AGRICULTURAL TECHNOLOGY RESEARCH PROGRAM

OUR VISION

TO DRIVE TRANSFORMATIONAL INNOVATION IN ADVANCED TECHNOLOGIES FOR POULTRY, AGribUSINESS, AND FOOD PROCESSING

FY 2016 PROJECT COLLABORATORS

Industrial collaborators support research projects by providing industry expertise and access to facilities for data collection and systems testing and contributing in-kind and cash support on an as needed basis. Academic partners collaborate with research teams by providing cross-disciplinary expertise and experience as well as access to university research facilities.

- American Proteins
- Auburn University
  - Department of Poultry Science
- City of Atlanta Department of Watershed Management
- DAR PRO
- Enviro Tech Chemical Services
- Environmental Treatment Systems
- Fieldale Farms
- Gainco
- Georgia Institute of Technology
  - School of Earth and Atmospheric Sciences
  - School of Electrical and Computer Engineering
- Harrison Poultry
- Highland Refrigeration
- KWJ Engineering
- Mar-Jac Poultry
- Neogen
- Perdue Farms
- Safe Foods
- Southern Company Services
- University of Georgia
  - Department of Poultry Science
- USDA-ARS Richard B. Russell Research Center

FY 2016 TECHNICAL ASSISTANCE

ATRP staff provided 32 technical assists to companies and individuals in the poultry industry across the state. These assists included simple inquiries regarding information or help needed to address a problem and extensive on-site consultations in which researchers collected data and provided a full report on their findings and recommendations. ATRP uses input from all assists to gauge situations calling for new research initiatives.

CATEGORIES

1 Automation
21 Environmental
2 Food Safety
3 Worker Safety
2 IT & Sensors
3 Other
Every once in a while we reach a milestone that is really worth celebrating, and this year it was the 20th Anniversary of the Poultry World exhibit at the Georgia National Fair in Perry, Georgia. After a year-long process of re-envisioning the exhibit, providing new content material, and completely updating the layout, a grand re-opening was held on October 8, 2015, to much fanfare and excitement. The resulting museum-quality exhibit is a real showpiece that the poultry industry and broader agriculture programs in Georgia can be very proud of. It is the result of the diligent efforts of many industry supporters, several state universities, and of course, the Georgia Poultry Federation. If you have never been, I invite you to visit the exhibit. It is held at the fair each year during the first part of October.

In addition to our outreach programs, the dedicated research activities in ATRP continued to show significant progress, with nine exploratory projects and eight full-scale research projects generating more than 40 publications and presentations, two invention disclosures, three patent applications and/or patents, and three technologies transitioning to commercial use. Many of these efforts were in collaboration with industry partners and researchers from other institutions including the University of Georgia. We sincerely appreciate these partnerships that enable us to jointly pursue new ideas and push research boundaries that we could not do individually. It is a key part of what allows us to fulfill our vision of “driving transformational innovation in advanced technologies for poultry, agribusiness, and food processing.”

It is with great pride that I share these accomplishments in this 2016 Annual Report, and hope you enjoy reading it. And, as always, I welcome you to join us as we continue to look forward to new technology frontiers that will enable us to collectively ensure the future viability of our industry.
FULL-SCALE RESEARCH PROJECTS

INTELLIGENT CUTTING AND DEBONING SYSTEM
Researchers created hardware and software upgrades to begin the transition of the prototype system into a commercial-ready product. The upgraded system successfully performed multiple successive automated bird shoulder cuts on a moving cone line. That milestone allowed the research team to seek out a commercialization partner.

NOVEL SEPARATION TECHNOLOGIES FOR POULTRY PROCESSING LIQUID STREAMS
Researchers constructed a scaled-up dynamic filtration system prototype to establish the design considerations needed for widely deploying the technology. Activities included studying the pressure profiles at the inlet and across the device [balance of system (BOS)] to quantify throughput and operational flux rates. Future efforts will specifically establish the throughput, efficiency, and footprint for protein and fat recovery from poultry chillers along with water reuse.

LEVERAGING ANIMAL BEHAVIOR FOR ROBOT PLANNING
Having shown that manual operation of their Growout House Robot (GOHBot) had no negative effect on flocks, researchers focused on implementing autonomous navigation. In FY 2016, tests were conducted in an experimental growout house that simulated the capacity of a commercial breeder production house. The GOHBot successfully completed more than 20 hours of fully autonomous operation with no robot-to-bird incidents. This could open the door for robotic handling of flock rearing and house maintenance tasks.

MONITORING BIRD WELL-BEING IN BROILER HOUSING USING AUDIO
Researchers continued to refine their Growout Monitoring System. Specifically, features using an approach called frozen dictionaries are being explored as a way to describe the rearing environment. Techniques for detecting and identifying anomalies are also being implemented. This alternate approach seeks to describe acceptable conditions and detect significant deviations. These anomalous occurrences could be used to create a well-being descriptor that could send an “action needed” alert to growout managers or potentially to provide a quantitative measure of the rearing environment.

PHOSPHORUS REMOVAL USING MAGNETIC NANOPARTICLES
Researchers developed a phosphorus removal method using functionalized magnetic nanoparticles (MNP)s. Experiments with poultry processing wastewater showed functionalized MNPs were an effective adsorbent even in the presence of other anions and organic materials like fats and proteins. This allows the MNPs to be used in a variety of wastewater treatment applications. The MNPs can also be regenerated for repeated use, helping to keep phosphorus removal costs fairly low.
ROBOTIC SENSING AND GRASPING
Researchers continued the development of dexterous grippers and utilized 3D imaging for the robotic manipulation of deformable objects. Experiments focused on bin-picking tasks while taking into consideration the motion control of real birds. The team successfully demonstrated object detection of graspable real bird wings in a random pile, as well as motion control of deformable objects with a constrained skeletal structure that were modeled as coupled articulated rigid bodies.

POULTRY SYSTEM SIMULATION MODEL
Researchers expanded their systems-based computer model to simulate power consumption associated with pumping, filtering, heating, and cooling water inside a poultry plant as well as wastewater treatment operations. Processors can use it to identify areas where power demands may be reduced. Future plans are to simulate labor requirements to pinpoint areas for better allocation. These models are in addition to the existing water usage and wastewater treatment models, which can be used to pinpoint areas for water savings and quality improvements.

ICE-WATER SLURRY FOR ENHANCED ANTIMICROBIAL ACTIVITY
Researchers continued to test the efficacy of ice slurry as an alternative chilling medium for poultry processing. In addition to its effective chilling ability, experiments revealed that the ice slurry’s texture seems to act as a scrubber along the carcasses’ skin, helping to attack and control the presence of harmful pathogens. More study is needed, but researchers believe this scrubbing phenomenon has the potential to hasten disinfection and possibly reduce the amount of chemical disinfectant needed.

EXPLORATORY RESEARCH PROJECTS

REMOVAL OF FREE FATTY ACIDS FROM RENDERED OIL
Researchers developed a method to remove free fatty acids (FFAs) from rendered oil using magnetic nanoparticles (MNPs). Experiments with samples of brown grease showed a reduction in the FFA level from an unacceptable 5% to a desired 3.6% with only a 4% weight loading of MNPs. A 10% loading further reduced the FFA level to 2.3%. The lower the FFA, the better for shelf life and oil quality.

USING FERRIC-BASED DISINFECTANTS IN FOOD PROCESSING WATERS
Researchers demonstrated the efficacy of using ferric-based compounds as antimicrobials for Salmonella and Listeria in chicken meat and fresh produce. Results showed that about a 2-log bacterial load reduction can be achieved in 30 seconds on both pathogens. Contact time and temperature had minimum impact on antimicrobial efficacy, and there was no noticeable change in food quality properties like color, texture, and taste after treatment. Researchers believe the compounds have potential as low-cost alternative antimicrobials.
ADVANCED ENRICHMENT REACTOR
Researchers refined their advanced enrichment technique for detection of pathogens in large-volume poultry processing samples. Using the technique, they were able to reduce the lag time before the start of exponential growth and subsequently increase the overall growth rate. Preliminary results with *Salmonella enterica* serovar Typhimurium outperformed the control, yielding a 37.6% shorter lag time followed by a 109.6% greater growth rate. Researchers believe these results suggest that accelerating the enrichment step for real-time detection is within reach.

ENHANCING PREDICTIVE MODELING FOR LIVESTOCK HARVESTING
Researchers evaluated the feasibility of using 3D model analysis to estimate bird weight for harvesting. The Microsoft Kinect V2 sensor was used in experimental growout houses to collect 3D data of broiler chickens over a 6-week period and breeder chickens over a 4-week period. The team compared the 3D data with manual weight measurements. Results indicated a 90% correlation, suggesting the sensor could be used in growout houses as an alternative non-contact weight estimation tool.

ON-FARM PRODUCTION AND TRANSPORTATION SYSTEM
Researchers completed a conceptual design of a mobile, on-farm poultry processing and transportation system. The system includes modules for catching, stunning, slaughtering, and shackling birds at the farm. A separate unit transports them to poultry processing plants. The system can easily move between multiple poultry houses with loading times comparable to existing industry standards. Researchers believe the concept is technically feasible and could produce savings over current production and transportation processes.

INDIVIDUAL BIRD MONITORING
Researchers created an Android smartphone Data Logger app to record data from a small, wireless EEG device. The portable device measures individual bird bio-responses and can be used to assess bird well-being during live operations. Initial tests were performed on birds at the University of Georgia; results are pending. The project is helping researchers test new techniques for live operations. It also helped them obtain a research grant from the U.S. Poultry & Egg Association to study chick euthanasia.

CORRELATIONS WITH BROILER PROCESSING CHARACTERISTICS AND GENETIC TRAITS
Researchers explored the weight and physical measures of different genetic species of broilers in an effort to determine the most efficient processing machinery design. Analyses showed correlations are stronger between various physical dimensions than with weight. Researchers believe this discovery opens up the possibility of improving processing efficiencies through the use of automation. It could also enable the use of computer-aided design and virtual reality tools to support equipment design.
GROWOUT SANITATION
Researchers studied 1,280 broilers during growout to determine the effects of water and litter quality and antibiotic use on broiler mortality and growth velocity. The broilers were divided into groups and raised under varying treatments: new or used litter, with and without chlorine-treated water, and with and without antibiotic feed. Data analysis is underway, and in addition to determining any potential linkage, researchers hope to define economically viable options for reducing or eliminating the use of prophylactic antibiotics.

MULTI-FUNCTION SENSORY SYSTEM FOR SMART POULTRY FARMING
Researchers designed a micro-sensor system aimed at measuring emissions of odor, ammonia, hydrogen sulfide, methane, and non-methane volatile levels at poultry farms with minimal interference from other sources. The prototype includes a micro detector and processor with a wireless module for real-time data collection and analysis. Samples of volatile organic compounds were successfully measured during laboratory testing with only minimal signal interference. System optimization is underway with the goal of further testing at an actual poultry farm.

TECHNOLOGY TRANSFER AND OUTREACH ACTIVITIES
Three issues of ATRP’s PoultryTech newsletter were published in FY 2016, with several articles reprinted in the trade press. The program’s Ag Robotics initiatives and Magnetic Nanoparticles research project were featured in episodes of the Georgia Farm Monitor, a weekly broadcast program of the Georgia Farm Bureau. The Intelligent Cutting and Deboning System was featured as part of a Robotics Technology article in The National Provisioner, a national magazine focused on the meat and poultry industry. Research staff also generated more than 40 articles and technical presentations, was awarded one patent, and filed two provisional patents and two invention disclosures.

ATRP helped the Georgia Poultry Federation re-design the Poultry World educational exhibit in celebration of its 20th Anniversary at the Georgia National Fair. Brand-new interactive displays highlight the poultry industry from farm to table, while other additions showcase allied industries and educational and career possibilities. ATRP co-hosted a private grand re-opening ceremony with the Federation, which was attended by several agricultural and poultry leaders, including Georgia Commissioner of Agriculture Gary Black.

ATRP also exhibited at the International Processing and Production Expo, Georgia Ag Week Kick-off Celebration, and the Georgia Poultry Federation’s Spring Meeting and annual Night of Knights fundraiser. Together with the U.S. Poultry & Egg Association, ATRP co-hosted the annual National Safety Conference for the Poultry Industry.
ADVISORY COMMITTEE

The Agricultural Technology Research Program is conducted in cooperation with the Georgia Poultry Federation with input from an external Advisory Committee consisting of representatives from leading poultry companies and allied organizations.

MEMBERS

Wally Hunter, Perdue Farms (Chair)  Ken Long, Pilgrim’s
Jonathan Green, American Proteins  Lonnie Wiggins, Pilgrim’s
Mikell Fries, Claxton Poultry  Mike Gasbarro, Prime Equipment Group
Steve Snyder, Claxton Poultry  Kirk Reis, Prime Equipment Group
Bill Crider, Coastal Meats  Greg Nichols, ProView Foods
Charlie Westbrook, Cobb-Vantress  Dwayne Holifield, Sanderson Farms
John Wright, Fieldale Farms  Lisa Blotsky, Tyson Foods
Alan Habegger, First Fresh Foods  Jared Campanella, Tyson Foods
 Humberto Hernandez, Gainco  Steve Schimweg, Tyson Foods
Carolyn Tynan, Georgia Power  Barry Vincent, Tyson Foods
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Bob Dowdy, Keystone Foods  Bryan Miller, Wayne Farms
David Sewell, Keystone Foods  Ron Rogers, Wayne Farms
Einar Einarsson, Marel-Stork Poultry Processing
Chad Ware, Marel-Stork Poultry Processing
John Weeks, Mar-Jac Poultry
Joel Williams, Mar-Jac Poultry
Keith Pritchard, Merial
Roger Huezo, Meyn Equipment
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