERP system, which tracks past quantities of inventory, using assumed values, to a container-based tracking system like BellHawk, which tracks the quantity and value of each item in each container in real-time.

This also enables the ERP or accounting system to work with large "locations" at the level of each plant or warehouse while each BellHawk system is tracking materials at thousands of bin and shelf locations. It also enables different valuations for the same item number at different sites, in different countries.

This is especially important where multiple BellHawk based systems are being used to track operations in different states or countries. In this case, a central accounting group has no idea what is happening at each plant or warehouse, let alone how to value its inventory. But, through a KnarrOps system, the value of each inventory at each site can be aggregated into a single ERP system.

Another major advantage of a container-based system is where certain inventory is supplied by a customer or is vendor-managed inventory, which belongs to a vendor until it is used. This tracking is performed at the container-level with the cost of customer or vendor owned inventory not being reported to an ERP or accounting system by KnarrOps but BellHawk tracking all of physical inventory, even if some containers of the same material belong to the organization and others do not. This is also carried through in BellHawk computing the unit cost of manufactured part by excluding the cost of customer supplied materials.

Pros and Cons of Container-Based vs Item-Locator Tracking

1. Don't have to shut down operations while taking inventory. Maybe an advantage or disadvantage depending on whether you want the time off or are earning extra money as part of the team taking inventory.
2. Results in accurate inventory costing. Maybe an advantage or disadvantage depending on what you want the value of the inventory to be.
3. Can eliminate taking year-end inventory taking altogether as container-based tracking system becomes statistically accurate "master" for inventory tracking. See item 1 above for advantages and disadvantages.
4. When used year-round can result in accurate real-time materials and work-in-process tracking. Very important of you are a materials or operations manager. Not so important of you are an accountant.
5. Eliminates need for ERP or accounting reconciliation with inventory taking results. With KnarrTek software, inventory quantities and value are kept up-to-date on a nightly basis (or more frequently if needed) based on audits and sot checks performed at each warehouse and manufacturing plant.

Cost Savings from using Container Based Tracking

The use of a BellHawk container-tracking-based warehouse management system is available, in the “Cloud” or installed in the organizations data center, or on a dedicated BellHawk server in the warehouse, for as little as $650/month.

Contrast this with the cost of materials handlers at a loaded labor cost of over $5,000/month and warehouse managers at over $10,000/month.

When used as the inventory tracking system of record, year-round, BellHawk will typically save the equivalent of at least one, and possibly two or three, full-time-equivalent (FTE) people by eliminating the use of paper forms, and manual keyboard data entry. It will often pay for itself, year-round, in the cost savings from performing the year-end inventory alone.

Even more important, the use of a container-based tracking systems, such as BellHawk, removes a major source of aggravation for managers, their staff, and their materials handlers by not having to manually take year-end inventory.

Commentary

Just before year end is an ideal time to change over to a container-based tracking system like BellHawk, as you have to take inventory anyway. The additional work of putting a tracking label on each container and recording its contents is about the same as manually recording inventory quantities in an Excel spreadsheet. Thereafter your organization will enjoy all the benefits of accurate real-time inventory tracking and the next year end (or quarter-end) inventory taking will be much easier and less stressful.

Author

This white paper was written by Dr. Peter Green, who serves as the Technical Director of KnarrTek Inc. Dr Green obtained his BSC (Hons) in Electrical Engineering and his Ph.D. Degrees in Electronics and Computer Science from Leeds University in England. Subsequently Dr. Green was a senior member of technical staff at Massachusetts Institute of Technology and a Professor of Computer Engineering at Worcester Polytechnic Institute.

Dr Green is a Systems Architect who is an expert in using real-time artificial intelligence methods to implement real-time Inventory Tracking and Operations Management systems for Industrial Organizations. He has led the implementation of over 100 such systems over the past decade. Dr Green also led the team which developed the BellHawk job and materials tracking software, the MilramX intelligent information integration software platform, and the KnarrOps EDS software platform.

For further discussion, or to send comments, please contact peter.green@KnarrTek.com.

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