



Robotic Industries Association

**Robots' influence growing in the food, packaging industries**

**Tanya M. Anadan** is contributing editor for the [Robotic Industries Association \(RIA\) and Robotics Online](#).

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# Robots' influence growing in the food, packaging industries

**Customization and variability are at an all-time high and food producers must keep up with the trends while trying to anticipate the future and robotics' ability to provide flexible automation will be key in making the industry grow.**

Tanya M. Anadan

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The global food industry represents nearly \$8 trillion of the world's GDP, according to Plunket Research. However, labor shortages, worker safety, and foodborne illnesses are a constant challenge along with rising living standards and changing eating habits in developing countries pressure capacity and throughput.

Consumers want more choices, more convenience, and they want their food to be fresh, fast, and affordable. Customization and variability are at an all-time high and food producers must keep up with the trends while trying to anticipate the future. But it's often difficult to know what's on the menu. Flexible automation is the ticket.



"Automation could do for the food industry what it did for the automotive industry in the '70s," said Carl Vause, CEO of Soft Robotics Inc., a manufacturer of soft-actuating adaptive gripper technology in Cambridge, Massachusetts. "It could take this industry to the next level. Drive quality, drive consistency. Make sure they can scale and grow, and meet the demands of the market, and in this case, feed the world."

## Robots satisfy labor woes

Feeding the world is proving tougher every year as our population ages and labor costs rise. Innovative automation solutions help tackle the tedious but necessary jobs.

"We're seeing a major shift in the mindset of our clients, safety being the number one priority for most of our customers," said Keith Allen, client manager for JMP Automation, Inc. "The priority is to get people out of unsafe tasks. There are major ergonomic challenges in tasks like case packing, carton loading, and palletizing."

He cited a case where workers were stooped over a fast-moving conveyor belt loading ice cream bars. The job was so taxing that workers had to rotate to another task every 15 minutes. Even then, they walked away with neck and back strain.



"It's not sustainable," Allen said. "So a lot of food companies are turning to a company like ours to help them solve some of their most ergonomic challenges. We focus on what we call smart robotics in the food and consumer packaged goods (CPG) marketplace."

In the case of the ice cream bars, three pick-and-place robots tied to the customers cartoning equipment was the solution.

In addition to issues with worker safety, Allen also noted labor shortages and an aging workforce as challenges. He said many millennials don't see manufacturing as a viable career. This is especially true in the fast-paced, often extreme temperature environments typical in food processing and packaging.

Vause said while sanitary practice is always top of mind, the primary pain point is labor. "If you're churning through your labor force, or you don't have well-trained people or access to a well-trained labor force, then you have sanitary concerns. As someone who has worked in medical devices, I can tell you going into a produce-packing house in California, there's a higher level of sanitary preparation and safety gear than there is in an operating room." Vause added,

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"The Food Safety Modernization Act (FSMA) has also raised the bar on the sanitary requirements for a lot of these packagers and processors. You have these two major megatrends, labor and FSMA. Companies are trying to solve for both of those simultaneously. It's an area where automation can really lend a hand."

### **Food sanitation standards for robots**

Robotic automation is getting a leg up with a new standard. Five years in the making, the 3-A Sanitary Standard for Robot-based Automation Systems, Number 103-00, became effective on October 13, 2016. The RBAS standard addresses robotic equipment used in primary food handling and packaging.

"3-A standards are some of the most stringent standards on the planet," said Bob Rochelle, document leader for the working group responsible for writing the standard. "These are the same standards used to meet state and federal regulations for food processing equipment in Grade A dairy plants."

Rochelle said the new standard is intended for manufacturers of robots and robotics-related ancillary equipment and the integrators of these systems. It establishes minimum sanitary hygienic requirements for design, materials, fabrication, and installation of the robot and ancillary robotic equipment, including the robot base, end-of-arm tooling (EOAT), tool changers, and robot dressing.



Developed in collaboration with the Robotic Industries Association (RIA), the RBAS standard brings together for the first time the robotics and the food processing sanitation worlds. Robotics suppliers and integrators, food processors, and several sanitary regulating bodies, including the USDA and FDA, worked together in its development.

"In the world of food science, this is definitely an inaugural moment," said Eric Schweitzer, director of standards and certification for 3-A Sanitary Standards, Inc., in McLean, Va. "There's no process equipment standard that informs manufacturers of robotic automation systems how to design for cleanability and inspectability. "The industry has been progressing more towards automation in recent decades. It seems to be progressing faster because labor is relatively expensive and robots have become less expensive. Robots don't have sick days and can operate far more efficiently without taking any breaks."

Traditionally, the convergence of robotics and food processing, especially in cases of direct food contact, has been problematic.

"You're dealing with joints and actuators, and things that are dynamically moving," Schweitzer said. "Not a very easy piece of machinery to design as sanitary. You have all of these cracks and crevices where bacteria and other microorganisms can harbor."

According to Schweitzer, a product contact surface is defined as all surfaces which are exposed to the product and from which splashed product, liquids or soil may drain, drop, diffuse or be drawn into the product or onto surfaces that come into contact with product contact surfaces of packaging materials. The 3-A standard addresses these scenarios and ensures that the construction of automation systems is cleanable, inspectable and meets the intent of the FDA's Grade A Pasteurized Milk Ordinance.

The RBAS standard is voluntary, but any robotics supplier or integrator looking to participate in the fast-paced food processing industry should definitely take a hard look. Schweitzer says 3-A doesn't endorse or approve any equipment. The not-for-profit writes standards and then licenses the use of its registered trademark symbol for equipment that has been inspected by a third-party evaluator and shows conformance to the 3-A Sanitary Standard.

### **Cupcakes, cones, and corn dogs**

Allen said FSMA (and now 3-A) is compelling the food space to take a look at their processes and how they design their equipment. Trusted systems integrators with expertise in the food industry are at the ready to help processors and packagers improve efficiency and sanitation.

"The minute a product comes out of a fryer or a freezer, or has been processed, that's where customers are turning to JMP for help and support," Allen said. "Our strength lies in collaborating with our customers to design full line packaging integration. We're taking into consideration things like product quality, flow, and surge. These are especially important in designing a turnkey solution

for our customers. Our systems have to meet FDA and AMI (American Meat Institute) standards."

Allen said 95% of the systems they build are shipped to clients in the U.S. Allen added that it's important to work with suppliers whose platforms integrate well with existing systems in their clients' plants and that are easily supported by in-house maintenance personnel. JMP has designed, built, and integrated robotic systems for handling an interesting array of food products, including ice cream cones (pictured), brownies, corn dogs, cupcakes, and bagged food product.

"Whether it's corn dogs or egg rolls, or two-bite brownies or cupcakes, there are a variety of ways that you can handle product," Allen said. "It really comes down to collaborating with the end customer to ensure that you're addressing their concerns.

"The vast majority of customers today want to know if you've handled their product," he continued. "Often the answer is no, because there's so many different unique products out there in the food space. Whether it's fresh or frozen, or baked goods, it's impossible for most systems integrators to have handled all these different products. But you can tie it back to similar shape and size, and environments that would be applicable."

#### **Pick product by day, self-clean at night**

JMP has also developed an innovative robotic wash-down solution for selective clean-in-place applications. The patent-pending system not only uses robots to wash the conveyors and surrounding equipment, but also each other.

During the day, the FANUC M-430iA robots are picking and packing product at blistering speeds. At night they wash down their robot coworkers and their workcell, so they're ready for the next shift.

These aren't the only robots playing nice with water. Waterjet technology has been used to cut everything from pickles, cheese and even stringy celery, to metal, stone and glass. Couple that with robotics technology and you have the icing on the cake.

#### **Robots being used for produce packaging**

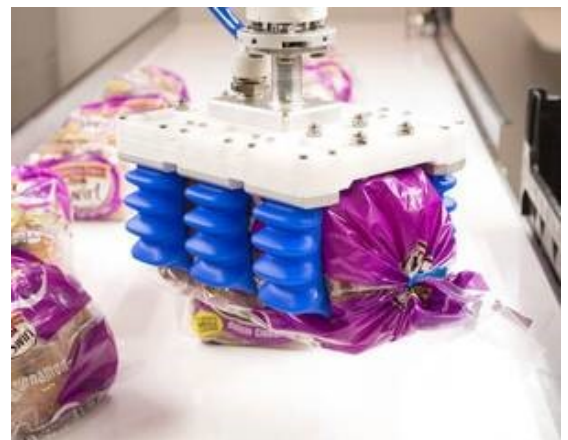
Another innovation garnering rave reviews in the food space is a unique gripper based on Soft Robotics technology developed by the Whitesides Research Group at Harvard University. "Our mantra is things that vary in size, shape and weight, or are easily damaged," Vause said. Robots used in packaging could go a long way to helping with food safety and advanced technologies.

We joke about the \$7 apple, Vause said. But in reality, fruits and vegetables could become so difficult and costly to produce and keep up with worldwide demand, that they become scarce and too expensive for the masses. Robotic grippers that are adept with primary and secondary packaging can help.

"Take a head of Romaine lettuce in a plastic bag. We're able to do secondary packaging of those bagged products into cases at higher speed and reliability than traditional suction cups," Vause said. "When you're thinking about moving things that are maybe wet or have particulate matter on them, or where a suction cup can't get a good grasp, that's where our technology works very well. Then if you have things of varying size, like small, medium and large bags of celery on the same packaging line, we can do all of that without any tool changers."

#### **Soft touch for sensitive fruits**

The Soft Robotics gripper has also been used to automate tomato sorting, a traditionally labor-intensive process. "Anyone using tomatoes has to sort them on a regular schedule to find the ones that are at the same level of ripeness to ship to their customers," Vause said. "They sort by size and color. All of that is done by hand today. We've been able to show that we can handle these



tomatoes with a robotic system at speed with reliability."

Tomatoes aren't the only sensitive food products ripe for the picking. Soft Robotics is reaching deeper into the supply chain. "We're talking to berry farmers right now," Vause said. "Twenty percent of the strawberry crop in California in the last two years has been left in the fields due to a labor shortage. So there are two or three different companies trying to automate the harvesting challenge. We're working with them for different technology approaches. I think it's a great opportunity."

The Soft Robotics gripper meets the food safety cleanability standards. The fingers are made from food-grade polymer material and there are no electromechanical devices in the end effector, making wash-down easy.

### **Bakery automation on the rise**

From fresh produce on the packaging line to fresh fruits in the field, Soft Robotics is branching out in more ways than one. It wasn't long until the grain-based food industry came calling.

"There's a huge opportunity in bakery automation," Vause said. "We found it fits right into our mantra of things that vary in size, shape or weight, and are easily damaged. We continue to find that this adaptability in automation is so important and we can help people."

It was especially useful when it comes to raw dough handling, which is a long-time automation challenge for the baking industry.

### **Soft dough handling**

The bakery automation industry has become a proving ground for the Soft Robotics gripper. One of those early adopters is ABI LTD, a global integrator of automated bakery equipment in Concord, Ontario, Canada.

"It was an ongoing struggle for us to find good, reliable solutions for soft dough products," said Aaron Burke, marketing and communications coordinator at ABI LTD. "When you're dealing with soft dough products, particularly proofed dough products (dough that has been allowed to rise), they have to be handled very gently, otherwise you can end up leaving impressions in the dough, or you could deflate the dough or malform the product."



Burke said they just shipped a robotic system for a large pizza company in U.K. and is working on a second system for them right now, both utilizing the Soft Robotics grippers. An ABB Robotics Preferred Partner, ABI LTD developed a four-robot system that picks raw pizza dough right from the rounder and places it into trays.

"In the old methods of picking and placing, we were using needle tools or suction cups, or some kind of metal tools. All of them had their downfalls."

The Soft Robotics gripper is able to handle different sized dough balls with one tool. Coupled with a nimble robot and 3-D vision that determines the position and size of the dough balls, you have a complete solution that doesn't require tool changers.

"You have to have a tool that treats a 150-gram dough ball the same way it treats a 50-gram dough ball," Burke said. "It has to be able to open and close variably to grip the product without putting too much pressure on it."

"We were able to come up with a configuration that has five fingers," he continued. "The fingers spread wide enough to get

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around the full size of the largest dough balls, but when the system recognizes that it's a smaller dough ball, it squeezes a little tighter (based on the amount of air pressure flowing into the gripper). We were able to find a combination that can handle three or four different sizes of product with the same tool."

### **Robotic waterjet cutting used for cakes**

ABI LTD is bringing other innovations to the bakery automation space. Waterjet technology has been used in the food industry for years, but now robots are taking it to new levels of creativity and efficiency.

The Katana robotic waterjet cutting system marries a flexible robot with a pure waterjet system and 3-D vision technology for high-volume cake and pastry cutting. Here's how it works.

First, a 3-D laser scanner determines the presence and position of the cake, then it maps out the product's typography. Software crunches the data gathered by the vision system to determine the robot parameters for the preprogrammed cutting patterns. Then a robot equipped with a waterjet nozzle uses a very narrow stream of water at extremely high pressure to slice through the cake in the designated pattern. An easy-to-use touchscreen interface allows you to hand-draw or import new designs.

No two cakes are exactly the same, so the integrated vision system is very important, especially when you're nesting shapes within a cake. The system maps out how those shapes will fit together in a particular product to minimize waste during the cutting process.

Burke said the system can be used with fresh, semi-frozen, or deep frozen product.

"The waterjet pump at 60,000 psi of pressure coming from a tiny 0.05 mm orifice has a lot of cutting power," he said. "But we find the best results to be in the semi-frozen state. That tends to be the sweet spot because you have a lot of structural integrity of the product at that temperature. Also products with inclusions, like fruits and nuts, are no problem."

Traditional cutting methods often restricted cake slicing to straight-line cuts with blades that wear down. With the flexibility of a six-axis robot, users can cut circular patterns unachievable with a straight blade. Burke said they've cut everything from seahorses and hearts to maple leaves and Christmas trees out of cake.

"Historically, for that kind of stuff you had to go to some type of die-cutting system, where you're stamping your shape into the cake. With dedicated tooling like that, you get into changeovers, you have potential cross-contamination. You have to make sure they are clean," Burke said.

In the food industry, robotic waterjet cutting uses only pure filtered water. This makes it both sanitary and environmentally friendly.

"Cakes and pastries are the primary use of these types of systems, but they can cut just about anything," Burke said. "We've also integrated waterjet cutting for Rice Krispies squares and energy bars, which typically start off as long sheets and then get cut down into pieces."

Robotic automation is also used for cupcake and muffin depanning, croissant bending and pinching, and sheet cake box loading. For the food producers of the world, the question is no longer whether to automate, but how soon to automate.

**Tanya M. Anandan** is contributing editor for the [Robotic Industries Association \(RIA\) and Robotics Online](#). RIA is a not-for-profit trade association dedicated to improving the regional, national and global competitiveness of the North American manufacturing and service sectors through robotics and related automation. This article [originally appeared on the RIA website](#). The RIA is a part of the [Association for Advancing Automation \(A3\)](#). A3 is a CFE Media content partner. Edited by Chris Vavra, production editor, *Control Engineering*, CFE Media, [cvavra@cfemedia.com](mailto:cvavra@cfemedia.com).

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