

Robotic Packaging Considerations

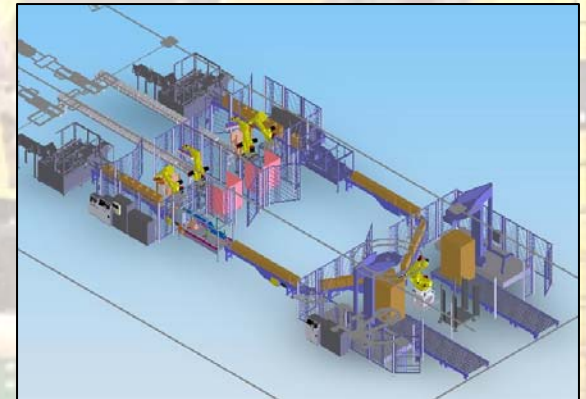
- Highlight Robotic Packaging Features & Benefits
- Explore “When & Why” To Incorporate Robotics for Packaging Automation
- Dispel Misconceptions about Robotics for Packaging
- Robotic Example Opportunities
- Pricing Considerations for Robotics
- Getting Started: How to Develop a Request for Proposal [RFQ]
- List of Vendors and Additional Resources

Robotic Packaging Opportunity

- Properly integrated, today's reliable robots offer tremendous opportunities for meeting the challenges of today's dynamic products, product presentations and packaging lines.
- In addition, companies are commanding stringent operational conditions for 24/7 operations while still necessitating high reliability, low maintenance, flexibility and quick changeover between products.
- Robotic solutions are now competitively priced commodity products yielding superior performance, reliability and versatility.

Robotic Packaging Opportunity

- Robotics are being successfully implemented for most all packaging automation applications including:
 - Depalletizing
 - De-Casing
 - In-feed Handling
 - Raw food Handling
 - Primary Packaging
 - Secondary Packaging
 - Mixing [Combo/Rainbow packs]
 - Palletizing
 - General Material Handling
 - Full-line & Integrated Solutions

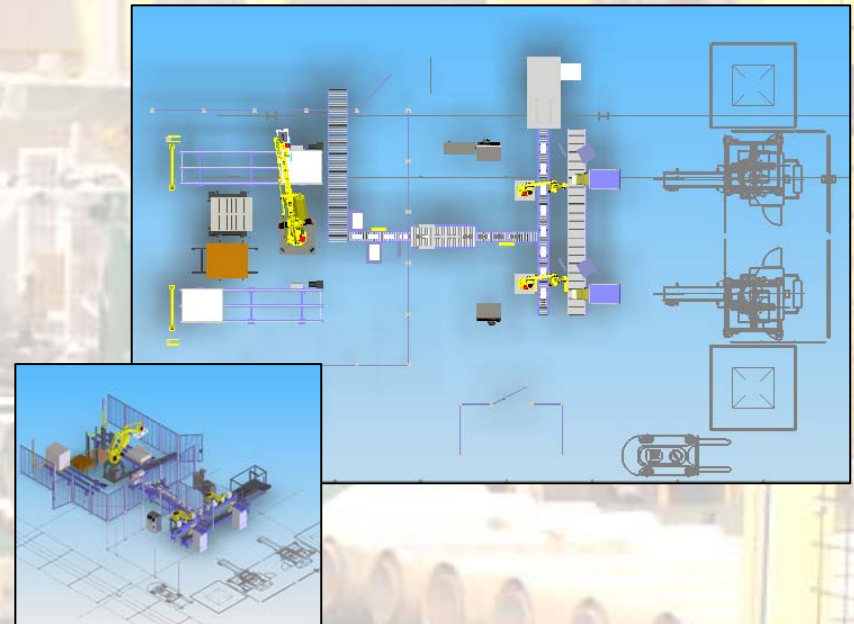
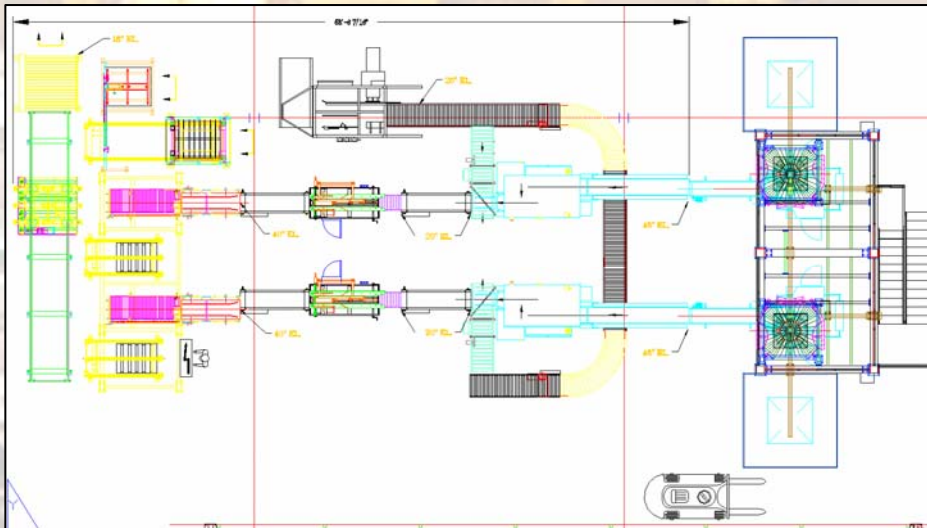


Robotic Packaging Opportunity

- Robotics provides a unique opportunity for packaging automation solutions. These opportunities include:
 - Minimize Risk
 - Minimize Product Handling
 - Minimize Damage To Product
 - Minimize Failure Opportunities
 - Minimize Operator Intervention
 - Minimal Grade Change/Product Change Over
 - Minimize Maintenance
 - Optimize Operational Performance

Opportunity: Robot vs. Conventional

- **Traditional Horizontal Loader & Palletizer**
 - More Cost
 - More Footprint
 - More Maintenance
 - More Failure Opportunities
- **Robotic Loading & Robotic Palletizing**
 - 20% Less Cost
 - 15% Less Footprint
 - ≈ 90% Less Maintenance
 - ≈10x Less Failure Opportunities



Robotic Packaging: Features & Benefits



- Understanding the features and benefits of using robots for packaging automation is best described when comparing to traditional packaging automation technology.
- Key benefits of robotics over traditional include:
 - Higher Reliability
 - Greater Flexibility & Versatility
 - Optimum Product/Case Handling
 - Quicker Changeover
 - Lower Maintenance
 - Greater Layout Flexibility
 - Control & Software
 - Common Technology Solution Across Plant Applications
 - Ease for Upgrade or Redeployment
 - Environment Compatibility

Robotic Packaging: Features & Benefits



- **Higher Reliability**

- Robot/Controller providing over 70,000 MTBF [Mean Time Between Failure].
 - This equates to “35 man-years” of failure free operation.
- Simplify product handling and minimize total number of electrical/mechanical components.
 - For example, using vision and robot to locate and pick product eliminates product collating, accumulating and orienting.
- Addition of automatic tool changer eliminates operator removal, handling, storing and assembly of tooling
- Utilizing robot auxiliary axes for ancillary motion/control eliminates an additional servo/control/software platform.
- Utilizing 6-axis robots for product loading can eliminate flap control devices and changeover.

Robotic Packaging: Features & Benefits



- **Greater Flexibility & Versatility**

- Robotics can be configured to optimize the product handling compared to traditional packaging machinery which has a fixed footprint, product in-feed and out-feed.
- Robotics works to provide a solution based on the specific application requirements rather than forcing a standard designed machine onto the process.
- Examples of Robot Flexibility & Versatility
 - Product In-feed
 - Product may be picked and/or placed with product in most any configuration including:
 - » ***Random Orientation using vision locate and track to pick on the fly.***
 - » ***Radically Oriented using sensor locate and tray to pick on the fly.***
 - » ***Collated in One or More Lanes***
 - » ***Multiple Locations and Heights***
 - Using a single lane to simplify in-feed and loading multiple cases per cycle to achieve rate.
 - Product may be picked and placed from ***Multiple Heights & Locations.***
 - Mixtures of products can be created by bringing in multiple in-feeds.

Robotic Packaging: Features & Benefits



- **Greater Flexibility & Versatility**

- Flexible to Handle More Than Just “Product”

- Depending on system throughput rates, the robot may have time to handle other “components” of the product/process. This reduces or eliminates other components yielding a much more reliable system.

These may include:

- Case Lids
- Inserts or Literature
- Partitions
- Separator Sheets
- Labels
- Pallet sheets, tier sheets, bottom or top caps
- Transferring empty cases, full cases, pallets, pucks, bins or totes

Robotic Packaging: Features & Benefits



- **Optimum Product/Case Handling**
 - Robots are ideal for handling of the product to optimize speed while maintaining integrity and quality. This is achieved by:
 - Optimizing speed/motion while minimizing handling and reducing indexing acceleration/deceleration of product/cases/cartons. For example the robot can accelerate/decelerate modestly while moving from point to point very fast.
 - Manipulating product to minimize interference with adjacent product and case/trays.
 - Ability to use **Six Degrees-of-Freedom** for optimum loading, packing or palletizing
 - Robots allow products to be handled in both Intermittent [indexing] or Continuous Motion
 - *Robots using line tracking can be configured easily for any combination of motion: Indexing to Indexing Motion; Continuous to Continuous Motion; Indexing to Continuous Motion; Continuous to & Indexing; Continuous to Continuous Motion*
 - Product – Continuous motion reduces or eliminates collation and/or accumulation. Product is not affected by backpressure, stops, adjacent product, pushers, etc... The motion of the robot is smooth and robot utilization is 100% since the robot isn't waiting for product to be "configured" for picking.
 - Case/Tray Continuous motion for moving the case while loading eliminates indexing and squaring. The case moves through at a slow and constant speed. Indexing case/product at high speeds is difficult and damaging. It also simplifies changeover to required only changing of side rail for case width. Usually, all pneumatics are eliminated.
 - Example is picking bags/pouches/cartons which are in a single lane and gapped from a bagger and picking them on the fly as they pass in front of robot(s). Incorporation of continuous case handling provides the most reliable configuration due to the virtual elimination of mechanical/electrical components for material handling.

Robotic Packaging: Features & Benefits



- **Quicker Changeover**

- Product changeover can be minimized or even eliminated with the use of Tool Changers.
- Automatic tool changers are available for all ranges of robots and payloads.
- Six axis robot provides automatic flap control using robot motion instead of additional electrical/mechanical devices.
- Database programming allows computing of robot motion based on product parameters which eliminates teaching of the robot for each product/presentation. This is especially important for applications with 10 or more products.
- For some applications, On-Fly-Product/Grade Change are required.

Robotic Packaging: Features & Benefits



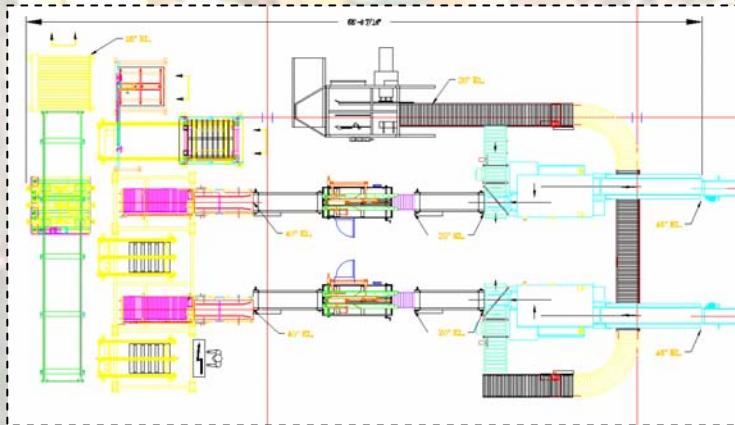
- **Maintenance**

- When using the robot to simplify the system design and operation, the total number of electrical and mechanical components to maintain/repair in the system can be significantly reduced.
- Robots are virtually maintenance free requiring only greasing every 6 months to 3 years and changing of batteries annually.
- Tool Changers increase reliability by eliminating operator intervention of the tool, system and changeover procedure.

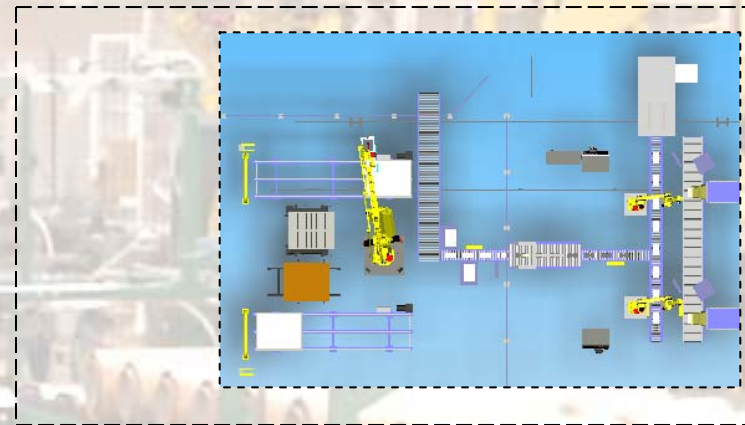
Robotic Packaging: Features & Benefits



- **Greater Layout Flexibility**
 - Robots provide for design freedom to configure a system to optimize space and operations.



Conventional Solution



Robotic Solution

Robotic Packaging: Features & Benefits



- **Control & Software**
 - Robots control is highly advanced taking advantage of the latest in safety, communication, HMI [Human Machine Interface], web interface, simulation, on-line documentation, integrated vision/intelligent sensors and application specific software.
 - Robots controllers can be used to control the entire packaging solution including I/O, HMI's and additional servo devices such as collators and metering conveyors.
 - Ethernet communication provides reliable control interface to I/O and other equipment.
 - Database driven software reduces or eliminates changeover.
 - “Collision” Guard Software Protects Robot, Tooling and Product.
 - Soft Float Software allows X-Y “Float” during product placement.
 - Remote connectivity provides remote support capability.
- **Common Technology Solution Across Plant Applications**
 - Same robot/controller or robot family can be used for primary, secondary and end of line applications

Robotic Packaging: Features & Benefits



- **Ease for Upgrade or Redeployment**
 - Upgrading for new products/processes is minimized. Typically, changes are limited to robot tooling and programming.
 - Robots can be redeployed for new applications if product/processes become obsolete or are moved to another facility.

Robotic Packaging: Features & Benefits



- **Environmental Compatibility**
 - Robots are available and proven for most any application and environment.
 - Clean Room
 - Cold
 - Dusty
 - Explosive
 - Heavy
 - Hot
 - Noisy
 - Radiation
 - Sanitary
 - Wet

Robotic Packaging: When & Why?

- Use Robotic Packaging if your product or process presents any of the challenges called out below:
 - Product
 - Difficult to Collate
 - Difficult to Accumulate
 - Difficult to Orient or Maintain Orientation
 - Variety of Product Types
 - Variety of Presentations
 - More than one case/tray/Bliss Configuration
 - Random Product Orientation
 - Mixing/Combo/Rainbow Packs
 - Process
 - Ergonomic Issues
 - Continuous Motion Product and/or Case/Tray/Bliss

Robotic Packaging: When & Why?

- **Facility/Line Configuration**
 - Multiple Lines
 - Minimal Space
 - Minimal Accumulation due to space
 - Utilization of existing material handling or peripheral equipment
- **Operational Challenges**
 - High Frequency of Changeover
 - Difficulty to ramp up production between changeovers
 - Market driven changes in product and product presentations

Robotic Packaging: Misconceptions

- If you're trying to improve your packaging process, don't be misled by these old misconceptions about robot reliability, complexity and costs.
 - Robots cannot handle high speed lines.
 - Robotics technology is complex.
 - Robotics requires higher skilled operators and support personnel.
 - Robotic solutions are unreliable.
 - Robotic solutions are expensive.

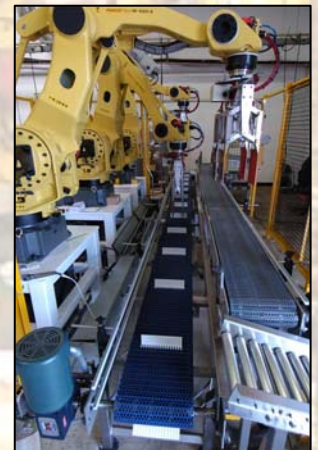
Robotic Example Opportunities

- **Primary Packaging**
 - Primary packaging for Healthcare products, for an example, efficiency of cartoning is improved through the robotic handling of bottles and jars.
 - Robots pick from accumulated conveyors and loads into a continuous motion vertical cartoner.
 - For jars, the one robot picks from an in-feed conveyor and spreads the jars to match the pitch of cartoner.
 - For bottles, a second robot picks four, eight, 12 or 16 bottles depending on product presentation and the gripper groups the bottles together to fit into carton.
 - This solution simplifies in-feed and provides for programmable changeover. A downstream system utilizes the same model robot for case packing the cartons into shipping cases.
 - What were the **key** decision factors for choosing robotics?
 - Flexibility, reliability for existing and future products.
 - Use of common technology for carton loading and downstream case loading.



Robotic Example Opportunities

- **Secondary Packaging**
 - An example of optimizing robotics for secondary packaging is a system with continuous motion product in-feed and continuous motion case/tray/cartons handling.
 - The bagged food product ranges from 4 pounds to 12 pounds and is packaged standing up. Bags are conveyed on a flat chain/belt and robot tracked via sensor if single lane and oriented or vision if random, and picked on the fly without collation or accumulation.
 - Cases, trays or cartons are tracked and loaded with continuous motion to provide a smooth and simple conveyance during loading.
 - In this example, the system only uses pneumatics to actuate the gripper for picking product. This limits total failure opportunities to a few sensors and standard, single lane conveyors.
 - Automatic tool changers on the robots allows for quick and reliable changeover between products and the simplified case and product in-feed requires only rail adjustment for the width of the product/case.
 - The robot orients bags for each display tray configuration per the customer's club-pack specification.
 - What were the **key** decision factors for choosing robotics?
 - Eliminating collation, accumulation and in-feed orientation of the product.
 - Chose three (3) robots over 1-2 robots due to their flexibility and reliability.
 - Quick changeover using robotic tool changers.



Robotic Example Opportunities

- **Packaging & Palletizing: Over 300 Presentations**
 - An example of full line packaging automation at work in a standard setting involves a full packaging line which case packs and palletizes over 300 SKU's with a large variety of shrink bundled roll product presentations, trays and RSC (regular slotted containers) type case sizes.
 - Dual robotic case loaders are database driven to eliminate programming specific paths for each product.
 - No changeover is required on product in-feed or case/trays.
 - End of the line palletizing provides fully automatic handling of the open trays and sealed RSC's without changeover.
 - The robotic palletizer also handles empty pallet, pallet sheets and tier sheets. This eliminates Sheet Dispenser, Pallet Dispenser and pallet transfer conveyor.
 - What were the **key** decision factors for choosing robotics?
 - Ability to run 100's of SKU's with little changeover and database driven software for robot motion.
 - 6-axis robot for loading and fully automatic palletizing without changeover.



Robotic Example Opportunities

- **Packaging & Palletizing:**
 - Robotics is now being used to enhance or even replace traditional case erectors and tray formers.
 - System utilizes robots for picking case blanks and forming the first “folds” of the case. This eliminates the traditional magazine in-feed and blank load.
 - Solution allows the user to load blanks as a horizontal stack direct from the forklift eliminating ergonomic and labor issues with handling the blanks.
 - This same system uses two more robots for handling the large rolls of roofing material to load the case and to palletize.
 - The palletizing robot is highly flexible handling the empty pallets, cased rolls and bulk palletizing un-cased rolls.
 - What were the **key** decision factors for choosing robotics?
 - Elimination of tradition methods for handling, loading and forming case blanks.
 - Use of common robot technology for case forming, case loading and palletizing.
 - Ability to palletize cases or bulk product without changeover.
 - Reliability/Efficiency was the #1 deciding factor.



Pricing Considerations for Robotics

- Cost comparison between various solutions/vendors can often be difficult.
- Prices can have a wide range due to the range of solution possibilities. Keep in mind, you are buying a solution, not just a robot.
- How competitive are robotics?
 - Robotic solutions are highly competitive with “conventional” solutions. Pricing comparisons are further enhanced when you factor the benefits such as:
 - Reduced Maintenance, Spare Parts, Repairs, Changeover Time, etc...
 - Price is highly dependent on the application and automation solution.
 - A good example is using the robot to simplify the mechanical handling of products/cases on the in-feed of a case packing system.
 - Another example is to replace a complicated in-feed to a cartoner with a robot and gripper.
 - Price is affected by the degree of “features” which a supplier has pre-engineered such as a gripper or software interface.
 - Robotics systems are easily configured to meet Company Machine Specifications.
 - Flexibility in layout using robotics can lower material handling costs.

Pricing Considerations for Robotics

- **Understanding Price**
 - Focus on the System Price and Scope of Delivery along with other Project Costs.
 - Project pricing should include:
 - System Price
 - Product/case In-Feed and Out-Feed Handling System
 - Robot(s), Robot Tooling, Robot Software
 - Compliance with ANSI/RIA Safety Standards.
 - Peripheral Components such as Case Erector, Stretch Wrapper, etc...
 - All Guarding, Software and Control
 - System Options
 - Preliminary Acceptance Test [at Supplier]
 - Documentation
 - Crating & Shipping
 - Final Acceptance Test
 - Installation
 - Training
 - Warranty

Getting Started: Developing an RFQ

- Packaging automation analysis requires a detailed functional requirement analysis to develop an RFQ [Request for Quotation].
- It is critical that all products, product presentations, throughput rates, plant layouts and process details be included in the RFQ.

Developing an RFQ: Project Requirements

- **Primary & Secondary Packaging**
 - **Product Description**
 - General Description of product and wrapping/packing
 - For food, is it wrapped or raw/frozen
 - Dimensional Size & Weight
 - Pictures & Samples
 - **Case/Carton Description**
 - Type: RSC [Regular Slotted Case], HSC [Half Slotted Case], Tray, Carton, etc...
 - Material: Corrugate, Chipboard, Plastic, etc...
 - **Case/Carton Presentation**
 - Pack Pattern
 - Product Orientation
 - Product array for each layer
 - # of layers

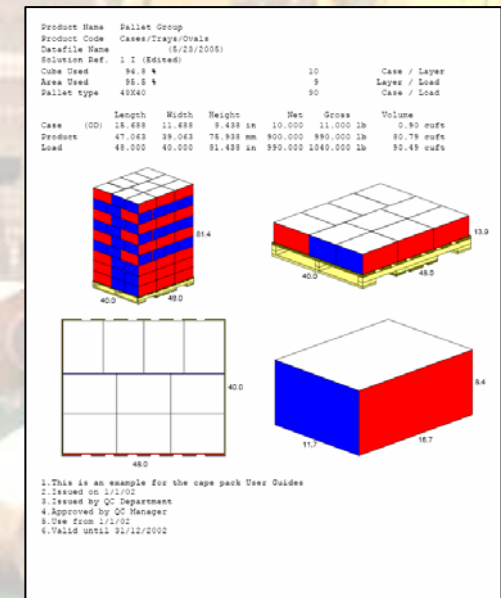
Developing an RFQ: Project Requirements

- **Primary & Secondary Packaging**
 - **Product Rate**
 - Nominal Rate
 - Maximum Rate
 - Desired Surge Rate
 - An additional 5%-20% additional rate should be planned to assure that the downstream system runs faster than upstream processes.
 - **In-Feed Delivery**
 - Current Orientation
 - Random
 - Lane Divided
 - » # of Lanes
 - Amount of accumulation/buffer
 - Back pressure considerations
 - **Line Configuration**
 - Number of lines
 - Plant/Line Layout
 - Environment: Temperature, Humidity, Wash Down, Freezer, etc...

Developing an RFQ: Project Requirements

- **Palletizing**

- Generate Unit Load configurations for each product.
- If available, utilize the TOPS or CASE diagrams which are created by company packaging engineers or the corrugate supplier.
 - TOPS and CASE are software programs used by packaging engineers.
- If TOPS/CASE diagrams are not available generate the data shown on the Palletizing Functional Requirements for Unit Loads slide.



Developing an RFQ: Project Requirements

- **Palletizing**
 - Palletizing Functional Requirements
 - Product Type
 - Case [RSC, HSC, Bliss, etc.]
 - Tray
 - Bag or Bundle
 - Pail
 - Bottle, Can, Combinations, Other
 - Pallet Type
 - Wood or Plastic
 - Pallet Sizes
 - Two-way or Four-way
 - Preferred direction for forklift access

Developing an RFQ: Project Requirements

- **Palletizing**

- **Palletizing Functional Requirements**

- **Unit Load [Each Product]**

- **Case Rate**

- » Add additional 20% Surge Rate over maximum rate.

- **Cases per layer**

- **Layer Pattern**

- » Show diagram of pattern.

- » Is there a combination of column and interlocking on a unit load?

- **Layers per pallet**

- **Number and position of pallet sheets, tier sheets, bottom or top caps.**

- **Is there a “label out” requirement**

- **Pallet or No pallet**

Developing an RFQ: Project Requirements



- **Palletizing**

- **Palletizing Functional Requirements**

- **Line Configuration**

- Number of lines
- In-line palletizer or centralized
- Plant Layout
- Environment: Temperature, Humidity, Wash Down, Freezer, etc...

List of Vendors & Additional Resources

- **Robotic Packaging Integrators & Suppliers**
 - [Integrators & Suppliers](#)
- **Related Links to Robotic Packaging Articles**
 - [Myth Busters: Robotic Line Realities; Packaging Machine Technology](#)
 - [Robotics Online Packaging & Palletizing Case Studies](#)
 - [Robotics Online Packaging & Palletizing Papers and Articles](#)

Special Thanks to Mark Senti of [GSMA](#) and the entire RIA Education Committee for developing this tutorial