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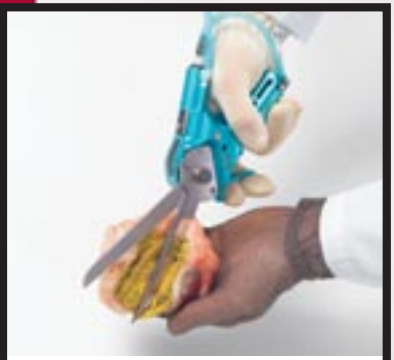

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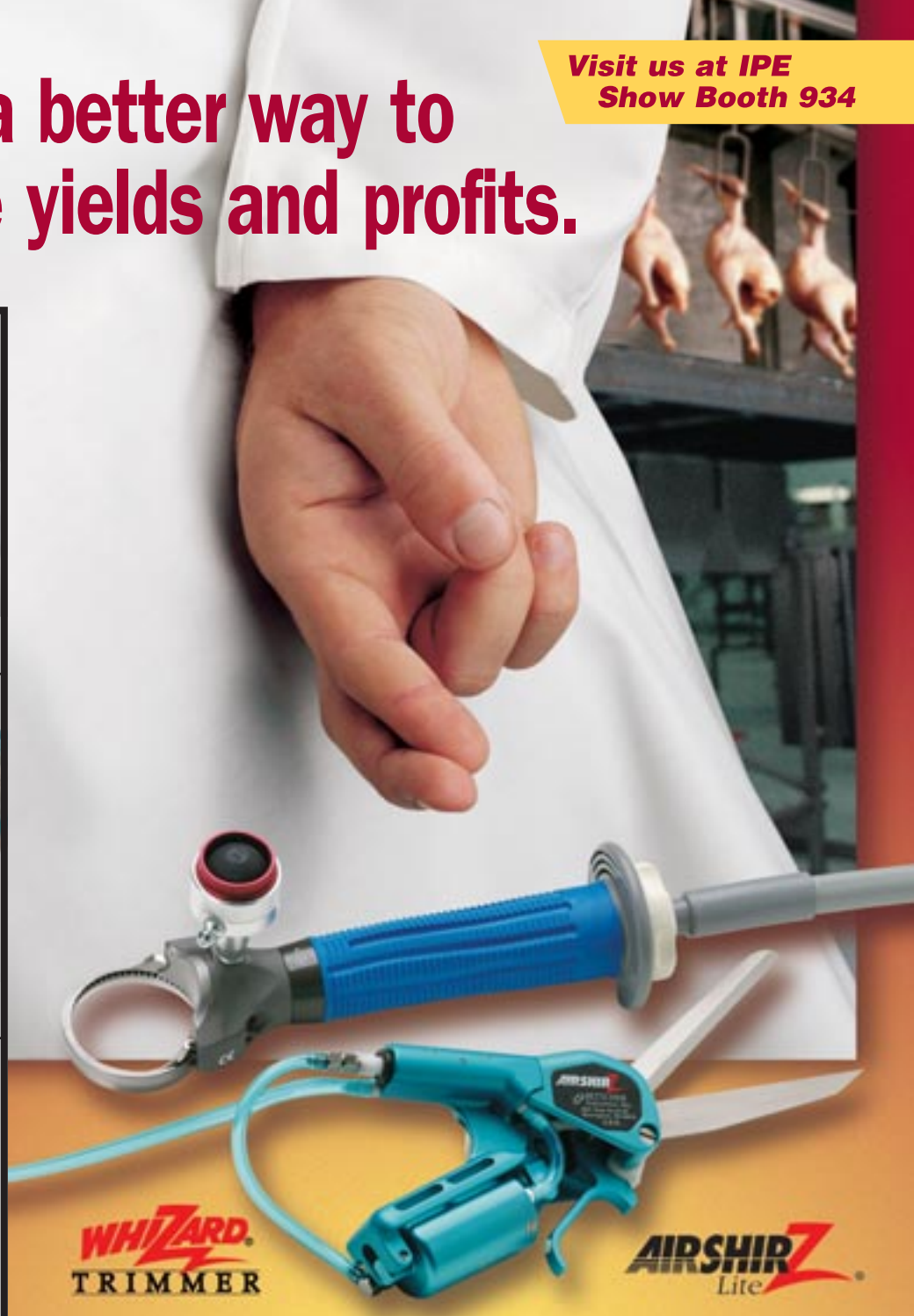

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2009 Tech Journal Series Poultry Processing Technology 101

A NATIONAL PROVISIONER RESEARCH PROJECT
BY BARBARA YOUNG, EDITOR-IN-CHIEF
LISA WHITE, RESEARCH ASSISTANT

PART ONE: INTRODUCTION

Progressive poultry processing practices call for a streamlined approach to the flow of information among machines, people and integrated technology.

The industry is light-years ahead of its poultry-plucking days of the 1900s, especially concerning processing equipment-design improvements.

Even so, the livestock poultry industry has been grappling with an operating backlash triggered by high feed and fuel prices — feed being the single most important input cost of poultry production. Due to such operating challenges, the poultry industry finds itself fine-tuning practices concerning business management and production strategies. Experts suggest greater use of genetics and economic modeling as strategies that can offset escalating production costs. Technology is a key driver behind efficiency and growth in the food-production realm.

To keep up with trends impacting food production, *The National Provisioner* continues its Tech Journal Series that debuted in 2008 with this first research project of 2009, focusing on the poultry industry. The 2008 reports covered bacon, ground beef, sausage, and deli meat. This poultry research project delves into current research and development projects designed to improve poultry-processing practices with input from scientists and other industry experts. Select poultry processors offer their real-world operating strategies. Other topics include production basics, plant-floor innovations and regulatory update.

The taste for chicken among urbanites in the 19th century fueled the demand that encouraged farmers to travel great distances to deliver birds and eggs to city markets along with their marketable produce. Their customers bought these birds, which were essentially marketed as "killed on demand" with only the feathers removed onsite. The whole bird, labeled "New York dressed" with everything else in tact went home, with customers for "further processing."

The welfare of birds during slaughter now is protected by law and must be integral to every processing plant's Standard Operating Procedure. Congress passed the Poultry Products Inspection Act (PPIA) in 1957 in response to rapidly expanding markets for dressed, ready-to-cook poultry and processed poultry products. PPIA was amended in 1993 to require that slaughter of poultry and the processing of poultry products in federally inspected establishments be performed in accordance with humane methods.

Stunning, which prepares birds to automatically move into machines for the kill, was introduced in the late 1960s initially as a labor-saving strategy. Modern stunning methods, considered humane and efficient, include electrical, percussive (captive-bolt) or controlled atmosphere (gas).

In the early 20th century most farm products were sold on the open market as commodities. Technological advances and other changes in the American economy coupled with changing food-consumption patterns provided new opportunities to agribusiness companies. Until the late 1940s, poultry was shipped in canvass covered trucks heaped full of ice. Thereafter, it was transported in closed trucks.

In 1940, most of the work in poultry-processing plants was manually done with a knife and two hands. By 1949, evisceration was pretty much a standard procedure with fresh, whole birds ready for the oven replacing "New York dressed" birds.

Chicken were scalded, plucked by hand and dipped in hot wax in the early years. Wax was removed after it congealed bringing feathers along with it. The remaining feathers were removed manually. Automation kicked in by 1954 with the introduction of a picking machine that eliminated much of the hand de-feathering.

Over the years, automation facilitates line-speed efficiencies. Although traditional organoleptic inspection is somewhat inhibiting concerning high-speed throughput in first processing, automation promises to deliver a remedy via such innovations as machine vision along with statistically based inspection.

POULTRY TECHNOLOGY 101

Photo by Vito Palmisano

PART TWO: SNAPSHOTS OF PROGRESSIVE POULTRY PROCESSORS

The U.S. poultry industry evolved from a fragmented, mostly agrarian enterprise in the 19th century to a highly efficient, vertically integrated and progressive collection of businesses by the 1970s.

By the early 1980s, cut-up and further-processed chicken overtook traditional whole-bird demand. Chicken surpassed U.S. pork consumption in 1985 and beef consumption in 1992.

Meanwhile, during the past two decades the turkey industry evolved from a single-product, holiday-oriented business into a fully integrated industry with a diversified product line. Total U.S. turkey consumption has increased 116 percent since 1970 — 50 percent of all turkey that year was consumed during the Thanksgiving holiday compared with current data pinpointing to 29 percent consumption year-round.

Today the poultry industry is supplying a substantial share or meat protein for human consumption thanks to the chicken and turkey segments. Processing plants are equipped with high-tech industrial systems designed to facilitate manufacturing efficiencies and promote the highest standards for safe food production.

Following is a sampling of exemplary programs employed by U.S. poultry processors. Representatives include Foster Farms, Cooper Farms, Sanderson Farms, Butterball, LLC and Simmons Foods.

FOSTER FARMS

Founded in 1939, Foster Farms is a privately held, family-owned-and-operated branded supplier of fresh chicken and turkey. Based in Livingston, Calif., the company generates annual sales estimated at $1.7 billion.

Foster Farms operates with 10,500 employees and 10 processing plants. The management team is headed by Ron Foster, chief executive officer.

Its birds are locally grown on farms it owns or operates in each of its markets (California, Oregon and Washington). Primary product categories include fresh tray-pack retail chicken and turkey. It specializes in producing high-quality fresh chicken products that are all-natural with no preservatives or sodium-based additives, in addition to a full line of other poultry products.

A 2005 expansion project at its Porterville, Calif., facility enabled Foster Farms to increase capability by 80 percent to 12,000 pounds of food products per hour. The plant manufactures fully cooked chicken products such as wings, breaded tenders, breaded patties, breaded nuggets, grilled breast strips, pizza toppings

and mini corndogs.

"We have done a lot of remodeling over the years," notes Foster. "The most recent and largest project has been the installation of a high-pressure pasteurization system in our Turlock plant. This is where packaged, fully cooked turkey items like lunchmeats go through the system to eliminate microbials."

A recent improvement benefiting production focused on deboning. "We've added more automated deboning equipment," Foster reports. "This is one of the biggest investments. The major advantage of this system is reduced labor requirements."

Distribution channels include retail, warehouse clubs and foodservice customers throughout the West. "We have a well defined and established supply chain that allows us to achieve efficiencies that a lot of companies do not," Foster notes.

Foster Farms' processing plants are a critical part of its dedication to producing the highest-quality products. Poultry is minimally processed and handled only as much as necessary.

California plants operate in Livingston, Fresno, Porterville and Turlock. The Kelso, Wash., plant handles 650,000 birds a week. Three million birds are slaughtered weekly at the Livingston fresh chicken plant and a combined 2.25 million a week in two fresh chicken plants in Fresno. Turkey production in Turlock requires 8.7 million birds (2008) for lunchmeat and further-processed products.

"Our plants have fantastic safety standards in terms of *Salmonella* control," Foster reports. "We operate in the lowest levels within USDA categories. We also enjoy the most favorable status in that regard."

Processing facilities, moreover, are among the most modern and technologically advanced poultry-production operations in the nation, thanks to highly efficient and sanitary programs, comprehensive food-quality control and safety-management systems. "We are conscious of repetitive motion disorders in terms of worker safety, but in reality the more every-day things play a bigger role such slips, falls, strains and sprains."

Foster Farms' commitment to worker safety has delivered results. "We have a history over the last five years of significant reductions in work-place injuries," Foster confirms. "We have a safety program based on DuPont's safety model that has been in place six years," he says. "It is very effective in reducing work-place injuries and the severity of injuries."

DuPont's Safety Training Observation Program (STOP). Is designed to teach employees to identify hazards using a step-by-step approach to eliminate or reduce the hazards.

COOPER FARMS

Established in 1938 by Virgil and Virginia Cooper, Ohio-based Cooper Farms is a leading wholesale food supplier, selling a variety of pre-cooked and ready-to-cook turkey products to customers around the United States and in Mexico.

Cooper Farms processes more than 185 million live pounds of turkey annually, produces more than 400 million table eggs a year, and annually raises and markets more than 105 million live pounds of hogs. The company operates with four divisions, including hatchery, feed and animal, processing and cooked meats. The business includes four Ohio-based manufacturing facilities, 1,300 team members and approximately 200 local farmers under contract to grow turkeys for Cooper Farms. The management team includes the founder's two sons Jim and Gary Cooper and daughter Dianne Cooper. Third-generation members of the Cooper family are also involved in the business.

Cooper Farms offers a wide variety of deli turkey and chicken, including branded and private-label sliced meats. Ready-to-cook products include turkey burgers, roasts, portion-controlled cuts and boneless meats and parts. Fully cooked products include breakfast sausage, turkey taco meat and the company's patented meateor wings line.

The company operates a processing facility in

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Photo courtesy of Cooper Farms

POULTRY TECHNOLOGY 101

St. Henry, Ohio and a cooking facility in Van Wert, Ohio, and has expanded both facilities significantly in the past five years. A $10 million capital improvement project over the years netted additional production capacity for new and existing product manufacture.

The company's food-safety initiatives include a stepped up *Salmonella*-reduction program that includes a cross-functional team comprised of management staff from hatchery, live-animal growing and processing facility. "We currently are seeing positive results in the reduction of *Salmonella* by implementing the ideas this team has generated," reports Roger Wellman, director of marketing. "The most significant process change in the past year concerns stunning."

Cooper Farms converted to controlled atmosphere stunning, replacing its electrical stunning system. "This new system exposes turkeys to lower handling stress by stunning them before they leave the truck," Dale Hart explains. "Meat quality is improved with little or no blood spots evident in finished products."

More than 185 million pounds of live turkeys are processed annually in the St. Henry state-of-the-art facility that includes optimum ergonomic conditions and efficient value-add processing techniques for raw products.

Cooper Farms recently added a state-of-the-art patty forming line with IQF capabilities at this facility "to keep pace with the growing demand for high-quality turkey products," Wellman reports.

Raw turkey meats are shipped immediately from this facility to the cooked meats division in Van Wert, where cooked turkey products for foodservice and deli customers are produced.

The Van Wert facility was rebuilt in 2003, after a tornado tore through the original facility, to become a model state-of-the-art U.S. cooking and slicing facility designed with food safety as the driving force. Surface pasteurization further protects products.

The facility processes more than 50 million pounds of fully cooked turkey, chicken and pork hams for restaurant and deli use each year.

In 2005 the company installed a certified clean room for slicing meats for retail, deli and foodservice. This technology includes a European package design which allows for slicing of high-quality turkey and ham.

Major supermarket chains have begun to request infrared pasteurization as assurance of safety for their sliced meat and poultry products.

Photo courtesy of Butterball

BUTTERBALL, LLC

Butterball, LLC was formed in October 2006, when Carolina Turkeys acquired the *Butterball* brand from ConAgra Foods. Thanks to the marriage between Carolina Turkeys -- with its progressive track record of high performance in turkey production and customer service — and Butter Turkey Co. — with its international brand recognition — Butterball, LLC is a major player in the poultry industry. To be sure, Butterball enjoys recognition as an American tradition offering innovative turkey recipes, quality products and a delightful culinary experience.

"Once Carolina Turkey purchased Butterball, we wanted to make ourselves more flexible by producing products in different plants to be close to raw material and customers to decrease transportation costs and distances," says Joe Nalley, chief operating officer. "We also improved manufacturing flexibility and are constantly upgrading for improved food safety, quality, employee safety and overall facility maintenance."

Executives include Keith Shoemaker, chief executive officer; Joe Nalley, chief operating officer; Edward Kacsuta, chief financial officer; Dennis Stover, vice president, corporate controller; Kerry Doughty; executive vice president, sales & marketing; Gary Lenaghan; vice president, Human Resources; and Alice Johnson, D.V.M., vice president, Food Safety, Government Regulations and Pubic Affairs.

The manufacturing process includes brine- and emulsion- development, injection and tenderizing, vacuum massage process, product cooking and chilling (steam injected, oven/blast), impinge and smoking (steam cabinet, liquid smoke drench, impingement oven and blast cell chilling), raw packaging (includes rollstock machine with pan-shaped dies and shrink tunnel), regular packaging (includes product bagger, vacuum packaging machine, shrink tunnel and post package surface pasteurization tunnel).

"We're constantly upgrading facilities because we're committed to safety and quality," Nalley emphasizes.

Continued on page PTJ-8

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POULTRY TECHNOLOGY 101

Butterball stats at a glance

- $1.2 billion in annual sales
- 6,000 employees
- Total manufacturing space comprises 1.6 million square feet, Mt. Olive being the largest facility at 700,000 square feet
- 615 poultry growers in the six states
- Production output involves 1.4 billion pounds of live weight
- Distribution channels: retail, foodservice, school-lunch program, commodity sales for other manufacturers of branded turkey and export
- Processing facilities operate in Carthage, Mo., (slaughter, de-boning and raw further processing); Ozark, Ark., (whole birds); Huntsville, Ark., (whole birds, de-boning, raw further processing, fresh tray pack, fully cooked whole birds, bone-in breast); Jonesboro, Ark., (fully cooked deli products and logs); Longmont, Colo., (fully cooked deli, sliced lunch meats, logs, hot dogs, and food service/institutional); and Mt. Olive, N.C., (whole birds, de-boning, raw further processing, fresh tray pack, ground turkey, variety of fully cooked products)
- Product mix comprises fresh, frozen and cooked whole turkeys, turkey breast meat, turkey sausage and bacon, lunchmeats, deli products and turkey strips. Other products include a line of fresh ground turkey, seasoned ground turkey, patties, sausages, breakfast links, tenders and deli meats. Frozen items include meatballs, fully cooked flavored strips and roast-in-bag breasts, both bone-in and boneless.

This process heats the external face of the sealed-in-bag fully cooked turkey breast to eliminate potential microbiological issues.

Photo courtesy of Butterball

"We're looking at ways to improve facilities and make them more functional and efficient."

To that end, Butterball has made recent improvements to all plants.

In Carthage, live-dock modifications focused on employee ergonomics and improved live-bird handling.

In Longmont, a new slicing line for lunchmeats with updated packaging featured zipper seals for variety-pack products. Also, a post-packaging process for the foodservice line was added here for surface sterilization prior to bagging. The same process was added in the Jonesboro, Ark., plant.

The Huntsville, Ark., facility was upgraded by adding a cook-in-bag line for boneless roast and bone-in breasts. An automatic carcass removal system was also added.

The Ozark plant was revamped to improve efficiency and yields with a reconfigured grading chain so that birds travel shorter distances in the process.

The Mount Olive plant recently completed an expansion and renovation of the fresh tray pack area to include ground turkey, turkey burgers, dinner sausage, breakfast links, cutlets, bone-in parts, among others.

SANDERSON FARMS

Sanderson Farms Inc., the 61-year-old agribusiness that started as a farm-supply enterprise in 1947, today stands as the fourth-largest U.S. poultry producer boasting annual sales of more than $1.47 billion. Based in Laurel, Miss., the company incorporated in 1955 as a fully integrated poultry processing company to produce, process, market and distribute fresh and frozen chicken. The company went public in 1987.

"The environmental, food-safety, employee-welfare and animal-welfare aspects of [the] business are critical," notes Bob Billingsley, Sanderson Farms' director of development and engineering.

Safe and efficiently operated facilities are also important.

"We built new facilities, employing the latest technology and have been successful in this and managing environmental responsibility and cost," Billingsley confirms. "We can do both in a competitive manner and have been able to address food safety, environmental issues and sanitation concerns."

Sanderson Farms operates processing plants in Texas at Waco and Bryan, Hammond, La.; in Mississippi at Laurel, Hazlehurst, Collins and McComb; Moultrie, Ga.; and a further-processing facility in Jackson, Miss.

"Sanderson Farms is the only poultry company that

Continued on page PTJ-10

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Photo courtesy of Sanderson Farms

has built new plants in the last five years," Billingsley emphasizes, adding that since 1996 the company has spent $320 million on new assets.

The company's 10,000 employees and 650 independent growers of broilers contribute to its weekly production involving 8.125 million chickens.

The manufacturing process includes scalding, picking and evisceration.

"Based on our bird sizes and line speeds, we match processes up for maximum yield to be a low-cost producer," Billingsley reports. "We look at all the processes to maintain a competitive advantage — from quality, yield and cost standpoints. We won't provide details on specific equipment, but consistency is important to us in terms of types of equipment and the processes used."

Employee comfort and safety receive major attention and, to that end, Sanderson Farms pays special attention to ergonomics to prevent employee injuries and fatigue. Other employee-safety measures include glazed wall tiles and floor treatment rendering floors slip resistant. Work-place comfort is enhanced by dehumidification to control plant temperature levels.

"We monitor our food-safety processes continuously to ensure maximum results as it relates to *Salmonella*," Billingsley says. "We consider all processes, but obviously once the birds are received we always ensure that we maintain the highest standards concerning animal welfare. Our corporate culture is in the attention to details. We gather data, analyze data and ensure that customers receive the highest quality products in the industry."

SIMMONS FOODS

In 1949, M. H. "Bill" Simmons and Frank Pluss established Simmons Foods — originally known as Pluss Poultry — in Decatur, Ark. Bill Simmons acquired Pluss' business interest in the mid 1950s.

The company was renamed Simmons Industries in the 1970s to better reflect the company's heritage. Simmons Industries purchased O'Brien Foods in 1982, to nearly double in size with processing plants across three states in Southwest City, Mo., and Jay, Okla., a feed mill in Anderson, Mo., and a hatchery in Jane, Mo.

Today Simmons is positioned among the top 10 privately held U.S. poultry processors, with more than 5,300 employees. It operates three processing facilities in Southwest City, Mo., and in Arkansas at Siloam Springs and Decatur. Additionally, the company's further-processing facilities operate in Siloam Springs and Van Buren, Arkansas.

The vertically integrated business — whose components include breeder farms, hatcheries, grow-out farms, feed mill, processing, distribution, pet food and ingredients — uses market-size birds for raw-material processing.

Simmons offers a range of custom-formulated and customer-branded packaged products. Key distribution channels include national foodservice chains, retail club stores and mass merchandisers.

Processing technology is the cornerstone of the Simmons Foods' production program. "More than 90 percent of what we do is automated," confirms David Rose, vice president of marketing. "Our plants are very clean and modern technology allows them to run efficiently."

For example, the firm's "state-of-the-industry" template slicing machines enable precise portioning of whole-muscle product. Thanks to the latest packaging technology including a sophisticated system that blast freezes cases, the company is able to ship directly to customers ready to meet their specific usage requirements. Benefits include improved product quality and reduced handling costs.

"Like any manufacturing plant, there is heavy equipment and knives and blades, which is why we have standard safety programs, a training program, signage and enforcement programs," Rose reports. Plant-floor apparel includes special gloves to prohibit cuts, ear plugs and hair nets. "GMPs [good manufacturing practices] ensure that equipment is kept clean and staff safety personnel enforce [worker safety] rules," Rose says. "All steps are equally important." **NP**

Photo by Tom Ewart

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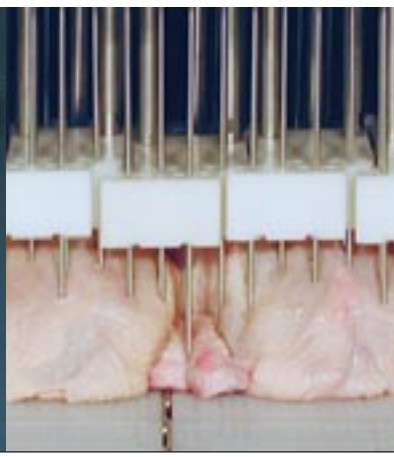

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Even the smoothest operators recognize that all equipment can't run perfectly all of the time. Experienced poultry processors understand that engaging suppliers in both response-based and preventive service plans can save a plant costly downtime and optimize current running time and performance.

Plants that run systems from JBT FoodTech (formerly FMC FoodTech), encompassing brands like Stein, DSI, Northfield and Frigoscandia, also know that service and aftermarket parts professionals are available 24 hours a day, seven days a week, through a simple phone call or email. "JBT FoodTech doesn't have any downtime in our service because our goal is to help customers realize the best productivity and cost of ownership that they can from our processing lines," remarks Charlie Rogers, director of customer services for JBT FoodTech. "Our services help customers improve uptime, yield, maintenance cost, safety, product quality, reliability and rework costs. We're uniquely positioned to do that because we offer a toolbox of service and products, from direct access to spare parts inventory and skilled technicians to upgrade kits that can take original equipment to the next level."

While the service and parts team at JBT FoodTech are ready to help 24/7, consultations are frequently done on a one-on-one basis. According to Rogers, the company has provided comprehensive advice at nearly 30 customer sites in the past two years, at no cost to the customer. Rogers, can cite several examples of how JBT FoodTech has answered the call from customers at virtually all times of the day. He also relates how simple changes lead to immediate and effective results. During one consultation, JBT FoodTech's technicians corrected air pressure in a freezer's ADF, boosting productivity by four hours. Elsewhere, a JBT FoodTech professional adjusted blow-off tubes in breaders and batter applicators, improving product pickups by one to three percent.

JBT FoodTech can also save poultry processors valuable time and hence, money, by supplying upgrade kits to original equipment.

Many JBT FoodTech customers take advantage of the company's Service Inspection Agreement, a preventative maintenance program designed to maximize equipment uptime by checking the critical components that may lead to an unscheduled breakdown. On average, according to Rogers, customers protected by a Service Inspection Agreement are 40 percent less likely to suffer equipment breakdowns than customers without the agreement. In addition, the agreement enables processors to cut parts and service costs by five percent. Customers protected by inspection agreements can rely on a service professional to be at a plant location within 24 hours of reporting a breakdown, guaranteed.

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POULTRY TECHNOLOGY 101

PART THREE: PRODUCTION BASICS

Overview

In modern times, the journey from live birds to processed poultry involves abundant capital investments in new technologies and a payroll compensating millions of workers in the industrial supply chain. This is basic economics for the poultry industry operating as a highly commercialized venture for killing, dressing, eviscerating, cutting up, packaging and transporting chicken and turkeys that ensure a constant supply of fresh, ready-to-cook and fully cooked products, among other options, to satisfy the global marketplace.

As a vertically integrated business, the poultry industry is about genetic research, breeding, hatching, rearing, ingredient procurement, feed transportation and delivery services. Independent farmers working under contract with U.S. integrated chicken and turkey production and processing operations produce the majority of meat from these birds raised for human consumption.

"We are committed to the humane production of wholesome food products and thus have a strong relationship with contract growers," notes Joe Nalley, chief operating officer, Butterball LLC. "Our field service crew works with contract growers to advise them on bird care with an emphasis on safety, including keeping birds as calm as possible."

Aside from predictable operating issues related to commodity pricing, among other business expenses, current challenges impacting production success include food-safety and worker-safety issues, animal health and welfare, pollution and environmental concerns and biofuel as an energy alternative. Poultry processing byproduct such as feedstock material (primarily unrefined and waste oil) is among the targeted raw material suitable for biofuel conversion.

Processing equipment

Commercial poultry processing plants are outfitted with overhead tracks powered by belt chains moving at controlled speeds for shackling suspended birds. Other equipment includes automatic stunner, automated killing systems, scalder, picker, hock picker, automatic hock cutter, outside bird washer, eviscerating trough, oil sac cutter, opening cut machine, automatic lung remover, automatic neck breaker, combination washer, automatic head cutter and neck skin cutter, automatic continuous chill system, continuous giblet chiller, automatic giblet wrapper, automatic sizing system and automatic cutup machines. This equipment allows poultry processors to process several thousand birds per hour with a single system of machines.

The process

Poultry plants are designed for optimum processing flow including a hilltop construction allowing gravity to pull wastewater and byproducts to treatment systems beneath production floors.

Flexibility is the cornerstone of versatile processing operations with mixed processing production programs that progressed from generic whole birds to outputs of deboned poultry, tray-pack and further-processed products. Consider that a single poultry plant can annually produce millions of pounds of cooked chicken strips, whole-muscle products, formed chicken products, mini corn dogs and pizza toppings. Butterball processes turkeys weighing between 10 pounds and 40 pounds, thus plants are set up on an individual basis.

"Every plant is its own entity, so they are all different," Nalley confirms. "Because there are so many types of plants, there are many types of equipment in them."

Before processing begins, shackled birds are stunned then moved to the slaughter phase. Stunning methods include immobilization by inhaling carbon dioxide (chemical stunning), sending a sufficient electrical current through the brain (electrical stunning) and stunning birds before they leave transporting trucks (controlled atmosphere stunning), which exposes birds to less human handling. Meat quality is improved with little or no blood spots evident in finished products using controlled atmosphere stunning.

Once feathers are removed, birds travel through a hot-water bath (scalder) that runs in the opposite direction of its natural water flow to ensure that they exit where water is cleanest. Birds are picked cleaned using automation along with manual labor in some cases involving separate pickers for necks and hocks — an extra measuring ensuring product quality.

After defeathering, birds follow a charted path beginning with mechanical evisceration and ending at final wash stations. Along the way, birds are subjected to several washes in chlorinated water to reduce bacteria counts. A critical step in the process involves live-bird testing in line with pathogen-reduction efforts.

"We have an aggressive testing program whereby we constantly test all plants completely including floors, walls, ceiling and drains," Nalley confirms. "This is to make sure the sanitation process is doing the job it is supposed to."

Worker safety is another priority as Roger Wellman, director of marketing, Cooper Farms, explains. "Designing work stations to reduce stress on our team

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POULTRY TECHNOLOGY 101

members in turn reduces the chance of a less-than-desirable impact on our products," he says. "We encourage team-member involvement when changes are made, which creates ownership and has a positive effect on food safety."

Mississippi-based Sanderson Farms also concentrates on employee comfort by creating ideal temperatures in processing facilities through dehumidification, among other initiatives. "We are always looking for ways to improve the condition of our employees' work [environment] ergonomically to ensure their safety," reports Bob Billingsley, director of development and engineering.

Other poultry-processing systems are also available to support product quality, grade, yield, cost and productivity — including building size, spacing of equipment, line placement and stops.

"We match processes up for maximum yield based on our bird sizes and line speeds to be a low-cost producer," Billingsley says. "We look at all of the processes to maintain a competitive advantage, from quality, yield and cost standpoints. Consistency is important to us in terms of types of equipment and the processes used. The best way to manage our business is to maintain consistency in our processes and do that from plant to plant."

Food safety, worker safety and animal handling

To be sure, processing precision is the name of the game — and food safety is the end goal buttressed by worker-safety and environmental-protection initiatives. There is no question that a strong food-security program is the key to a solid foundation coupled with a comprehensive quality-inspection system for raw materials.

"Food safety is a key factor in designing plants and in materials used for construction and design," Nalley emphasizes. "When we purchase processing equipment, cleanability is a big factor."

Concerning ready-to-eat [RTE] product, Nalley reiterates that the key is pathogen prevention. "We segregate raw areas from RTE or fully cooked areas of plants with separate lockers, lunch rooms and entrances for workers," he explains. "A monitoring process is critical for the RTE side. We monitor sanitation and GMPs [good manufacturing practices] constantly. Our new pasteurization practice ensures maximum food safety and shelf life."

Once the raw material arrives at the plant, ensuing steps must be executed with precision to efficiently move the process down the line.

"When they arrive, birds go through a rigorous inspection program to make sure specs are met," Nalley says. "We make sure our specifications are in the hands of our suppliers, including bird age and the temperature of products. A zero defects attitude is our mentality, and we monitor and measure to make sure we are achieving this. We focus on our process control, and all facilities have a team of monitors that perform a variety of checks on every step to make sure things are done right."

Coping with operating challenges

It's one thing to have dream machines and a skilled workforce to execute innovative product manufacturing programs. Product manufacture does not happen in a vacuum, however, and that is the rub. These days processing company executives must not only keep their eye on the ball concerning production efficiency, so to speak, they must keep both eyes on challenging market forces. Major challenges these days relate to the high cost of animal feed and the shrinking share of grain available to the poultry industry.

"Grain and fuel costs are leading causes of increasing expenses," confirms Ron Foster, chief executive officer, Foster Farms. "Anything related to petroleum products has become expensive."

At issue is the federal government's mandate that essentially shifts a high level of corn from feed to the nation's fuel supply via its Renewable Fuel Standard. This is burdensome to the industry since corn is the major ingredient in poultry feed. Moreover, higher feed costs push food prices higher.

A Butterball plant stopped shipping turkeys under the economic strains triggered by high grain prices. "It was a direct result of this [ethanol]," Nalley reports. "This also relates to other issues impacting the industry. All protein markets have overproduced over the last few years. This has caused market prices to decrease. The selling price of our products has not matched that due to the oversupply of meat. The situation will work itself out, but this is a challenging time for food processors."

Poultry Facts

- Classifications of chickens and turkeys primarily relate to size, weight and bird age when processed. Birds are produced to meet requirements specific customers including retail food stores, fast-food chains and institutions. Poultry is a domesticated fowl raised for meat and/or eggs.
- Turkey hens are processed and usually sold as whole birds, while toms are further-processed into products such as cutlets, tenderloins, turkey sausage, turkey franks and turkey deli meats. The hen usually takes 14 weeks and weighs 15.3 pounds when processed compared to toms, which take 18 weeks to reach a market weight of 33 pounds.
- The live weight of broilers (chickens raised specifically for meat products) has trended upward from 4.79 pounds to an average of 5.37 pounds since 1996. Broilers for deboning are usually five-to-six-pound males between 47 and 56 days old. This deboned meat can be used for nuggets, patties, strips and other boneless product. Broiler roasters are hens weighing five-to-six pounds and generally are 55 days old. Heavy young broiler roasters are six-to-eight-pounds and are sold fresh or frozen as whole or parts and generally are 10 weeks old.

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Jonathan Holmes, Georgia Tech research engineer and project director, is spearheading a high-pressure robotic wash-down initiative for fresh meat and poultry tray-pack product.
Photo courtesy of Georgia Tech

PART FOUR: POULTRY INDUSTRY INNOVATIONS

Emerging technology promises to deliver new tools and improve existing devices designed to reduce labor requirements, operating costs and increase processing efficiency.

Although the poultry industry has been in the forefront concerning innovations that improve processing operations, opportunities exist for further improvements. Chief among them being innovations that address challenges related to employee recruitment and retention.

The poultry industry continues to be labor intensive by design and necessity due to certain complex production programs. Conventional automation, moreover, may not always provide solutions for certain poultry-industry jobs such as feeding and transferring between lines and machines; getting product into trays, boxes, cases and on pallets; deboning and continuously inspecting products.

The range of automated devices over time include pickers, immersion chillers, eviscerators, cut-up machines, freezers, continuous cookers and machines for weighing, pricing and labeling.

Notably, advancement in technology went into overdrive after World War II with poultry processors among the agribusiness leaders. The commercial poultry industry emerged in the 1940s, thanks to the

Continued on page PTJ-20

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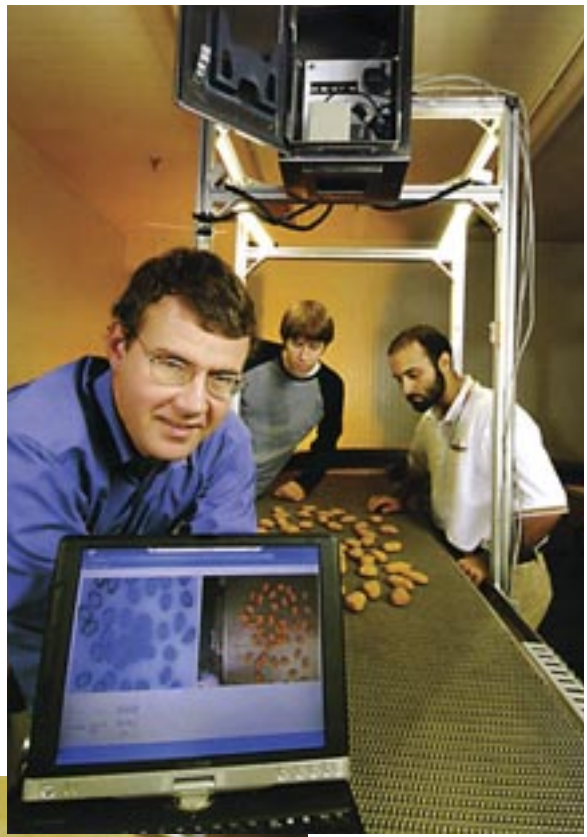
earlier development of broilers (chickens raised specifically for meat) coupled with the U.S. government's approval of on-line evisceration in 1942.

Previously, poultry meat typically came from older hens and young roosters that were byproducts of raising chickens for egg laying. Allowing birds to range in barnyards hardened their muscle fiber, yielding meat that was dry and strongly flavored. Much of the supply in some seasons were birds stored frozen as "New York dressed," meaning bled, plucked but with head, feet and organs intact. The condition of these birds was distasteful to consumers and commercial handlers triggering a change in operating practices involving improved processing standards including in-plant evisceration and cleaner carcasses. Although many processing plants had voluntarily participated in a USDA inspection program for wholesomeness since 1926, federal inspection of broilers became mandatory in 1959. Notably, online evisceration increased the industry's labor pool dramatically.

Poultry-industry processors continue to build their businesses by following operating strategies that focus on food-safety measures and production efficiencies. Research and development programs on the part of industry, the commercial realm and institutions such as the Georgia Tech Research Institute (GTRI) deliver better and better tools and operating aids.



John Stewart, senior research engineer, and Georgia Tech students Michael Matthews and James Lentini see infrared computer vision as the futuristic approach to safer, tastier and less-costly meat products.
Photo courtesy of Georgia Tech

The industry has been incredibly adaptive in getting the most out of the technology available and has done a fantastic job, which has resulted in increases in production and yield, confirms J. Craig Wyvill, chief, (GTRI) Food Processing Division.

"To take it [technology] to the next level and squeeze out the next percentage points of yield we need a new system and that's what we're trying develop," he adds.

The Agricultural Technology Research Program (ATRP), under the auspices of GTRI, has delivered more than three decades of research and development projects to assist the poultry industry in developing new technologies and adapting existing ones for specialized industrial needs.

ATRP worked for a number of years on developing a sensor for biosensors. "This is still in development, as we are refining electronics andsurface chemistries," Wyvill reports. "We are testing that platform on a couple of fronts, including the USDA with bird flu and measuring chemical compounds used for disinfection."

ATRP's goal is to improve productivity, reduce costs and enhance safety and health through technological innovations. Research focuses on immediate- and long-term industrial needs ranging from advanced robotic systems to improved waste-water treatment technologies to machine-vision grading and rapid microbial detection.

"We have tests for compounds and chillers that will have a strong commercial potential," Wyvill says. "Still, going from the conceptual ideal to field test to

Continued on page PTJ-22

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commercialization is a lengthy process. Some efforts date back 10-12 years. The key is to sustain our research in these areas."

There has been a slow evolution picking up steam in terms of closed-loop-control concepts, Wyvill notes. "In the past, lots of processes were open loop with humans involved in adjusting processes. In this case, processes cannot change quickly," he explains. "Closer control was popular in the late '80s or early '90s, where cuts were adjusted to each product. This reduced waste and controlled the process better than open loop."

Innovations with imaging and inline sensors are now available. "We know what's going on online and can make dynamic adjustments," Wyvill says. "Close loop management is just now hitting the poultry industry. We couldn't bring on high-tech systems right out of the chute because they weren't available; but now they are."

ATRP engineers provide technical assistance at no charge to members of the Georgia poultry industry. Assistance ranges from addressing simple inquiries to extensive on-site consultations whereby researchers analyze problems and provide a full report of findings and recommendations.

"We have had strong programs in imaging with computer visioning and robotics," reports Wyvill, an expert in poultry processing and production trends. "We are coming out with imaging cells licensed commercially and used for online control processes. The older one was for kill-line screening, but more recently portion management screening [is available], which is still in negotiation."

Georgia Tech researchers have been able to build on foundation breakthroughs on solid state lighting and digital camera technology. "This has sustained us in bringing out a range of systems," Wyvill says. "We are working on disinfection and recycling technology on other fronts. This is a mixing concept so we can introduce disinfection by light or other sources in a more predictable fashion. We are investing long term in technology where we can spin off different systems."

Georgia Tech's wash-down-ready robot is designed to deliver the speed and performance for current processing throughput requirements.
Photo courtesy of Georgia Tech

Thermal cells for cooking operations and 3-D imaging are also part of research initiatives. As Wyvill notes, many fully cooked products are probably overcooked by 10°F to 20°F due to inadequate oven-control technology. "Cooking meat to 180 or 190 degrees can ruin its texture and make it lose its aroma, which affects taste," he says. "It is a waste of energy to cook it longer and then quickly cool it for packaging."

Given that products are sold by the pound, Wyvill says overcooking promotes moisture and weight reduction resulting in yield losses.

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Although GTRI researchers initially planned to explore the potential of this technology to help measure core product temperature, the research "fanned out" to include oven control and to provide help for technicians on the production line. "The technology is fueling opportunity in cooking operations and may make microwave precooking more practical in plants," Wyvill says.

Researchers currently are developing a robot that can handle high-pressure washdowns at high rates of speed. It can run with water and speed, taking routine washdowns like any other machinery. This has had an influence on commodity products.

Jonathan Holmes, research engineer and project director, is spearheading the effort to build a robot capable of handling high-pressure washdowns while also delivering ideal speeds and performance to meet current processing throughput requirements.

The initial prototype is currently in the testing phase in collaboration with ATRP's industrial partner, an Atlanta-based supplier of high-speed automation for the manufacturing and service sectors. The test robot incorporates three major improvements including a vision system capable of determining product orientation, the inclusion of a pneumatic wrist for great flexibility and the ability to work with two conveyors as opposed to the current static product surface.

To establish requirements for operating in a washdown environment, researchers reviewed cleaning procedures of processing plants determining a robot's components should withstand high-pressure washing up to 600 psi and high-temperature washing up to 140°F, and be able to handle a combination of nitric and phosphoric acid, quaternary ammonium complex, sodium hydroxide solutions and general foaming cleaners.

"Depending on the results of this testing, which will be finished in the January/February [2009] time frame, it is feasible a machine could be introduced to the market six months after that, based on interest," Holmes says. "We have received a great deal of positive feedback from the industry, but with that comes a lot of skepticism. A truly washdown-capable machine is difficult to design and operate in this environment."

Adding more electronics and axes of motion, as is done with most robotic systems, introduces another level of complexity that is susceptible to damage from this environment, Holmes explains. "If you have spoken to many industry staff that are involved in the introduction of new machines, you will see that they all want to see it to believe it," Holmes concludes. "They recognize this could be a great improvement to current processes if more robust washdown-robotic solutions were available."

Other initiatives include an optical sensor for chlorine detection in poultry chiller water, a non-robotic system for rehanging birds exiting an immersion chiller onto a transfer shackle line, "smart" deboning systems, an infrared computer vision system to measure core temperature in meat products, and a biosensor to detect avian influenza.

"Smart" deboning systems are designed to further automate the deboning process by employing a 3-degree-of-freedom device capable of adapting to internal bird anatomy while compensating for any body shape changes.

Gary McMurray, senior research engineer and robotics and automation systems group leader at GTRI, says the main benefits provided by the "smart" deboning system are product yield and improved

More Georgia Tech Research Institute projects

Optical sensor for chlorine detection: This technology provides near real-time information on chiller killing power enabling poultry processors to more dynamically track and control chiller management. The sensor, which uses an interferometric measurement principle previously developed by Georgia Tech researchers, can detect chemical and biological species. It is fast, has high sensitivity and provides a direct measurement with no additional steps or consumable reagents.

Non-robotic chiller rehang system: This concept is designed to automate this task making it a tightly integrated function combining grading and weighing. The system incorporates a funnel conveyor, pneumatic orientation stations, a vision system and a hanging box for shackling. Birds moving through the system are oriented in each successive step until all exit in the same position and orientation prior to being hung on a moving shackle line.

Infrared computer vision: This technology measures the core temperature to prevent the harmful effects of undercooking while minimizing the chance to overcook product, especially ready-to-eat meat. Researchers discovered that some product had lower surface temperatures than the bulk of product during the imaging trial process. Cold areas were caused by ruptures in the outer casing. Notably, this technology may also make microwave precooking application more practical in plants. An algorithm analyzes data allowing the system to adjust microwave oven cooking as needed, which is more difficult in conventional ovens.

For more information search online at http://www.atrp.gataech.edu

quality. "This can eliminate bone chips and improve yield by doing certain types of cuts," he explains. "Yield is a big issue in this industry. Lost value per plant is $10 million, so there is a sizable amount of money left on the table due to bone loss. There are worker-safety issues, as well."

McMurray and his team are still in the prototype and lab-testing phase of deboning systems, which involves developing vision algorithms in terms of size of birds and the location of bones and ligaments. "We are testing control algorithms to detect when we're cutting meat, tendons and bones," he says. "If we are cutting tendons, the machine will stop cutting and adjust its path so it's not cutting into bone. Right now, we are focused on cutting through the shoulder and avoiding bones so we don't generate bone chips or fragments. When we cut from the clavicle to the shoulder we impact meat's yield. When we cut along the scapula bone, that also affects yield and can generate bone fragments. We've already demonstrated the ability to cut along the scapula bone without generating loss of yield or bone chips, but can't quantify benefits yet because the system is not put together. We want to get to this at some point."

The team plans to start wrapping up lab tests within the next year and then build prototype systems to conduct more realistic tests in the field. "Ultimately, we would like to incorporate what we have on someone else's machine," McMurray says. "We want to help with what they [poultry industry firms] already have, using relatively fine motions of between 20 and 30 mm. We don't need a $100,000 robot arm to do this. This is the future of food processing. The number-one challenge is different bird sizes. We can sort birds according to weight but can't sort birds to do fixed cut or have everything at the same point. We're trying to bring vision systems to give us an estimate of the size of birds and estimate internal anatomies. Then we can rely on sensors and high-speed control to adjust to particularities of each bird. When birds are placed on cones, they won't sit the same. A bird will be slightly inclined and rotated, which adds to the variability as to where cuts are supposed to be. If we try to deal with the current fixed system, we run into plateaus of yield and it's gotten to that point." **NP**

POULTRY TECHNOLOGY 101

PART FIVE: REGULATORY UPDATE

BY MICHAEL RYBOLT, DIRECTOR, SCIENTIFIC AND REGULATORY AFFAIRS, NATIONAL TURKEY FEDERATION

With the increased cost of producing poultry products, processing plants face the challenge of remaining profitable. Poultry companies are not only seeking means to reduce input costs, such as alternative feed ingredients but are also working to ensure regulatory compliance is maintained to avoid unnecessary costs. Maintaining compliance requires establishments to stay abreast of regulatory challenges. While the 2008 election is over, it is more important than ever that the industry understands the regulatory environment and addresses any changes that may come with the new leadership on Capitol Hill and at the White House.

Meat and Poultry Inspection

The meat and poultry industry has operated under the science-based inspection program, HACCP (Hazard Analysis and Critical Control Point), since 1998. This program affords the industry the ability to develop and modify its food-safety programs as new science and technology emerges.

As the Food Safety and Inspection Service (FSIS) continues to move toward a modern risk-based system, the industry should work to ensure that the government and industry focus on the 2004 Office of Food Safety document, "Fulfilling the Vision: Initiatives in Protecting Public Health."

FSIS has developed various initiatives to accomplish its goal of protecting public health. It began withRisk-based Inspection (RBI) for processing and then moved to its *Salmonella* Initiative Program (SIP), which is directly applicable to poultry operations. A third project proposed by FSIS was the risk-based inspection for slaughter, known as Public Health-Based Slaughter Inspection System (PHBSIS). Both RBI processing and PHBSIS are the operational components of the new inspection system; while SIP is merely a data gathering program designed to support PHBSIS. Each of these programs will feed data into and will be supported by an upgraded database of the Public Health Information System (PHIS).

Salmonella Initiative Program (SIP)

In February 2006, FSIS published SIP and outlined how the incidence of *Salmonella* on poultry

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Biography: Michael Rybolt

As Director of Scientific and Regulatory Affairs for the National Turkey Federation, Rybolt represents the turkey industry to government agencies such as USDA, FDA, EPA, and DOL. He also facilitates the Federation's Technical and Regulatory, Live Production, Turkey Health and Welfare, and Worker Safety and Health Committees.

Rybolt holds a doctorate of philosophy in veterinary medical science with an emphasis in food safety from Mississippi State University (MSU) College of Veterinary Medicine.

He received his BS in microbiology from the College of Arts and Sciences at MSU. His undergraduate experience included a stint in a poultry parasitology laboratory studying Eimeria spp. in both broilers and turkeys, as well as various aquatic parasitic species.

He has been involved in various research projects focusing on pre-harvest food safety risk factors, as well as examining the ability of several *Salmonella* isolation and identification methods including rapid techniques.

Rybolt is a member of the International Association of Food Protection, Poultry Science Association, United States Animal Health Association and Gamma Sigma Delta.

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products will be addressed. SIP was developed to encourage poultry processors to further reduce the level of *Salmonella* on poultry products. As part of the program, FSIS is notifying establishments of its sample results immediately, rather than waiting for the entire *Salmonella* set to be completed. FSIS is also collecting samples from turkey slaughter establishments for whole turkey carcasses. The most significant components of the initiative are the categorization of establishments based on the incidence of *Salmonella* on products, posting establishments' categories on the Web and allowing establishments demonstrating *Salmonella* reductions to operate under regulatory waivers, coupled with additional testing by the establishment.

Categorization of Establishments

Arguably the most important component of the initiative is FSIS' categorization of establishments based on regulatory sample set results:

Category 1: the establishment has maintained less than half the *Salmonella* Performance Standard for the last two sample sets;

Category 2: the establishment has maintained less than the *Salmonella* Performance Standard at a level exceeding 50 percent of the standard; and

Category 3: the establishment is not maintaining the *Salmonella* Performance Standard

FSIS allocates resources depending on the category of an establishment. If an establishment is Category 2 or 3, FSIS considers it higher risk and the agency will schedule follow-up sampling more frequently as well as subjecting it to a comprehensive Food Safety Assessment (FSA) to evaluate the design of the effectiveness of the overall system. Conversely, FSIS would consider an establishment in Category 1 to have demonstrated "consistent process control" and would subject it to regulatory sample testing at least once every two years, but no more than once per year.

FSIS Web site posting

FSIS now posts establishments' categorization results on its Web site, if 90 percent of the industry is not in Category 1. After determining the

This conveyor system handles more than 25,000 cases of product daily with minimal human handling.
Photo courtesy of Butterball

percentage of establishments in a product class (i.e. broiler carcasses) in each of the three categories, FSIS will post those establishments in Category 2 and 3 by name, plant number and location on its Web site. FSIS contends that the consumer should know the *Salmonella* results of those plants that it deems to not have control over *Salmonella* in its products.

Incentives-Based Inspection

FSIS has begun accepting establishments opting to operate under the incentives-based SIP. Under SIP, any establishment that would like to operate with a waiver to any current regulation, such as alternatives to the time-temperature-chilling requirements for poultry, can do so if it is under *Salmonella* Category 1, increases testing programs, incorporates *Campylobacter* protocols, and shares data with the agency. FSIS decided that any establishment currently operating under a regulatory waiver (i.e. on-line reprocessing, HIMP (Hazard-based Inspection Model Project), time-temperature, etc.) would be required to comply with SIP or phase out its regulatory waivers.

Risk-Based Inspection

Concerning RBI, the agency will direct its resources towards establishments with greater need based on the plants level of inspection (LOI). The level of inspection is determined by a host of factors including results of any regulatory microbiological testing, any product recalls or regulatory enforcement actions, *Salmonella* categorization or non-compliance reports. LOI 1 is considered the status quo and therefore will experience normal inspection. Those establishments placed in LOI 2 will have increased inspection oversight and LOI 3 plants, perceived as the highest-risk plants, will enjoy more in-depth inspection including FSAs.

Public Health Based Slaughter Inspection (PHBSIS)

PHBSIS is much like RBI processing, however it focuses on slaughter rather than processing. PHBSIS is essentially SIP with additional requirements and regulatory challenges. PHBSIS is expected to

Continued on page PTJ-30

POULTRY TECHNOLOGY 101

Polar tumbling (binding together whole pieces of breast meat) produces material (tacking and cold) to aid fabrication and cooking processes in yielding a whole-muscle appearance with ideal slicing qualities.
Photo courtesy of Butterball

incorporate new regulatory performance standards besides *Salmonella*. These include standards (or guidance) for *Campylobacter* and generic *E. coli* at different points within the slaughter process.

To formally begin PHBSIS, FSIS will be required to produce a proposed rule that will need to undergo the traditional notice-and-comment rulemaking process. However, FSIS has begun portions of the PHBSIS through SIP, without the specific performance standards, by collecting data that will be used to support moving forward with PHBSIS.

PHBSIS will utilize a mathematical algorithm to assess the risk of an establishment to public health. The risk and the other supporting information about the establishment will provide the ability to assess the inspection needs for each specific establishment. This will all be supported through the efforts of FSIS' redevelopment and implementation of its Public Health Information System.

Public Health Information System (PHIS)

To support moving toward a more risk-based inspection system, FSIS will soon roll out its new PHIS system comprised of four primary components: domestic inspection, imports, exports and predictive analytics. Each of these components will, when coupled together, direct FSIS inspection resources based on risk. The data generated by FSIS and other public health agencies will be incorporated into PHIS and the predictive analytics component will perform analysis that will assist in focusing inspection activities.

Predictive analytics is the most critical of the four components — essentially the "brains" of PHIS. As an automated system, this component can evaluate available data and identify trends or anomalies in real-time. Findings provide feedback to incorporate into the other three components, resulting in more focused inspection activities. For example, within the domestic inspection component, if a trend or anomaly is associated with a specific establishment, the domestic inspection component may schedule a food-safety assessment at that facility. Further, predictive analytics contain self-learning algorithms that can analyze data and create models to detect patterns in disparate data. In other words, FSIS will no longer have to rely on their employees to find trends in the data; the computer will find them on a real-time basis allowing for a faster response time by FSIS employees.

With regard to the other three components of PHIS, the domestic inspection portion will provide automated laboratory-sample schedules, secure Web-based data entry, synchronization of various information warehouses, as well as electronically capturing food-safety assessment report findings. The import component will streamline the procedures for importing FSIS regulated products into the United States. The export component will verify that exported products are in compliance with country-specific requirements and standardize the export certification process.

In conclusion, all of the initiatives are currently in either developmental stages or are underway. Regardless of the status of these initiatives, the poultry industry can only stand to benefit if it knows and understands where FSIS currently stands as it prepares for future food-safety inspection regulations under the next administration. **NP**

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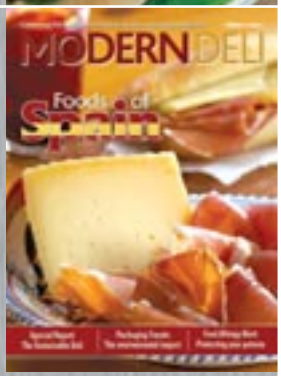
Neither does Lightsey discount the value of his company's partnership with Weber. "Weber's **responsive support** and fast answers have helped us satisfy customers with timely delivery, as well as good-looking products. "I joke with Weber that my headcheese is so good looking now, our customers are going to think I'm sending product out to be sliced."



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Pinpoint where the potential is.

Take yield management and productivity to new heights and deliver more profits to your bottom line! With the new YieldPlus™ system from Gainco, you'll maximize yield while measuring individual operator performance with pinpoint accuracy.

- Reduced labor – **up to 25% fewer operators.**
- Improved product yield – **typically 3% or more.**
- The ability to **accurately measure performance at the operator level.**
- Built-in QC workstation means better product quality and throughput.
- Real-time management reporting.

We'll design your system to meet the precise needs of your plant – **with all components completely engineered and built in the USA.** Better yet, it'll pay for itself in less than one year! To learn more, call **800-467-2828** or go to **www.GaincoYieldPlus.com.**

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