Food for Thought

Automated Material Handling Technology for the Food Industry

White Paper prepared by

Retrotech INCORPORATED

www.retrotech.com

610 Fishers Run
Victor, NY 14564

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1. Introduction

The severe and dynamic business conditions of the past decade have forced food companies to investigate different ways to manage their operations to achieve success. Factors such as globalization and health-conscious consumers have created remarkable opportunities to develop new products, attract new customers, and extend reach. However, unprecedented pressures to fill complex orders, deliver orders on time, increase food safety, and reduce carbon footprint have made success a daunting task. These demands are driving logistics professionals to investigate automated options for their warehouses to help drive revenue growth.

One of the first steps in considering warehouse automation is to assess your current operation to determine if automation makes sense for your company. At certain thresholds of volume and dwell time (e.g. 225,000 pallets per year for 21 days or less) automated order fulfillment operations are less costly. There is a useful tool to assess your operation at http://www.activ.com/ feasibility_calculator. This site can help you determine if your operation could be filling orders more profitably and will assess various scenarios such as warehouse consolidation/automation of higher volume faster moving inventory.

There are numerous resources and experts available that can help you with this process. Ideally, you should seek technically qualified, unbiased support when considering automated warehouse solutions for your order fulfillment operations. Experienced independent systems integrators can assist you in the process of identifying appropriate warehouse material handling technologies and capacity constraints while developing solutions that align with your business requirements.

2. Issues Shaping the Food Industry

With economic recovery and growth opportunities gaining steam, the next five years could prove to be one of the more dynamic, if not challenging, times for businesses. Add to the mix the unique challenges prevalent in the food industry, and even more pressures will be piled upon the food warehouse manager. So, what are some common trends affecting the food industry warehouse landscape?

Changing Consumer Preferences

Frugal buying habits developed during the recent recession appear to be deep-seated as shoppers continue to be careful with food spending. This has driven the tendency to shop for food at mass retailers, club stores and "dollar stores".

Private-label food product options have increased and growth in this area will continue. This is driven by consumers' desire for value, perception of the improved quality of private-label food choices, and the price increases that packaged food companies are likely to implement in the near future to help offset their rising costs.

Another factor affecting consumer preference is the increasing desire for fresh, natural foods, with no preservatives, and the push towards healthier eating habits. Many experts call obesity our nation's biggest health crisis. According to the Centers for Disease Control the obesity rate for children ages 6-11 is 19.6 percent, meaning almost one out of every five American children are considered obese. The food and beverage industry has responded with reformulations and changes in their tactics. For example, manufacturers in the Healthy Weight Commitment Foundation (HWCF) promise to introduce lower-calorie options, lower the calories of current products and reduce single-serve portion sizes, all in an effort to reduce the amount of calories customers consume by 1.5 trillion calories by 2015.

Finally, consumers are also making intelligent decisions about which brands they support. Companies who are identified as eco-friendly and socially responsible demonstrate values that many consumers find important. Improving practices in material handling by reducing energy usage, greenhouse gas emissions, packaging, worker safety and water consumption will be more relevant and will most likely be rewarded with customer loyalty.

Compliance

The regulatory environment is already requiring more from food manufacturers and it is likely that recent regulations in labeling, traceability, and recall practices will significantly increase supply chain visibility and pressure. The 2009 salmonella recall of peanut butter and peanut paste from Peanut Corporation of America involved more than 2,100 products, from 210 food companies, and cost peanut producers over $1 billion in lost production and sales.

In January 2011, the Food Safety Modernization Act (FSMA) was passed and signed into law. The bill increases the Food and Drug Administration's authority over food recalls. It will require companies to enhance their track and trace capabilities – rapidly tracing back from where a product was received and tracking forwards to the point of sale. This will create massive amounts of information that companies will have to manage to provide complete traceability across the supply chain.

Also drawing attention is the Produce Traceability Initiative (PTI). It is the produce industry's effort to create a standardized process for tracking and tracing fresh produce throughout the entire produce supply chain - from the time it's harvested through the time it's purchased by the consumer. The goal is to achieve complete adoption of electronic traceability of each and every case of produce by 2012.

Food industry warehouse managers will need to become proactive in understanding and addressing changes in regulations. It is also critical for warehouse managers to realize how to optimize hidden benefits; for example, produce traceability will add costs but there could also be benefits in reduced shrink and increased accuracy.

Increasing Complexity

As anyone in consumer goods knows, brands are continually adding products in an effort to remain competitive, control shelf space and support consumer preferences. In the food industry these new product offerings, brand extensions and product variations all add up to an increase in the SKUs that distribution must handle. Increasing SKUs can strain warehouse resources, increase order processing costs, delay delivery time and cause accuracy issues.

Orders are also getting smaller and more complex, making them harder to fulfill. As discussed earlier, changing consumer preferences and spending habits have required manufacturers to service a wider variety of stores, each with different service requirements. In addition, smaller and more frequent orders are becoming more common as retailers are responding to customer demand by changing their inventory replenishment strategies. These factors have driven home the need for flexibility in the supply chain to adapt to these challenges. Unfortunately, many current distribution centers handle these pressures with existing systems that were built for simpler orders.

Growing Need for Speed

Today, quick and accurate responses to customer orders is the key to keeping existing customers, as well as gaining advantage over the competition. Customers want what they want, when they want it. If a company can't meet these requirements, they'll find someone who can. Remember the Hershey Foods meltdown when they lost $150 million in orders during the 1999 Halloween season? Supply chain problems prevented Hershey from delivering $100 million worth of product on time, resulting in decreased stock price, a profit dive and lost market share to Mars and Nestle.

Competition, consumer preference and trends all increase the need for speed to market. Add to that, the inherent short shelf life of many food products, and there is great pressure on distribution centers to be agile to deal with increased order velocity.

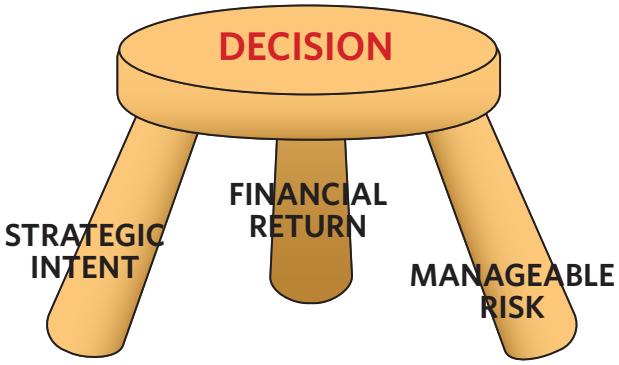
3. Principles of Automated Material Handling Design

As pressure increases to reduce costs and improve efficiency in distribution centers, many companies are once again looking at materials handling automation as a means of achieving the objectives set forth by management. Whatever the reasons, it is important to step back and consider whether an automated solution is right for your operation.

The most comprehensive order fulfillment solutions are developed by first answering a simple question - What do you want to accomplish? Many failures in such projects stem from overlooking basic business needs, respective of the current and future business vision and by not taking the time to clearly develop a path. Other failures have come from putting the cart before the horse. Examples of that can be seen where a building is under construction before the due diligence for the manufacturing and distribution processes and metrics are fully understood, causing the material flows to be improvised and constrained.

The following questions should be considered before determining the viability of an automation project:

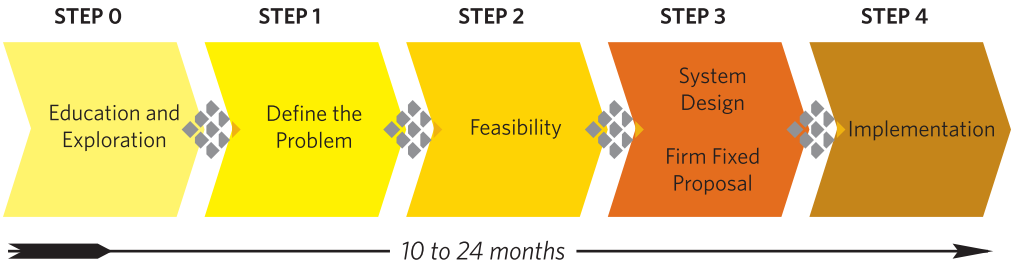
- Are decisions properly aligned with corporate strategies?
- Does it offer satisfactory return on investment?
- Is it an acceptable business and/or technical risk for the investor?



Companies that realize the best outcomes from automation projects use a strategic approach to chart their course. These innovators gather data, define problems, rank, structure and document system requirements before beginning any discussions about equipment. There is a tendency to rush through this definition process and jump right into hardware selection. In fact there are a number of examples in warehouse automation where the attention to determining needs and system requirements have been rushed and millions of dollars spent on equipment only to find out that it doesn't perform as desired.

Desired financial and operational results are achieved through proper analyses, system engineering/integration, delivery to requirements and well-executed project management during installation, testing and training. A structured planning process with multiple decision gates, as depicted below, is recommended in order to attain a successful business result. Iterations of each step may be required to achieve a sound, data-based decision to move forward.

Best Practices – Decision Making Process



After a clearly defined strategic direction has been determined you can begin to analyze how to achieve your goals. Designers for automated material handling must take into account several design criteria that can impact decisions including:

- Well-defined concept, relative to processes and metrics for the business
- New or fixed building and architectural constraints, including material flow
- Design that is readily adaptable to integrate customer changes, including work-arounds and related costs
- Computer platform and software standards
- Equipment suited to the particular purpose for which it was designed
- Company culture and its ability to adapt to automation paradigms
- Fixed cost per unit through goals or objectives
- Capital constraints
- Relatively short payback windows or aggressive targets for ROI
- Consider future state conditions — how will the business change over the next ten years?

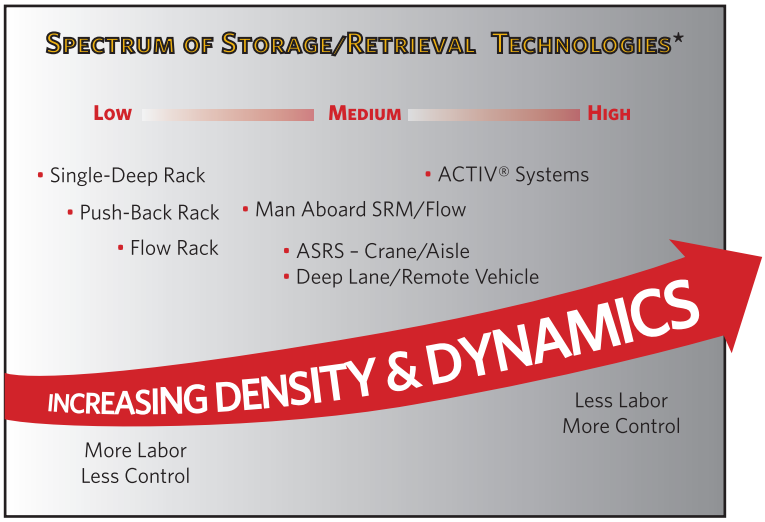
Don't Forget The Important Details

Before plans are finalized many particulars need to be determined such as:

- The exact nature of the materials handled relative to size, weight and stability
- All the units of measure to be handled in the various aspects of flow
- Strength and characteristics of materials, relative to handling damage issues
- Processes, sub-processes and their respective flow paths for each aspect of the 'end result' (i.e. a pallet order with one SKU versus two SKUs)
- Average and peak flow metrics, broken into increments ranging from weeks to minutes
- Customer order requirements including Key Performance Indicators (KPIs)
- End user demands such as column stack versus layers on a pallet
- The best equipment for the system, considering both short-term and long-term usage.

Once due diligence has been paid regarding system details, there are a wide variety of material handling technologies to investigate for warehouse operations. They range from traditional forklift trucks and floor stacking storage to fully automated, computerized, high-density flow systems.

The graph below displays the factors involved with technology selection. In general, density and dynamics increase as you select higher levels of automation. Labor will decrease and you can gain more control.



* Data adapted from St. Onge ProMat presentation on Dynamic Storage Solutions

4. Automated Material Handling Solutions to Common Challenges

Many corporations have realized that the same system that powered their success for much of the past century now stands in the way of their progress. Currently, in the US food industry, dozens of facilities operate with significant material handling automation in their processing areas. However, many manufacturers still use antiquated warehouse operations with equipment and facility designs that were commissioned years ago. These environments simply have not kept pace with the rest of the company's innovation and growth. As these warehouses continue to age, the gap between the company's long-term strategic goals and their warehouse capabilities broadens.

What Are Your Challenges?

Most likely you struggle with the same problems as every other manufacturer in the world. No matter what industry you're in, the questions remain the same. How do you keep costs down without compromising on customer service? How do you run a tight inventory and warehouse and still respond to complex customer demands? What's the best use of my current warehouse space and operations? The chart on the next page shows the business challenge, impact and how warehouse automation can improve the situation.

Business Challenge	Business Impact	Warehouse Automation
Growing demand for more fresh and organic products	Increasing SKUs can strain warehouse resources, delay delivery times, cause accuracy issues and negatively impact relationships with customers. Fresh and organic products need to move faster due to no preservatives.	Real-time visibility of customer orders allows for optimization of orders for freshness and accuracy, while intelligent staging of orders can offer shorter delivery cycles.
Food safety issues	To meet more stringent global food safety guidelines there is increased responsibility to track products to improve recall capabilities.	Precise reporting data can limit the consequences of a product recall and it's effects on business. Offers absolute tracebility and rapid access to all products.
Customer satisfaction with on-time delivery and accuracy	Poor customer service can end a customer relationship and decrease revenue. Added cost of order correction and expedited shipping.	Provides the level of control to deliver the right product to the loading dock at the specified time. This ensures that the truck will be loaded, as required, for an on-time accurate delivery.
Increasing demand for direct store delivery	Customized deliveries can strain warehouse resources, exacerbate delivery time and accuracy issues.	Provides the flexibility to stage the proper product in the proper sequence to accurately fill orders.
Rising order velocity	Customer demands, intense competition and the short shelf life of many food products requires fast turnaround	Automated solutions can retrieve/ship product faster with more accuracy and less personnel.
Increased truck wait time while complex orders are loaded	Idle time for trucks waiting for loading can increase shipping costs and delay delivery of orders.	Stages the proper product in the proper sequence enabling trucks to be loaded in the minimum time and get on the road faster, reducing carbon dioxide emissions and fuel consumption.
Carbon footprint reduction initiatives and high energy costs	Increasing order and SKU complexity makes it challenging to reduce carbon footprint and energy costs. More people and forklifts are needed to provide this higher level of service.	Can reduce the overall carbon footprint of warehouse operations by minimizing amount of forklifts required, eliminating lighting from storage areas, minimizing HVAC needs in the storage area and maximizing cube efficiency.
Turns per year increasing	Cannot meet demand. Poor customer service can result in negative revenue.	Can handle increasing demand without sacrificing delivery performance. Orders are staged at a predetermined time and sequence.
Current operations are landlocked or space constrained	Can't expand current operations using current order fulfillment methods, this could result in lost revenue.	Increases capacity within a smaller footprint by utilizing a stacked/higher building concept.
High labor costs or labor shortage	Need high labor content to handle volume and order complexity. High turnover due to environment can lead to increased training costs and reduced productivity.	Automated warehouses operate with far fewer people and can reduce dependence on manual labor, especially in freezer or refrigerated environments.
Equipment damage and repair	Added costs of new equipment and maintenance.	Operates with less equipment damage than manual warehouses due to the well-controlled movement of goods.
High product damage	Damaged product can lead to production shortfalls and lost profit.	Causes far less product damage than manual warehouses due to the precise movement of products throughout the system.
Stringent date coding	Some large chain stores will not accept product that is too close to the expiration date. Traceability to the pallet level is becoming the standard.	Warehouse control systems can easily track each pallet and ensures FIFO inventory management.

5. Technology Options for Automated Material Handling

Because of the broad range of equipment that is available to automate your warehouse, technology selection requires significant diligence. Driving the design and integration of the technologies should be good adherence to current and future business requirements and metrics, versus the sometimes easy, quick fix selection. This portion of the white paper contains short descriptions of types of equipment and systems that are commonly used in a warehouse environment. The discussion is limited to unit load or pallet technologies, however, it is recognized that in parts of the food industry, less-than-pallet load orders are common.

One important factor that is essential in automated handling environments is unit load integrity. Unit load integrity generally means that the load maintains a stable footprint and load envelope (actual height, width and length) while being handled, so equipment is not jammed.

Pallet Considerations

There has been much discussion recently regarding pallet type and technology in the food industry. Pallets are commonly made from wood, plastic/composite, paper and metal, with the vast majority in use today made out of wood. However in the food industry, plastic pallets and composites are seeing substantial growth. Some contribute this to well known issues with contamination of wood (i.e. Tylenol recall in 2008), the inherent risk of damage, (fire and structural) the added weight of wooden pallets and the ability to more easily merchandize directly in plastic pallets. Plastic pallets have been criticized lately because of toxicity concerns associated with Deca-bromine (Deca), a controversial fire retardant used in some pallets.

There are some factors to consider when selecting pallets for automation. Plastic/composite pallets tend to be more durable than wood overall, but they can bend and sag over time, which can negatively impact performance. They do have less issues with damage from nails, splinters, and warped wood that can cause jammed loads and can harm material handling equipment.

In addition, plastic/composite pallets can be more easily embedded with RFID tags to track the location of each load of products. Major retailers such as Wal-Mart and Costco and the US Department of Defense are pushing suppliers to deliver all products with RFID tags on cases and pallets. Pallets with RFID technology can help improve warehouse efficiency, product visibility and regulatory compliance by enabling rapid collection of data required to ensure the safety of food.

Rack Storage

While business needs are best optimized when unit loads are moved directly from packaging and palletizing into trucks, the need to stage, store, or pick-from has created a need for high velocity unit-load storage options. Depending on storage density requirements, a specific rack system or combination of systems, may best serve the warehousing and shipping needs of a business.

Most racks are made of steel (boltless, traditional open-back columns and closed tubular varieties), need to support heavy weights, keep loads uniform and straight, and protect products from damage. Rack systems today have come under serious scrutiny to avoid collapse. Only manufacturers that comply with the US-based Rack Manufacturers Institute codes should be considered.

Drive-In or Drive-Through Racks

Drive-In or Drive-Through Racks increase density and are often utilized where group pallet selection is more likely than individual pallet selection. Their lanes provide access for a forklift truck to place and remove stock. It is an ideal rack for cooler or freezer applications because loading and unloading within a bay can be done from the same aisle or it can be set up for FIFO (First In First Out) inventory control by loading from one side and unloading from the other. This type of system is economical for storing larger quantities of the same SKUs and is relatively low in equipment and maintenance costs. Drive-In or Drive-Through Racks are used in a number of cold storage applications due to the need to store as many pallets as possible in as little expensive freezer space as possible. But, it also can have high labor and energy costs, with limited or no ability to mix SKUs in deep lanes. These racks are typically subject to more abuse due to the way they are used, so rack integrity and strength are important factors.

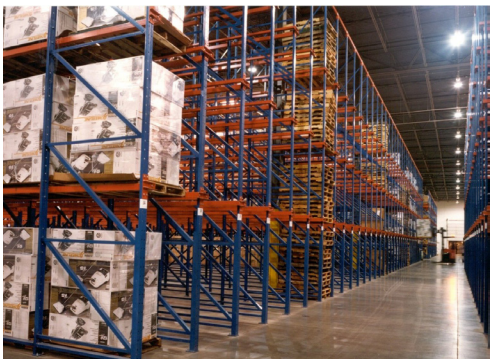


Image compliments of Frazier Industrial

Gravity-Flow Racks

Gravity-Flow Racks are racks with conveyor or skate wheel sections (or rollers) running from front to rear on horizontal load beams. The conveyor wheel sections are installed at a slight incline so all units can be loaded on one side of the rack system, flow down the incline, and be removed from the other side

Image compliments of Frazier Industrial

of the system. Brakes installed along the rails control the speed of the flow. With Gravity-Flow Racks inventory is rotated regularly because the first pallet loaded into the systems is the first pallet removed. This highly flexible type assures FIFO inventory management rotation of product (an advantage with perishable and time-sensitive products) and easy access to different SKUs with lane allocation for each SKU. However, there is limited or no ability to mix SKUs in deep lanes and an increased potential for product damage from impact.

Push-Back Racks

Push-Back Racks possess integrated castered shelving that allows unit loads to move into deeper rack positions without the assistance of an extending device such as a reciprocating fork found on a Storage Retrieval Machine (SRM). This is done by unit loads being pushed sequentially further and further into the rack by a single or double deep rack entry motion, similar to what a forklift truck does when setting a load into standard racks.

Image compliments of Frazier Industrial

Push-Back Racks facilitates LIFO (Last In First Out) inventory, which makes it an ideal solution for some items that may have a longer storage life or don't require immediate access. Because it provides very compact storage, they are often used in freezers, coolers and other food storage facilities, where floor space is at a premium. It may require added height to allow each pallet deep, which can reduce overall warehouse capacity when compared to other racks.

Selective Racks

Selective Racks, one of the most popular and versatile rack types available, allow for easy selection of fairly high volume SKUs, normally by service (forklift truck) aisles. Selective Racks can be Single Deep (one-unit load position deep) or Double Deep (two-unit loads position deep). They use the same basic design as rack structures operating with forklift trucks, reach trucks or VNA and turret trucks in conventional warehousing. This rack system provides constant access to every pallet and is ideal for faster moving products. They can help improve labor productivity through avoided shuffling of loads and has flexible heights and depths. It does require numerous wide aisles for forklift trucks, which does result in lower storage density.

Transport Equipment

Complex flow paths, extra moves, and inefficient activities add costs, time, and product damage to the material handling process. Transport equipment can reduce the excess movement and eliminate redundant handling where possible. When researching transport equipment determine the optimal path needed, within the shortest period of time, for the least cost and with the least amount of effort.

Transport equipment used in the food industry has some special needs. Because of food safety requirements these vehicles may need to withstand stringent wash downs, as well as have a minimal number of crevices and openings to help minimize microbial food safety hazards.

Forklift Trucks

The terms fork truck, counterbalanced trucks, turret trucks, high reach trucks, side loaders and VNA (Very Narrow Aisle), all describe variations of trucks that can manage different weights, rack heights, aisle widths and so on. Some can be customized to handle two or more loads at once and the size is directly affected by total lifted weights. Lift height is a critical design concern because higher lifts require operators to travel to the desired putaway height to maintain visibility into the racks for safe putaway.

This transport type handles a wide range of load capacities; with a variety of capability-enhancing attachments such as clamps, rotators and push-pull units, and can pick and stack speedily. While nearly every forklift manufacturer offers an add-on package of features that customize a vehicle for cold storage and sub-zero freezer use, the trucks that deliver a lower cost of ownership include these items as standard. Look for sealed components, electrical connections and switches because water from wash downs and condensation, caused by moving from sub-zero to ambient temperatures, can be a problem for sensitive components. For easier operation by drivers wearing gloves, look for oversized buttons on the control handle and switches that can be easily activated by minimal pressure.

Forklift trucks are very flexible and can transport goods over a variety of different surfaces, but they may have high initial investment costs and can be labor intensive.

Conveyors

Unit-load transportation, sortation and accumulation can be completed post-palletizing on conveyors, provided the unit loads are stable. Conveyors used in food usually convey Grocery Manufacturers Association (GMA) pallets, which are a standard 40″ x 48″ (1016mm x 1219mm, Euro pallets are typically 800mm x 1200mm or 1000mm x 1200mm). Conveyors come in dual and triple chain constructions, which are cost effective but tough on pallets, as well as Chain Driven Live Roller (CDLR), which support the pallets on 2″ to 5″ (51-127mm) roller centers and can be made in a variety of materials. Speeds for both may range from 20 Feet Per Minute (FPM) (6M/min) to 60+FPM (18M/min).

Conveyers can occupy a large amount of floor space and can reduce path flexibility on the work floor. They are cost efficient for moving continuous streams of product and can handle light to heavy loads.

Automated Guided Vehicles (AGVs)

Image compliments of Egemin Automation, Inc.

AGVs are autonomous roving machines directed by a computer system to optimize movement in simple or complex applications. They can transport and tug, store and retrieve and accumulate pallets, layers or cases. AGVs tend to operate at relatively low heights (up to 30 ft (9.1M) approximately) when used as storage and retrieval devices and usually travel freely on open floors, as well as in rack areas. Most designs are fork type with lifting height and speeds limited to their counterweight systems.

Like forklift trucks, they can be modified to be compliant with strict hygiene regulations, with stainless steel frames, sealed components, etc., to allow complete cleanliness of these vehicles.

In the food industry, AGVs tend to have double-unit-load wide forks that provide the flexibility for picking and depositing loads to a variety of locations. Radio frequency and laser guidance systems have replaced the wire and enable the vehicle to be directed virtually anywhere in the factory. Collision avoidance systems provide good safety in the event that an unexpected object or person is encountered. AGVs load and unload automatically and can operate 24/7, without human supervision. They are also adaptable to allow for expansion/business changes and integrate well with other equipment. The units can be expensive, are constrained by floor (surface and barriers) obstacles and require battery charging and regular maintenance.

Manual and Automated Turret or Narrow Aisle Trucks

This limited class of Automated Guided Vehicles is a modified version of a standard, manually operated Turret, Narrow Aisle or Very Narrow Aisle (VNA) truck. The modification of added controls, including the logic, drives, and condition-sensing equipment, allows the truck to travel and operate man-free if needed. Most are reciprocating-fork types with lifting height and speeds limited to their counter-weight systems. The maximum height of this type is usually 42 ft (12.8M). These units can be expensive, they are not as fast as some other methods, and they are constrained by floor obstacles. The benefits are they can operate in tight warehouse space, which can maximize space usage, and are adaptable to allow for expansion and business changes.

Storage and Retrieval Systems

Storage Retrieval Machines (SRMs)

Unit-load SRMs come in a wide variety of height ranges - from 30 to 150 feet (9M-46M). They are capable of handling different weights, widths, and performance functions. SRMs can be very reliable and offer high storage density. These systems can also be adapted to special working conditions such as freezing temperatures and extreme humidity prevalent in some food warehouses. They require precise rack structure to operate smoothly, some are battery powered and may necessitate significant maintenance and there is limited adaptability to change in business needs.

Aisle-Bound Cranes

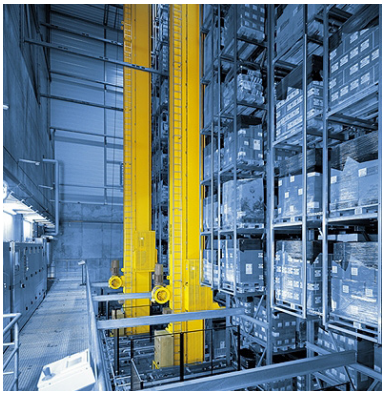
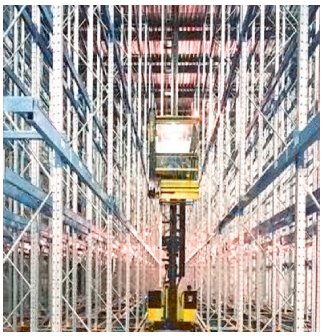


Image compliments of Dambach

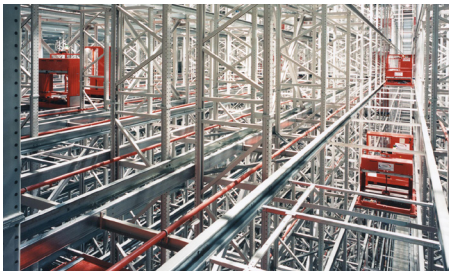
This class of SRMs is the broadest in design and typically employs single or dual mast, meaning that upright metal column(s) is/are used to guide a lifting platform which carries a unit load to the desired rack level and also carries the mechanical equipment needed to extend the unit into and out of the rack. They are made primarily for hi-rise unit load storage buildings above 32 ft (9.8M) and were designed for fixed aisle travel. Most ride on ASCE rails (similar to train track) and can travel nearly twice as fast as the other classes of vehicles (vertically 200+ Feet Per Minute (FPM) and horizontally 900 + FPM) (60M/min-275M/min). Absolute rack precision is required, especially as the height exceeds the 40 ft (12M) mark. Some allow for man-aboard operations but most are man-less, except for maintenance. Some classes of these SRMs operate in fixed-aisle mode but may be designed to transfer one aisle to the next. Others handle more than one unit load during an operation, either two wide across the aisle or two deep down the aisle, thus improving the performance of the SRM.

Deep Lane Storage Retrieval Machines



This type can be used when a rack is over four positions deep. A lanyard connected (or tethered) vehicle may leave the SRM to travel into the deep lane rack and operate as an autonomous device in retrieving or storing a unit load. These vehicles are also called satellites, moles, REMs, remote vehicles, and/ or deep lane carts.

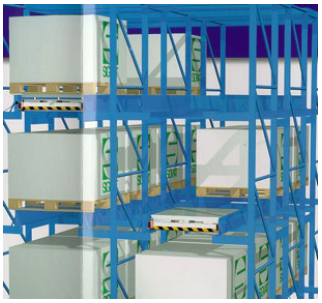
Automated Storage and Retrieval Systems (ASRS)



Automated Storage and Retrieval Systems are combinations of equipment and controls that automatically handle, store and retrieve loads to and from defined locations. Variants of this type of technology are typically used in applications where there is a very high volume of loads being moved and where storage density is important because of space constraints.

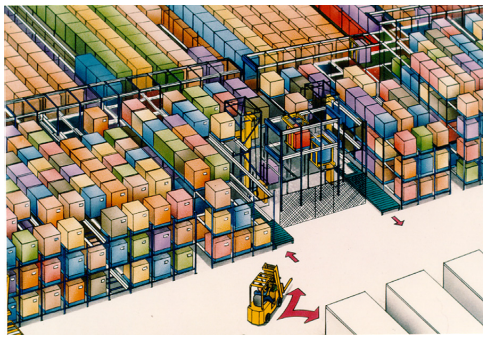
High Density Dynamic Storage (HDDS)

High Density Dynamic Storage systems sequentially store multiple unit loads of the same SKU, in the same lane, one in front of the other, with a minimum distance between the loads. A variety of low to high performance designs exist for this class of storage and retrieval. The oldest of the HDDS designs uses mechanical racks employing integrated, air or electric motor-driven sub-assemblies to pick up and lower the unit loads. This technology operates best in a minimal SKU environment with low to medium throughput. A more sophisticated technology uses very deep lane racking, 5-30 positions deep, and employs battery-operated, radio frequency-directed autonomous cars to travel under the pallets and provide the store and retrieve motions. Forklift trucks manage lane and/or elevation transfers, making this technology limited to those operational parameters.



High Density Dynamic Storage systems can increase product visibility, efficiency and density. HDDS systems with multiple deep storage designs can maximize cube, important in refrigerated or freezer environments because it can cost more to cool than to heat a warehouse. It utilizes a smaller building footprint for less impact to the environment and can deliver energy and labor cost savings. However, pallet quality, configuration and load stability can impact operations and there is a high initial capital investment.

Super High Density Flow System



One of the most capable and flexible technologies uses both deep lane, and cross-deep lane cable driven carts, to not only store and retrieve products, but to also sort and pre-stage unit loads. This technology employs automated lifts in-lieu of forklift trucks and can be built modularly and taller. It is most effective in existing warehouses because it provides the highest storage density possible for buildings that have a relatively low clearance height. This helps support corporate sustainability goals by conserving energy and using cubic space more efficiently, especially within cold storage.

The ACTIV® System is an excellent example of this technology. It is a unique, dynamic storage technology that can buffer, sort, and stage palletized unit loads in the exact loading sequence. Fast moving products are more accessible while slow moving products are positioned out of the way, so loads can be internally staged in the lower level lanes and sequenced for trailer loading – 24 hours a day. This type of system is expandable to support future business goals and it integrates seamlessly with other material handling systems. It can save significant dollars if dwell time is 15 days or less. Retrotech, Inc. is the exclusive authorized dealer in North America for the ACTIV technology and has installed nine ACTIV System sites in the USA with over 200,000 storage positions

Hybrid or Combination Systems

In these flexible systems, fast moving SKUs are stored/retrieved with an automated system where the slower moving SKUs are initially stored using traditional floor or rack technology. When an order requires one of these slower moving SKUs, the load can be manually delivered to the dock or it can be introduced into the automated system so it can be staged in sequence with the remainder of the order. Many warehouses today function using a mixture of manually operated and fully automated material handling processes to efficiently use equipment and optimize current operations, while leaving the fully automated option open for future growth. One of the biggest challenges in these warehouses is the proper alignment of the manual and automated processes to ensure smooth product flow between storage areas and shipping/order fulfillment. Possible miscues and poor interface between sub-systems is possible, if not planned and engineered properly. Detailed analysis of the warehouse throughput and the number of SKUs to be handled is required to ensure that adequate capacity is designed into the system for both the current business needs as well as future projections.

Control Systems

Due to recent legislature there is an increased focus on warehouse control systems and tracing product movement. Companies are realizing that any type of safety or security concern can be very damaging, and just one recall can hurt a company's reputation. Acting as the warehouse "traffic cop", product movement is directed and controlled during the process by material control software with the ability to track inventory throughout the system. By understanding the attributes and needs of a particular SKU, the system can direct it to the right place or temperature zone and can ensure that products that shouldn't be close (like chemicals and snack foods) don't end up next to each other.

Careful selection of computers, software, operating systems, programmable controllers, related sensors and other reading and identification devices are essential to system design, operation, and reliability.

Common material control software terms:

Enterprise Resource Planning Software (ERP)
Handles end-to-end operational planning. Larger software packages have warehousing and transportation modules designed to integrate operations, although most fall short of business operations details and require customizations or workarounds.

Warehouse Management Systems (WMS)
Offers significant tools and reports for managing operations at a detail level. Forklift truck management and picking management, as well as interfaces to automation systems, make these capable of managing inventories and material flows within the warehouse while evaluating productivity of staff and equipment.

Warehouse Control Systems (WCS)
Responsible for keeping everything running smoothly, maximizing the efficiency of the material handling sub-systems, and often the activities of the warehouse associates. It provides a uniform interface to a broad range of material handling equipment and their integrated controls, such as ASRS, carousels, conveyor systems, sorters, palletizers, etc.

Machine Control Systems
Provides on-board hardware and software control for equipment in a warehouse environment.

5. Summary

Changing consumer preference, compliance issues, increased speed and order complexity are all affecting the food industry warehouse dramatically. Many are looking to automation to help alleviate the pressure. It is well documented that warehouse automation can increase throughput speed, accuracy, safety, and traceability. It can also lower energy costs, use less labor and cause less damage. In fact, companies with an exceptional order-fulfillment process are 20% more profitable and grow top-line sales 25% faster than other companies.*

The decision to automate a warehouse should be made only after a careful and comprehensive business process review and evaluation is completed. The process can take a long time and it can be a complex path. But, it's worth it. The optimization of your warehousing activities can lead to drastic reductions in structural costs that can propel your supply chain front and center as a potential key to organizational success.

When considering an automation project, you most likely will encounter a variety of vendors and suppliers with whom you could potentially partner. Independent Systems Integrators, like Retrotech, Inc., can assist you in the process of gathering data, identifying appropriate warehouse automation technologies, developing solutions that align with your business requirements, and creating plans for implementation that mitigate risks.

* "Strategic Supply Chain Management" McGraw-Hill 2004.