Increasing Efficiencies with Returnable Asset Tracking

Returnable asset tracking helps Just-In-Time (JIT) manufacturers reduce costs, boost productivity and protect client relationships.

WHITE PAPER

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Boosting profitability, the sustainable way

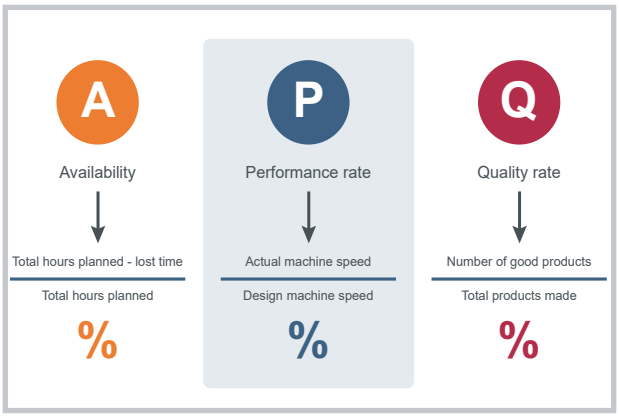
Perhaps the most impactful way to optimize workflow and increase efficiencies in large-scale manufacturing is to ensure that your machines are producing at full capacity and never experience unplanned downtime. Today, modern manufacturing enterprises express their progress towards maximum productivity as Overall Equipment Efficiency (OEE).

OEE is calculated based on a machine's availability, performance rate and quality rate with average values between 60% and 85%. To maximize performance rate, the machine needs to be consistently supplied with raw materials, the machine cannot experience unplanned downtime, and the machine must have somewhere to store production output.

In the case of raw materials and finished goods, suppliers and OEMs regularly use dedicated shipping containers, also called dunnage. And in industries with high value products, such as automotive manufacturers and the Tier 1 and Tier 2 suppliers that feed them, specialty shipping containers aren't an option, they're a requirement.

Today, the relationship between Tier 2 component suppliers to Tier 1 assemblers, and Tier 1 assemblers and automotive OEMs isn't solely dependent on providing materials in a timely manner, but they must be delivered in specific orientations, and with the highest, defect-free quality expectations. To accomplish this, automotive suppliers regularly spend considerable resources to develop custom containers to protect their products and offer plug-and-play compatibility with the Just-In-Time (JIT) manufacturing processes championed by automotive OEMs as well as most other manufacturers.

Racks holding doors or car windshields may cost $5,000 or more per container, consuming considerable resources. But the true liability to the manufacturer doesn't just lie with the loss of an expensive container, but by the potential for interrupting production efficiency, resulting in delayed orders, damaged brands and potentially lost customers.



Returnable asset tracking systems offer a solution to both asset allocation and productivity interrupters. By using commonly available tracking methods – ranging from manual scanning of barcodes to fully automated RFID, Bluetooth and GPS tracking systems – manufacturers can cost-effectively protect valuable assets, and even more valuable customer supply chains and relationships.

Returnable assets project JIT production

A returnable asset is often defined as a high cost, potentially reusable, packaging component required for the shipment of a finished good to an external customer, or to convey Work In Process (WIP) to a subsequent location for final assembly or packaging. Most WIP applications involve tracking products through automated material handling systems, such as conveyors, palletizers and related manufacturing and warehouse operations. The most common conception of a returnable asset conjures images of large metal component

racks in automotive manufacturing, or high value stainless steel tote bin in chemical manufacturing, electronics, and food and beverage production.

The racks, bins, and totes that most readily fit this description often cost upwards of $5,000 - $10,000 and have the potential to cause a large loss of capital even if a few are misplaced or not returned from end use. However, even low-cost plastic bins can cost a manufacturer tens of thousands of dollars in lost productivity. Therefore, even a plastic pallet, a bulk container bag for powdered material, or a corrugated paper or plastic bin has the potential to halt production and cost $10,000 - $100,000 in lost revenue within a few hours.

Consider a $200 plastic bin for delivering sequenced snack foods from a manufacturing site to a co-packing partner. It is not the cost of the lost bin to consider, but the hourly cost of a production change or stoppage because there are 55/60 bins and no way to complete the order, as well as fees and fines for accrued production delays.

With this thinking, anything can be considered a returnable asset worthy of tracking if it can be:

- Important to production and WIP operations
- Tracked into and out of your facility with a minor process change
- Reused

Led by the automotive and food industries, manufacturers across all industries are adopting Just in Time (JIT) manufacturing, further increasing the need for secure supply chains including product conveyance, shipping, and storage.

Under normal and expected operating conditions, JIT is extremely beneficial to the profitability of manufacturing companies by reducing inventory levels and freeing financial resources for capacity expansion and other purposes, but it can pose a problem to the manufacturer during times of stress or trial. For JIT to be successful, manufacturers must have all required raw materials at the right place at the right time, including the required packaging components.

As a result, perhaps the most undervalued component of this equation in JIT is the availability of high-cost or highly specialized returnable assets (containers, bins, racks, totes). These components are inherently simple to track, and can offer a large impact in raising the efficiency of a manufacturing facility.

Manual or automated asset tracking?

Today, manufacturers have a range of available asset tracking architectures and technologies to craft the most efficient, cost-effective solution. As a preliminary step it is important to determine whether or not your process will benefit from either a manual (human involvement) or automated (fully automatic scanning platform) or a hybrid of technologies.

Manual Process

Manual asset tracking processes involve a majority of human involvement for recording the movement of assets from and to the production facility.

In years past, this process involved recording of shipments and asset numbers into a record or manually entering the information into a database either by hand or by scanning a 1D or 2D machine readable code. The code is usually applied to the container via a label, and can be scanned by either handheld scanners or fixed units, in the case of conveyor tracking applications. While it does enable a small level of tracking capability, this type of non-automated system has a high potential for error in recording, leading again to lost or misplaced assets. Tracking labels are also easily damaged or lost. Optical codes require a clear line of site to the target; reliable and repeatable code positioning for scanning; only one asset can be read at a time; and cannot be farther than 4 meters from the scanner.

An example of this type of returnable asset tracking can be a returnable shipping bin that is scanned with a handheld barcode scanner and connected to the Enterprise Resource Planning (ERP) and Manufacturing Execution Systems (MES). In many situations, both the bin, and the shipping documentation (customer address for RA traceability) are scanned to tie the information together for traceability.

Automated Process

Fully automated tracking systems typically employ long range scanning technologies such as passive UHF RFID, or new active radio frequency technologies such as BLE (low power Bluetooth Beacons) or UWB (Ultra Wide Band, or 5G beacons) to track the internal movements and intended destinations of assets within the production facility, or even Global Positioning Systems (GPS). Each of these technologies offers unique capabilities tailored to specific production environments.

In addition to a variety of tracking options, automated asset tracking systems generally use one of three different architectures: portal tracking or perimeter control, which tracks asset conditions with a rough location inside the facility; Real Time Locating Systems (RTLS), which use active beacons to triangulate the exact position of an asset within a facility; and GPS, with the power to track asset location anywhere around the world.

Portal Tracking (Perimeter Control)

Portal tracking employs perimeter tracking of egress points in the facility. With the erection of scanning portals at critical points throughout the facility and the perimeter (shipping dock doors), portal tracking offers a low cost solution to tracking assets while offering additional logistics capabilities for ensuring accurate and on-time shipments and correct sequencing verification for JIT manufacturing.

Relying in many cases on a low cost, passive RFID tag or label, the solution can be scaled quickly with minimal investment while offering a full packages solution for returnable asset tracking. In recent years, additions to the UHF technology portfolio have also allowed for sensors (temperature, humidity, and level) to track supply chain integrity (ex, cold chain storage in food and beverage).

UHF RFID has an operating range of more than 10m, doesn't require direct line of site, is position independent as it relates to the scanner and tag, can read many assets at once and can be completely automated. UHF RFID is just as applicable for tracking the location of assets within a production facility as it is for tracking products leaving a facility. Combined with low cost points and ability to include sensors, such as temperature and humidity, UHF RFID is among the most attractive return asset tracking technologies available today.

Main benefits of portal tracking solution:

- Low cost per monitoring point (passive tag, label)
- Low hardware installation cost
- Ability to manipulate tracking information
- Ability to include specific order information

Limitations of portal tracking:

- Internal plant location tracking limited
- Limited range (10m) for scanning portals
- Requires tuning of proper readability for Asset (UHF RFID)

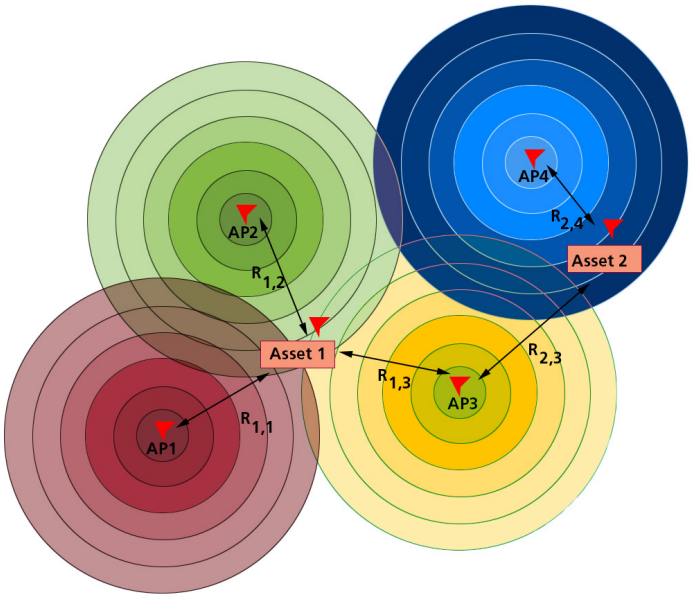
RTLS – Precise location, trilateralization

Real Time Locating Systems (RTLS) offer an additional level of traceability in many instances eliminating the need for perimeter control within a facility.

Whereas UHF RFID technology utilizes a passive tag that contains a capacitor that is charged when the antenna enters the radio field of the scanning portal of mobile automated equipment, the RTLS technologies available implement an active beacon that broadcasts its identifying information at set intervals. This active broadcasting allows for longer ranges and, in conjunction with the UWB and BLE technology's operating frequencies ability to adapt to and minimize interference from the ambient environment (3.0-10.6 GHz, and 2.45 GHz respectively), it also allows for accurate trilateralization and location data in real time.

BLE (Bluetooth Low Energy, Bluetooth 4.0+) and UWB (Ultra Wide Band, 5G) are very similar in operation. Designed primarily for locating assets inside a facility using RTLS architectures, these tracking solutions are capable of offering highly accurate, real time locations of assets within a facility via trilaterization. Trilateralization relies on an existing grid of battery-powered network-enabled gateways (usually no more than 20m apart) that communicate wireless with a beacon/regular transponder. Over regular intervals, the beacon will transmit its identifying information over the systems frequency band at a specific signal strength. Three gateways must receive this signal at a sufficient strength to utilize the Received Signal Strength Indicator (RSSI) translated to a physical distance. Once these distances are known, the three anchor gateways known locations are used to calculate the physical location of the beacon. While BLE and UWB both offer very specific localization data for tracking within a facility, RTLS systems generally require a large, upfront

investment for gateway grids, and costly, battery powered beacons. However, internally powered BLE and UWB tags do have the capability to include environmental sensors, similar to UHF RFID.



Tracking Assets / Objects using multiple APs

To implement an effective RTLS system there are many factors to consider. Active beacons require an onboard battery that will deplete over time, and while batteries can last between weeks and years depending on the broadcast rate and battery capacity, it does mean that eventually the beacon will require maintenance or replacement. It is also necessary to install a mesh network of gateways within the facility, such that a minimum of three gateways are within range of a beacons broadcast with a reliable received signal strength – usually requiring a gateway every ~30 meters within the facility.

Main benefits of RTLS:

- High accuracy, real time location tracking within the facility (~1 - 2 m)
- Active tags mean power is available for sensors for supply chain tracking (ex, cold chain in food and beverage)

Limitations of RTLS solutions:

- Active tags contain a battery requiring maintenance
- Require a mesh network of receiving gateways for trilateralization and location; the more gateways present, the more accurate the location data
- High cost of implementation
- High tag/beacon cost of implementation
- Limited to inside the production facility

Global Positioning System (GPS)

GPS systems relying on triangulation principles with Medium Earth Orbiting (MEO) satellites is the same technology (though now battery powered) that is used to navigate to a car to the nearest coffee shop or hotel.

Commonly applied to skid tracking in conjunction with RTLS, BLE or UWB beacon technologies, the GPS solution allows for global tracking of assets through a battery-powered transponder when they are not located within a facility fitted with beacons for trilateralization.

Main benefits of GPS solution:

- High location accuracy when outdoors
- Installed hardware independence
- Offers complete tracking of asset when in conjunction with other RTLS technologies

Limitations of GPS solution:

- High transponder cost for implementation
- Battery powered beacon requiring maintenance
- Little to no functionality within a production facility

Maintaining a database and the software piece

After we have collected and decoded the tracking information for an asset, we need to decide how we will utilize this information. We have the What and Where for the asset, but how do we turn this into a usable tracking system?

There are two main classes of asset tracking (Enterprise and Universal) and different levels of complexity based on how the information will be used.

Enterprise Tracking Solution (Bottom up)

At its most basic level, an enterprise tracking program can be as simple as a local database that is maintained by scanning assets in an out of the facility, maintaining their location based on the intended shipping destination, and marking them received upon return.

Many pre-made software suites are available for purchase that can be used to maintain this database. They are hardware agnostic and offer a complete tracking solution. In the case of previously integrated high profile ERP or MES systems, a middleware software can be used to maintain the asset database and communicate directly with the ERP/MES system.

At the enterprise level, an asset tracking program is locally stored (in most cases) with some level of cloud access. Its intent is to eliminate loss of high value assets and to make sure that the quantity of returnable assets on site are sufficient to keep manufacturing production running, eliminating down time.

Global Tracking Solution (Top Down)

Whereas the enterprise software model is initiated and utilized by the manufacturer, the new global tracking solutions are initiated by the primary assembly facility for tracking wholly owned returnable assets between their many suppliers.

Serving as a true cloud based returnable asset tracking environment, suppliers are but a client, required to report their receipt and shipment of assets to the final assembly facility. The environment allows for full cloud based visibility across all suppliers and facilities to ensure that the right assets are in the right location for JIT production globally. While a very powerful solution, these are extremely complex requiring at least some level of standardization among the supplier base.

It is usually financially beneficial to investigate a third party hardware supplier to discuss options for integration and connection to the global tracking system. As an example, a third party supplier may be able to significantly reduce the cost of initial hardware investment as well as significantly reduce the number of connections to a software suite. By simulation a single dock door with hardware throughout the facility (check in or check out of an asset) an automotive supplier may only need to pay for a single device connection to the chosen cloud service.

The best suggestion that can be offered is to work with a third party advisor to make sure that excess software and hardware costs are eliminated, hardware is reduced, and the tracking system is simplified. The turnkey solution from the software provider may be the simplest, but probably not the best, and almost certainly not the most effective option.

Determining if Asset Tracking is a good fit

Perhaps the most important piece of information to consider when investigating the implementation of an effective returnable asset program is the following:

- Is the item I am considering reusable?
- Will a shortage of the asset impact, reduce, or stop production?
- Is the item a high cost asset that will affect the bottom line?

The most important question to answer correctly is the assets ability to stop production. While an asset may cost thousands of dollars, a halted production line can accrue hundreds of thousands of dollars in losses and fines in a matter of hours.

The returnable asset must be reusable to some degree, and should not be subject to potential cross contamination. If contamination of food, chemical, or other products is possible and is a concern, be sure to consider what would be required to sort or clean containers so that they can be reused effectively, and whether or not this change is feasible in implementation.

Once it is established that re-use of the asset will be beneficial to your process in reducing cost of production, or eliminating capital investments into additional assets due to loss, consider how a program could be effectively implemented.

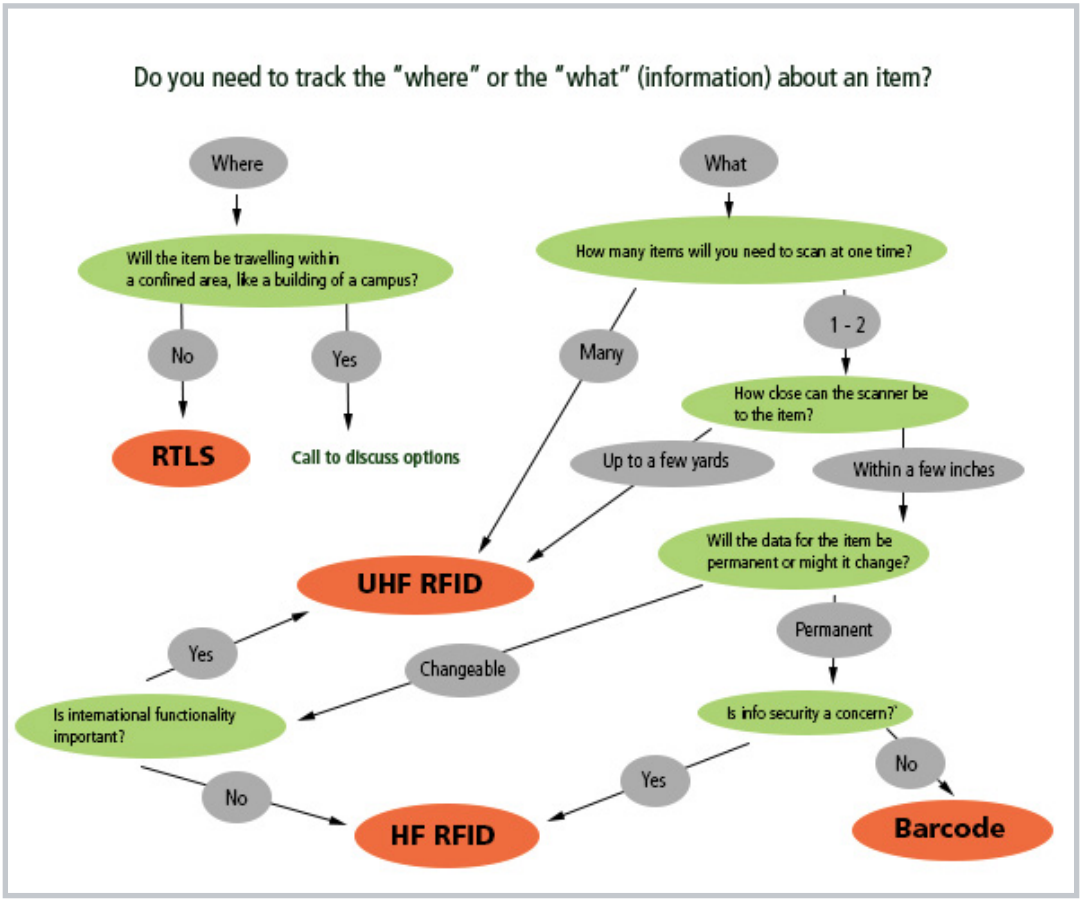
Smart manufacturers will gather all available knowledge and partners before evaluating their product transportation systems to see if re-usability is a benefit and cross contamination a concern.

When verifying the need and applicability of returnable asset tracking, be sure to completely review how a returnable asset would be handled both in your and in your customer's facility before moving ahead with development. An advisor experienced in returnable asset tracking should guide you through your production process and evaluate potential challenges in handling the asset.

Finally review the architecture that's best for your operation, and consider the pros and cons of the various tracking technologies. Finally, be sure to consult with experienced guides that can help verify and quantify the benefits of your new program.

After identifying the technology that will be the best fit for executing your asset tracking program with your advisor, the first step is always to identify a critical point of development and test the capabilities of the solution on a small scale. Any advisor or partner that does not recommend a Proof of Concept (PoC) should be subject to scrutiny.

Finally, test the concept. During this testing, it is important to subject the portal, or tracking system, to as many real world scenarios as possible. Try to break the system, trick the system, and identify as many fail conditions as possible that can be addressed before the final installation is carried out.



See the types of information that the system supplies, and ensure that communication is possible and optimized between the portal and your software suite(s) to ensure that information can be passed correctly and easily to the correct destination.

Prove the concept in its entirety before moving on to full installation.

Asset Tracking returns profitability

Standards like GRAI are helpful at evaluating returnable asset tracking solutions because they provide tracking standards around the world as well as recovery and return of reusable containers/rack. Nothing however can replace an experienced partner. Returnable asset tracking saves a company not only thousands in lost dunnage and material handling, but potentially millions in brand protection and customer relationship management.

With the stakes for success and failure so high, companies are right to pursue asset tracking while being daunted by the task at hand. Significant work is required in defining operating procedures and the asset to be tracked in order to design a sensible, reliable, and minimal cost solution. It is important not to pursue development alone. However there are many partners eager to recommend technologies that could potentially answer your need, it is important to identify an impartial advisor dedicated to keeping the best interests of your company in mind throughout the development process.

ifm USA is a subsidiary of the German-based company, ifm electronic, one of the world's largest manufacturers of industrial sensors and controls products. Our experience has taught us that each industry has unique challenges in production automation. We develop and customize our sensors and controls to meet the demands of each market. Our products help increase machine performance, make changeovers more flexible, and improve product quality. For more information on ifm returnable asset tracking solutions, including our newest UHF tracking portal solutions for automotive, food, and other essential supply chain processes, contact TJ Berlin at TJ.Berlin@ifm.com or visit ifm.com/us

About the author

TJ Berlin is ifm's North American Product Manager for Identification Systems, including industrial multi-code readers and LF/HF/UHF RFID tracking solutions for production and intralogistics/logistics processes. With seven years experience as a technical sales engineer, TJ gained extensive exposure to plant operations, improving equipment efficiency, and logistics and supply chain optimization within various industrial markets. Currently focusing on new camera technologies and possessing a comprehensive understanding of RFID in tracking systems for high speed applications, TJ maintains, "I hope to continue to develop and offer solutions that maximize efficiencies in tracking and tracing in the age of Industry 4.0."

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