

## ***Meet the Food Inspection Robots***

Americans want the best—and we want it fast. We already enjoy one of the safest food supplies in the world, but we want it even safer. We're likely to get what we want, thanks in part to Agricultural Research Service (ARS) innovations in food inspection.

Take the chicken-processing industry, for example. As America's productivity and prosperity rose, along with the demand from health-conscious consumers for more poultry, production lines cranked up. Now, many can run at 140 birds a minute. As a comparison, the human speed is about 35 birds per minute. Those high speeds bring the issue of inspection effectiveness and customer demands to the forefront. Similar issues are at work in other food industries.

The volume and rate of food flow beg for sophisticated instrumentation to ensure quality as American food industries struggle to compete in a global economy while meeting ever-higher safety standards.

And ARS is happy to help, bringing food safety and quality inspections to a new level by taking advantage of the latest technologies.

Several years ago, poultry processors and USDA's Food Safety Inspection Service (FSIS) asked ARS to design so-called machine-vision systems to address the issues associated with high-speed inspection. "Machine vision" refers to robotic equipment that can "see" product defects.

In response, ARS began working closely with FSIS to develop two machine-vision systems for chicken inspection, which are now being shifted to private industry for commercial development. One, developed by the ARS Instrumentation and Sensing Laboratory in Beltsville, Maryland, automatically spots birds with diseases and physical defects. The other, developed by the ARS Poultry Processing and Meat Quality Research Unit in Athens, Georgia, spots contamination from fecal matter and from partially digested food from ruptured chicken crops.

Both systems can handle line speeds up to 180 birds a minute, an initial requirement of the ARS research project. The ARS scientists knew that if they couldn't keep up with the actual pace of industry, their work would be useless. And the systems had to be easily adaptable to handle other birds, such as turkeys and ducks.

The ARS Preharvest Food Safety and Enteric Disease Research Unit in Ames, Iowa, is the third leg of the tripod that supports the ARS Food Safety national program's machine-vision goals. That team developed a system to detect fecal contamination on cattle carcasses and may expand it to include

swine. They have developed a fixed scanning instrument that stands 7 feet tall and are currently working to develop portable instruments. The stand-alone equipment is much like a metal detector in an airport: it scans the entire body. The portable instrument would be similar to the wands used by security personnel to spot-check a passenger.

The ARS national program Food Safety oversees the work of these three research teams to be sure the solutions they work on are compatible, useful, and not duplicative.

As the story on page 4 in this issue shows, the Beltsville team is now moving toward a machine-vision system for apples, which could have applications for all fruits and vegetables. Just as the chicken and beef industries dealt with their own widespread news coverage of food contamination incidents, the apple-processing industry was spurred on by reports of *Escherichia coli* O157:H7 contamination of unpasteurized apple juice and cider. In this case, the U.S. Food and Drug Administration (FDA) asked for help from ARS, as FSIS had done for beef and chicken inspection problems.

Because machine vision can work 24 hours a day, it could potentially be used to inspect all of America's processed foods, both domestic and imported. It even holds promise of spotting unusual forms of contamination, such as metal pieces, that can enter the food supply by accident or on purpose.

While the three teams do basic research as well as applied, they are all oriented toward benefitting the world outside their labs.

Despite the costs involved and human issues still to resolve, the industry is grateful to have machine vision as a tool, especially with the blessing of FSIS and FDA. With this new tool, producers can honestly say that their products have been screened for safety and quality by the most sophisticated systems science has developed to date—systems designed to work well with and benefit from the experienced people they are an adjunct to, not a replacement for.

The bottom line is that these systems can help make it possible, and much easier, for the industry to ensure that only the best products make it to the end of the food-processing and packing lines.

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