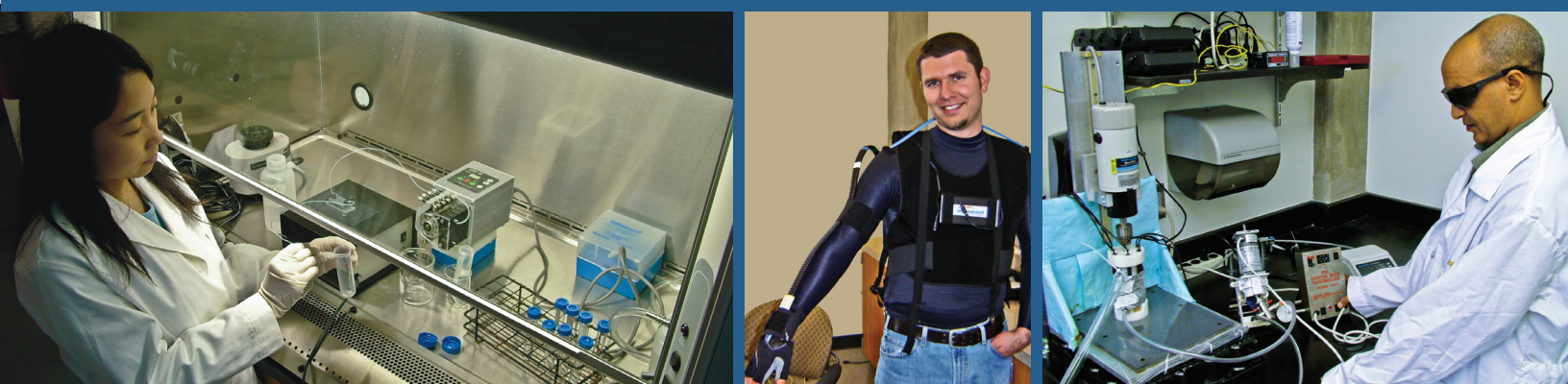
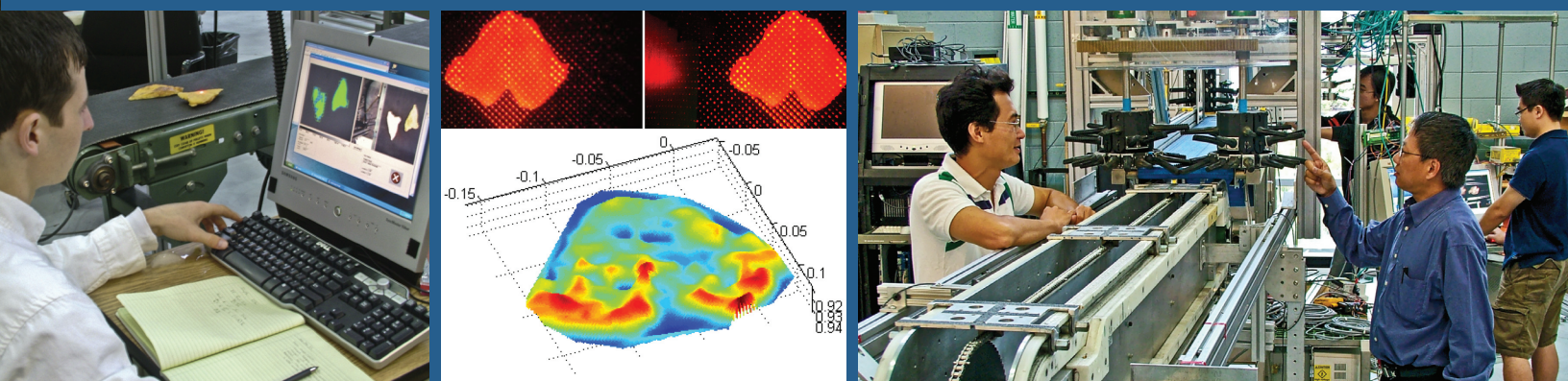


Agricultural Technology Research Program



ENGINEERING TOMORROW'S POULTRY INDUSTRY



MISSION STATEMENT

To promote the economic growth of Georgia agribusiness (especially the poultry industry) through:

- Research focused on the development of new technologies that improve productivity and efficiency;
- Exposure of students to the challenges of developing and adapting these technologies;
- Technical assistance to Georgia-based industry members with special problems;
- Release of information on emerging technologies and improved operational management through newsletters, articles, seminars, and presentations to speed ultimate commercial use.

The program is conducted in cooperation with the Georgia Poultry Federation with funding from the Georgia Legislature.

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Printer Imagers, Atlanta, Georgia

Published by

Agricultural Technology Research Program

Food Processing Technology Division

Georgia Tech Research Institute

Atlanta, Georgia 30332-0823

(404) 894-3412

(404) 894-8051 fax

<http://www.atrp.gatech.edu>

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- 8** Advanced Environmental Systems
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THE YEAR IN REVIEW

Fiscal Year 2007 was another strong year for the Agricultural Technology Research Program (ATRP) as progress was made on several priority research fronts along with a continued tradition of outreach/assistance to the industry. In addition, it saw the return of research on workplace safety, and the generation of a concept proposal for a new innovative Engineering Research Center. In all, 39 technical assists were provided to Georgia-based industry members on an “as requested” basis, more than 70 articles and technical presentations on research discoveries and emerging technology trends were produced, and 2 patents, 1 provisional patent, and 4 records of invention were generated. The program also continued its successful coordination of the National Safety Conference for the Poultry Industry.

Among its research achievements, engineers began prototyping a new “smart” deboning system design that employs onboard robotic and computer vision elements to produce higher yield and fewer bone fragments. They also constructed a first-generation, over-line, augmented reality laser projection system, and designed first-generation prototype elements for a new non-robotic shackle loading system to handle product exiting an immersion chiller. The program further helped complete a first-of-its-kind, washdown-ready, tray-packing robot prototype, which was displayed at the 2007 International Poultry Expo in Atlanta.

Enhancements were made to the stereo 3D imaging system under development, and a new multi-sensor tracking system was added to help control the grasping of birds in the Automatic Intelligent Transfer System. Performance studies were carried out on the disinfection efficiency of the Taylor vortex UV system, and design studies were undertaken to increase flow throughput. In addition, an initial chlorine sensor prototype was developed to help explore the potential of more dynamically managing disinfection compounds in poultry chillers.

The new workplace safety thrust got off to a good start when a commercial motion tracking system was found to replace goniometers used



on the old Ergonomic Work Assessment System (EWAS) design. This tracking system is currently used by the computer animation industry and provides EWAS with a much more dynamic means of measuring wrist, elbow, and shoulder movement.

On the technology transfer front, *PoultryTech* received an APEX Award for Publication Excellence and rolled out a new look with the Spring 2007 issue. And the 2007 National Safety Conference for the Poultry Industry arguably had the strongest program of its 24-year history, capped again by an address from the Assistant Secretary of Labor for Occupational Safety and Health.

Looking to the future, program staff played key roles in organizing a proposal to the National Science Foundation to create an Engineering Research Center in Intelligent Food Processing Systems. As one of the major focus areas of ATRP, this is an opportunity to expand research and educational activities in this important thrust area. In addition to Georgia Tech, the proposed center's partners include the University of Georgia, Alabama A&M University, and Dublin City University in conjunction with numerous industry supporters and the Institute of Food Technologists.

As we look ahead to another exciting year, we would like to take a few moments to look back and thank all of our sponsors and supporters who helped to make these and other accomplishments of the past year possible.

A handwritten signature in black ink that reads "J. Craig Wyvill".

J. Craig Wyvill, ATRP Director

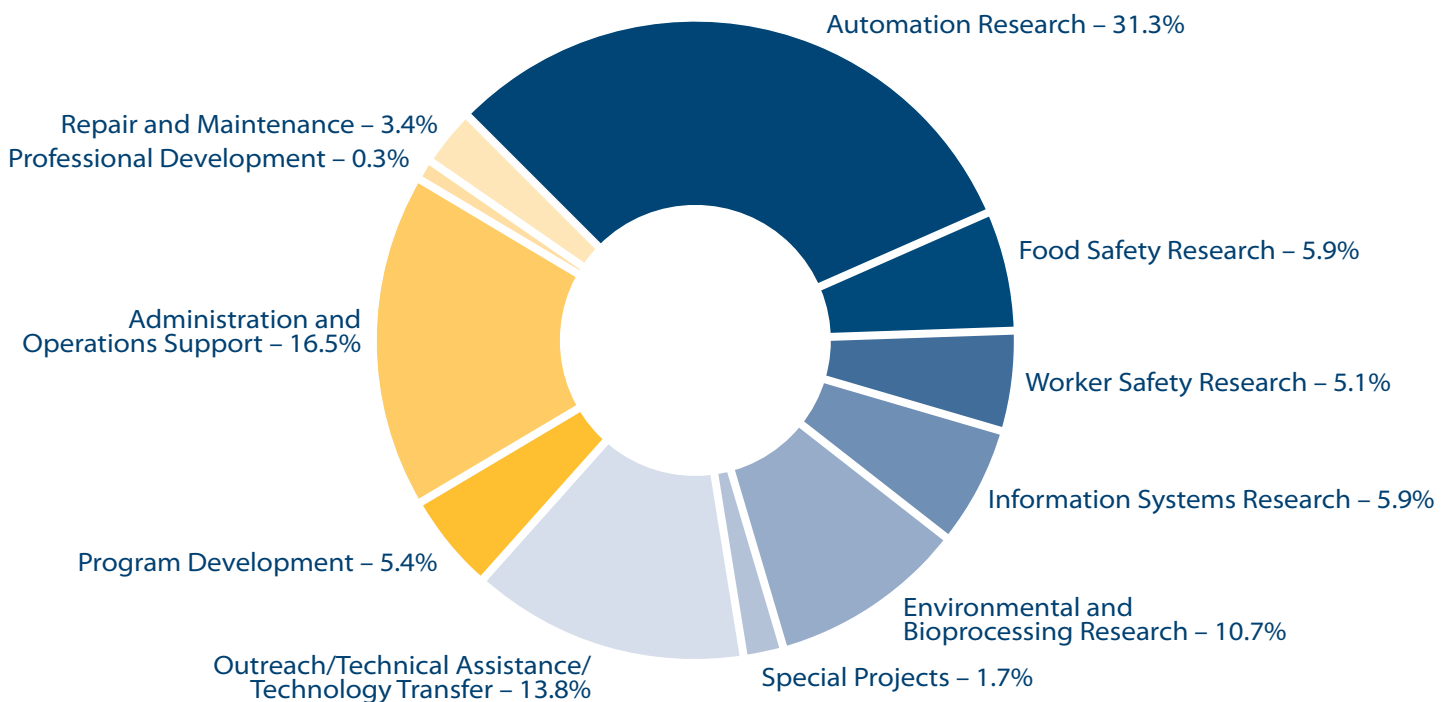
FINANCIAL SUMMARY

Fiscal Year 2007 saw state funding support for the program grow for the second straight year. Enhancement funding allowed the program to reinstate research in the area of workplace safety, bringing it back to its full complement of targeted research areas.

In all, eight systems development efforts were undertaken in five research focus areas in FY 2007: advanced automation technologies, food safety technologies, environmental and biological systems, information systems technologies, and workplace safety. In addition, four special projects were undertaken, and the technical assistance element expanded to meet growing interest in in-depth energy audits due to mounting energy costs.

More than 60% of the FY 2007 program budget was directly invested in research and special projects. More than one-third of the remaining program budget was invested in outreach and technical assistance/technology transfer.

FY 2007 BUDGET MIX: \$1,783,216



INDUSTRIAL PARTNERSHIPS

INDUSTRIAL COLLABORATORS

Industrial collaborators help provide direction and support to the specific research projects undertaken. They also participate directly in research projects by providing access to industry facilities for data collection and systems testing and contributing in-kind and cash support on an “as needed” basis.

Advanced Environmental Systems
American Proteins, Inc.
Perdue Farms Inc.

Advanced Imaging Technology
Gold Kist Inc.
Wayne Farms LLC

Advanced Information Technology Systems
U.S. Poultry & Egg Association

Automatic Intelligent Transfer System
Banner Engineering Corp.
Danfoss
Turck Inc.

Other Collaborators:
University of Georgia
USDA Russell Research Center

Chlorine Sensor Technology
Gold Kist Inc.
Perdue Farms Inc.
Pilgrim’s Pride Corporation
Tip Top Poultry, Inc.
Wayne Farms LLC

Intelligent Cutting and Handling
Gainco, Inc.
Gold Kist Inc.
KUKA Robotics
Pilgrim’s Pride Corporation
Tyson Foods, Inc.

*Washdown Robot Development
(Special Project)*
CAMotion, Inc.
Cargill Meat Solutions

Worker Safety Technology
Gold Kist Inc.

ATRP POULTRY ADVISORY COMMITTEE

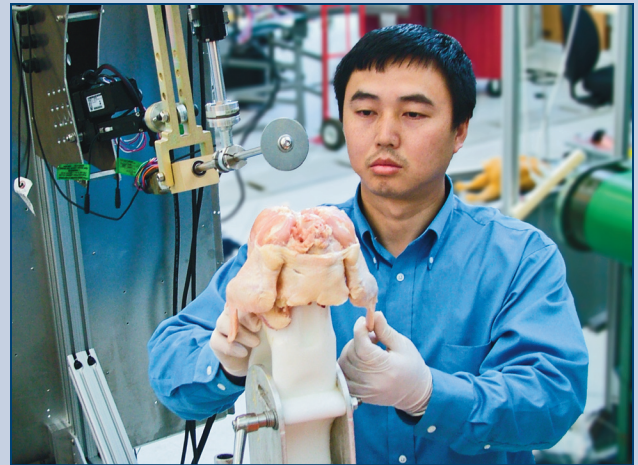
ATRP’s Poultry Advisory Committee is composed of poultry industry leaders who give their time to help the program identify research topics that best address priority industry needs. The committee meets annually to hear updates on program research efforts and to discuss challenges and future direction with program personnel.

Richard Jamison	<i>Perdue Farms Inc. (Chairman)</i>
Ken Smith	<i>American Proteins, Inc.</i>
Mark Ham	<i>Cagle’s Inc.</i>
Jerry Straughan	<i>Cal-Maine Foods Inc.</i>
John Seibel	<i>Claxton Poultry Farms</i>
Bill Crider	<i>Crider Poultry Farms</i>
David McEver	<i>Crystal Farms</i>
Clay Banks	<i>Equity Group - Georgia Division LLC</i>
Steve Collier	<i>Fieldale Farms Corporation</i>
Steve Smith	<i>FMC FoodTech</i>
Gene Parets	<i>Gainco, Inc.</i>
Delane Borron	<i>Gold Kist Inc.</i>
Richard Curvin	<i>Gold Kist Inc.</i>
Wayman Hollis	<i>Hall Equipment Company</i>
Matt Brass	<i>Keystone Foods LLC</i>
Phil Wilkie	<i>Kings Delight</i>
Joel Williams	<i>Mar-Jac Poultry, Inc.</i>
Steve Bass	<i>Pilgrim’s Pride Corporation</i>
Rory DeWeese	<i>Pilgrim’s Pride Corporation</i>
Scott Rushing	<i>Sanderson Farms</i>
Jamie Usrey	<i>Stork Gamco Inc.</i>
Angela Bradach	<i>Tyson Foods, Inc.</i>
Leon Dixon	<i>Tyson Foods, Inc.</i>
Guy Hinton	<i>Wayne Farms LLC</i>
Ron Rogers	<i>Wayne Farms LLC</i>

<i>Ex-Officio</i>	
Abit Massey	<i>Georgia Poultry Federation</i>
Mike Giles	<i>Georgia Poultry Federation</i>
James Scroggs	<i>Georgia Poultry Laboratory Network</i>
J. Craig Wyvill	<i>Georgia Tech Research Institute</i>
Michael Lacy	<i>University of Georgia</i>

INTELLIGENT CUTTING AND HANDLING

The intelligent cutting project focused primarily on constructing a prototype system for performing the wing cut on a breastcap. To achieve this goal, the research team worked on defining the best cutting trajectories, the kinematic and dynamic requirements of the cutting path, as well as designing a new prototype cutting system and developing the controls to operate the device. The team developed a real-time control system that runs on a Linux kernel for the control and sensor integration of the cutting system. Researchers also constructed and tested a two-axis system with a servo control blade to perform all of the cutting motions. They further made progress on modeling the wing manipulation and cutting task. This work is critical to controlling the cutting path and optimizing yield.

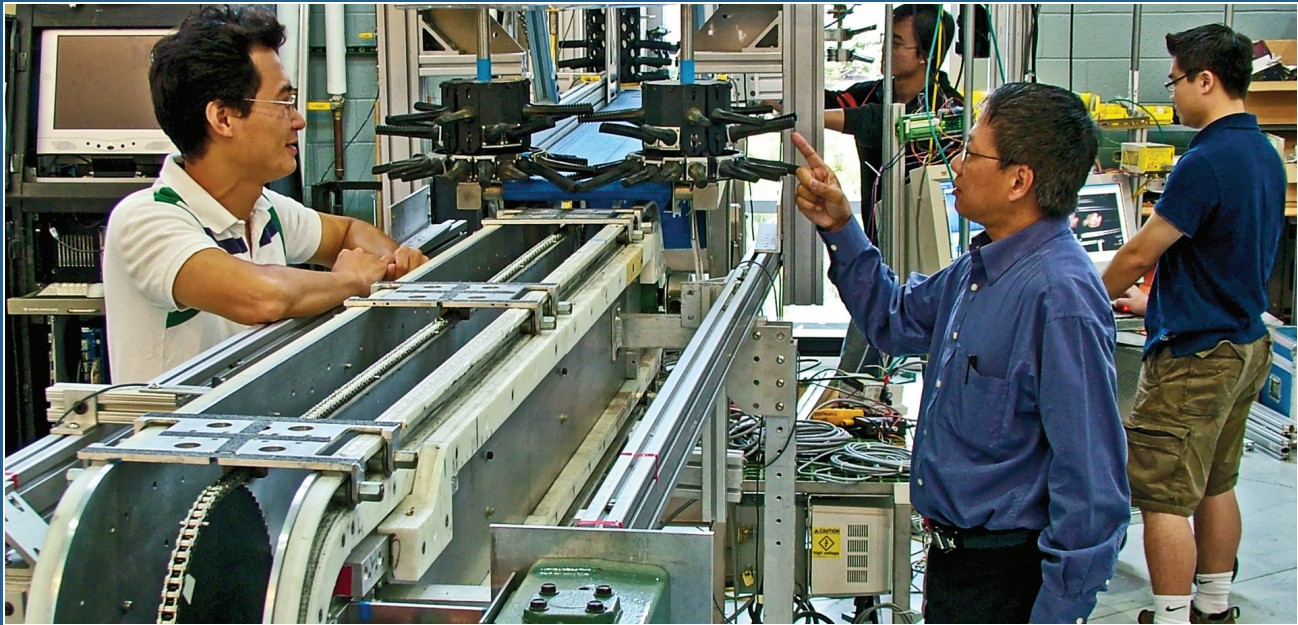


For the advanced material handling project, the team finalized the robotic handling studies and focused on refining and advancing its non-robotic transfer system for moving carcasses from an immersion chiller to a shackle line. The concept uses conventional automation technology (beam switches and pneumatic actuators), an imaging system, and a chain conveyor to transfer the birds from the chiller to the shackle line. The prototype system moves birds into a single-file flow that is randomly positioned. It then orients them properly (breast up vs. breast down) and adjusts their positions (legs first versus neck first) before depositing them into a transfer box that then loads them onto the shackle line. A first-generation prototype of each element has been completed and tested.



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AUTOMATIC INTELLIGENT TRANSFER SYSTEM



The automatic intelligent transfer system project focused on taking live birds on a moving conveyor belt and ordering them into singulated, properly oriented positions to be grasped by the device's proprietary grasping system.

Specifically, the team optimized the singulating finger design and developed a motion controller to synchronize the singulator with the bird arrival such that the fingers rotate only after the bird is in position. The team conducted two experiments (with 120 birds at the University of Georgia) to determine the impact of acceleration on the birds' reaction in order to reduce wing flapping due to a sudden velocity change.

The team also developed a multi-sensor system to estimate the spacing between two adjacent birds and their orientation. This provides an effective means of reliably cradling the bird immediately after singulation, thereby minimizing the number of conveyors and more importantly the effects of the birds' reaction on mechanical handling. In addition, the team

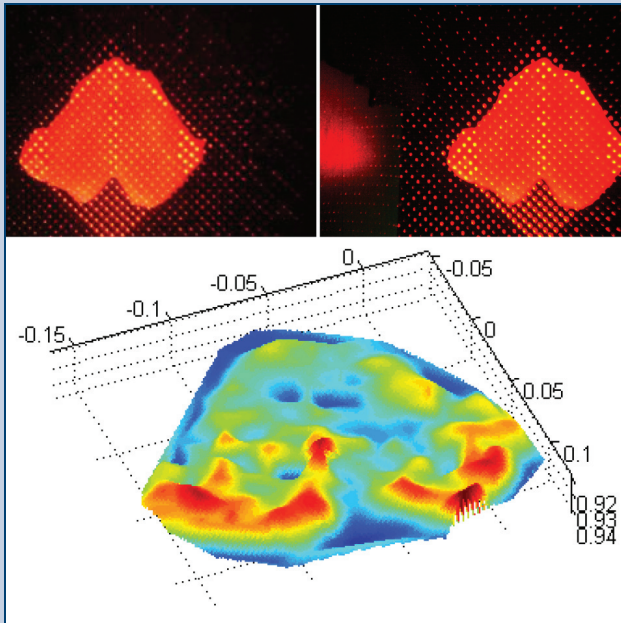
actively involved equipment companies to help optimize the cost-effectiveness of the system design and shorten the time for technology transfer from laboratory prototype to shop-floor implementation, particularly for experiments with a large number of birds. For these, Banner Engineering Corp. and Turck Inc. donated an estimated \$20,000 of "industrially hardened" electronics/sensors and in-kind support for the development of the multi-sensor system.

Lastly, the team developed a concept design for transferring birds from the singulation fingers to the grasping fingers where the bird is to be stunned and shackled. A brainstorming session lead to the development of several concepts that were investigated. Of particular interest to the team were bird safety and welfare as well as the level of risk in attempting each solution. A preliminary design selection was performed, and three potential solution candidates were identified. A more detailed design was conducted on each of the concepts, and a leading concept was identified.

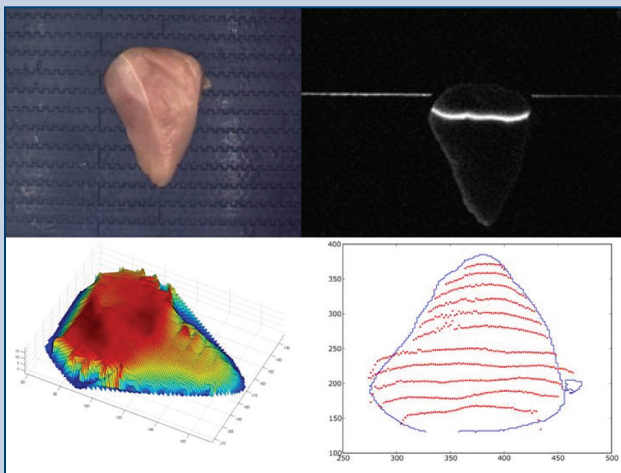
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ADVANCED IMAGING TECHNOLOGY



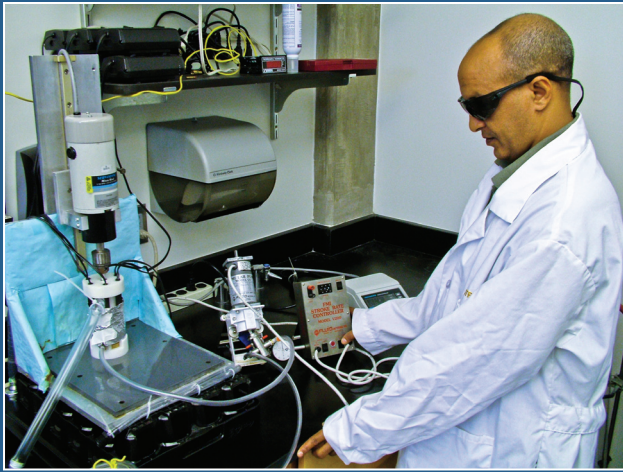
The advanced imaging technology project team focused its research efforts in the areas of stereo imaging and enhanced structured lighting concepts. Stereo imaging activities involved accessing improved techniques for obtaining correspondence between two simultaneous images through the use of projected laser patterns. This is necessary because there are no readily apparent structural features on the surface of poultry products to enable the system to reliably determine correspondence between the two images. In the enhanced structured lighting area, the research team explored approaches that do not require the use of an encoder, thereby simplifying and lowering cost for final implementation.



The developments on stereo imaging were used to support studies on robotic shackle loading. The research team plans to extend the techniques developed here toward the non-robotic transfer (shackle loading) implementation. The enhanced structured lighting work supported one aspect of the sensing required on the development of the prototype system for portion and process control under FoodPAC (Food Processing Advisory Council). The research team also developed a technique for estimating trajectories that will be used as the baseline trajectories on the prototype system for intelligent processing (intelligent cutting) project.

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ADVANCED ENVIRONMENTAL SYSTEMS



Environmental researchers concentrated on technology development for non-chemical disinfection of liquid streams for reuse as well as alternative fuel production from waste materials. Ongoing work with the advanced mixing, ultraviolet light (UV) disinfection system focused on design modification studies to achieve higher flow rates in the larger pilot-scale system. Progress was made toward upgrading the system, with a final design pending. Principle work at the bench-scale level focused on UV penetration studies and UV lamp intensity management and fluid temperatures resulting from intensity fluctuations. A significant component of this work entailed numerical simulations and experimental data collection focused on assessing UV intensities and hold-up times within the irradiation zones.



On the biofuels front, the project examined novel acid-catalysis biodiesel conversion processes designed to improve yield from biodegraded feedstocks (e.g., dissolved air flotation (DAF) skimmings, brown grease, or stabilized poultry fat). Additionally, solid acid catalysts were considered for deoxygenation, both with and without hydrotreating, to improve surrogate biofuel flow characteristics. Work also focused on advanced mixing pre-processing needed to generate higher value biofuels and “drop-in” diesel. Initial results show strong promise for improving conversion efficiency using these novel approaches while opening the process to lower quality feedstocks.

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CHLORINE SENSOR TECHNOLOGY

During FY 2007, the ATRP interferometric sensor was modified from a biosensor into a chlorine sensor to address expressed industry needs. The research initially focused on developing a sensor that can measure free chlorine in chillers and other process control water systems. After initial screening of several polymer-based sensor coatings, a novel reactive sensing film for the optical waveguide interferometer was used to create an assay for rapid, on-line quantification of free chlorine (hypochlorous acid). The data suggest it will be possible to detect levels below one part-per-million of chlorine within a matter of minutes, independent of sample matrix or interfering substances. Initial experiments with grab samples of chiller water indicated, as previously observed, that chlorine demand in the organic-rich medium is very high, resulting in low levels of free chlorine.

Consequently, work also began on developing a second sensing film for quantification of combined chlorine (chloramine). The combination of the two assays in a single on-site measurement will provide real-time input for improved chemical maintenance in poultry chiller systems.



Project Directors David Gottfried

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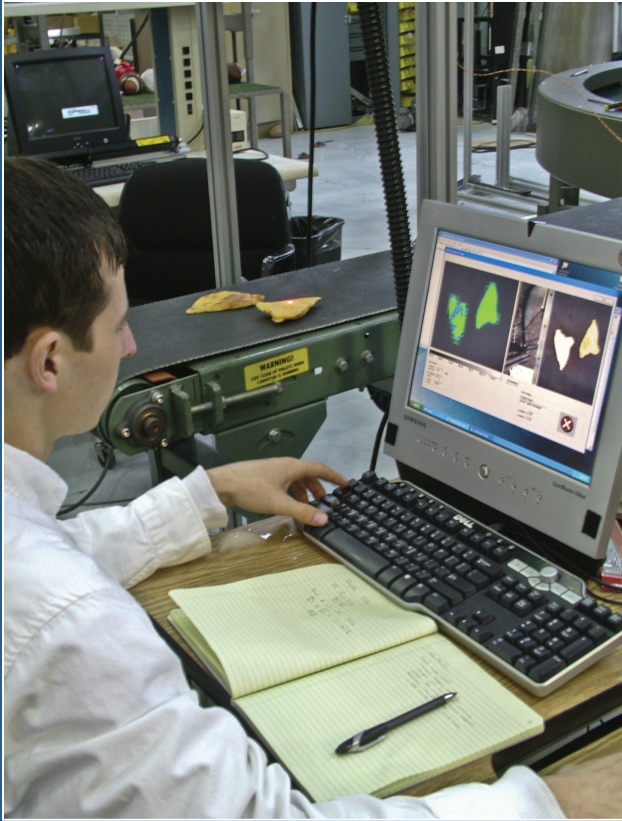
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ADVANCED INFORMATION TECHNOLOGY SYSTEMS



The main research thrust for the advanced information technology (IT) systems project concentrated on using the laser projection system in the cooking areas of plants where real-time communication between a computer and a person on the processing line is critical. A demonstration pointing/tracking system was developed and shown at the 2007 International Poultry Expo. An infrared camera system captured the thermal image of each exiting product and identified suspected undercooked product. It then relayed the product's location to the laser projector, which began tracking it down the belt. The team also investigated how to best project the information on moving products, and tested a number of hardware/software systems, including various lasers and LCD projectors as well as various colors and data symbols. Ultimately, researchers are working toward a modular system with the ability to dynamically and adaptively identify potentially out-of-spec product on a moving conveyor line, which is seen as useful across a broad range of applications.

The research team also completed analyzing laboratory-generated test data in preparation for publishing a research paper that compares the use of augmented reality (AR) systems to enhance communication between computer databases and poultry processing line workers with more conventional hand gesture and other systems of communication. In addition, the project supported the U.S. Poultry & Egg Association's annual Information Systems Seminar survey of information technology usage and trends throughout the poultry industry.

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WORKER SAFETY TECHNOLOGY

Fiscal Year 2007 marked the initiation of a new thrust to reintroduce cutting edge measurement systems to help track and control injury risk to the musculoskeletal system of line workers. After meeting with an expert ergonomist in poultry processing and resident experts in the biomechanics of human movement, the main goal of the project was to redesign/rebuild the Ergonomic Work Assessment System (EWAS) developed by ATRP in the 1990s.

Early in the EWAS redesign process, a considerable effort went into the selection of a physiological measurement device capable of surviving in a poultry plant. The design team selected a system that uses fiber optic sensors that are not affected by electromagnetic interference. The system is manufactured by Measurand and is used to support computer-generated animation activities. In addition, electromyography (EMG) hardware was selected and redesigned to be easily incorporated into the Measurand data capture system.

The study team also focused on conducting a detailed literature search on research identifying ties between exertion activities and injury that can be correlated to the factors tracked by the new system. Several important risk factors such as carpal tunnel pressure, knife sharpness, and wrist angles were discovered that will be the focus of detailed testing in the coming year. The first-year goal of the project was accomplished, which was the design and development of a new system capable of making physiological and EMG measurements. The unit is now ready for more detailed testing. The project team also plans to focus attention on developing a back monitoring system in future years.



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SPECIAL PROJECTS

The program conducted four special projects in FY 2007.

Development of a Standardized Control and Data Acquisition System

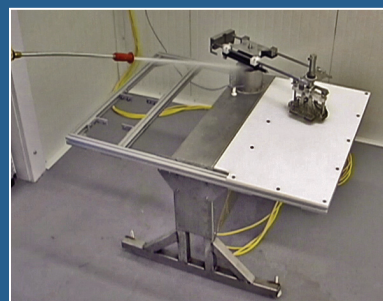
Project Director Gary McMurray 404-407-8844 gary.mcmurray@gtri.gatech.edu

Using open source software and inexpensive system hardware, this special project developed standardized tools for designing and modeling control and data acquisition solutions for prototype systems using sensor inputs. Standardized developmental tools help to reduce development time, reduce system costs, and simplify system testing. The completed system is currently being used by the intelligent cutting and shackle loading development efforts.

Washdown Robot Development

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When funding from FoodPAC (Food Processing Advisory Council) yielded less than half the amount sought to fabricate a first-generation washdown robot, ATRP set up this special project to help cover some of the fabrication costs needed to keep this development on track. The resulting investment allowed the design team to complete the prototype construction within 6 months and to have it ready for demonstration at the 2007 International Poultry Expo. The resulting prototype system has attracted strong commercial interest and has undergone a series of tests. It recently was awarded FoodPAC FY 2008 funding.



Economic and Fiscal Impacts of the Poultry Industry in Georgia for 2005

Project Director William B. Riall, Jr. 404-894-3800 bill.riall@innovate.gatech.edu

This special project continued a study series dating back to 1989 that periodically estimates the impact of the poultry industry on Georgia's economy. The study showed that with recent expansions by the industry in Georgia, its impact had grown 6.7% from 2004 to 2005. It further showed that the industry's total impact on the Georgia economy now exceeds \$15 billion, and its contribution to state and local tax revenues now totals nearly a half billion dollars.

Junior Achievement Job Shadow Day

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At the request of a member of the Georgia poultry industry, ATRP agreed to host a Junior Achievement Job Shadow Day at the Food Processing Technology Building at Georgia Tech. On November 2, 2006, 18 students from Banneker High School participated in a half-day event that enabled them to become part



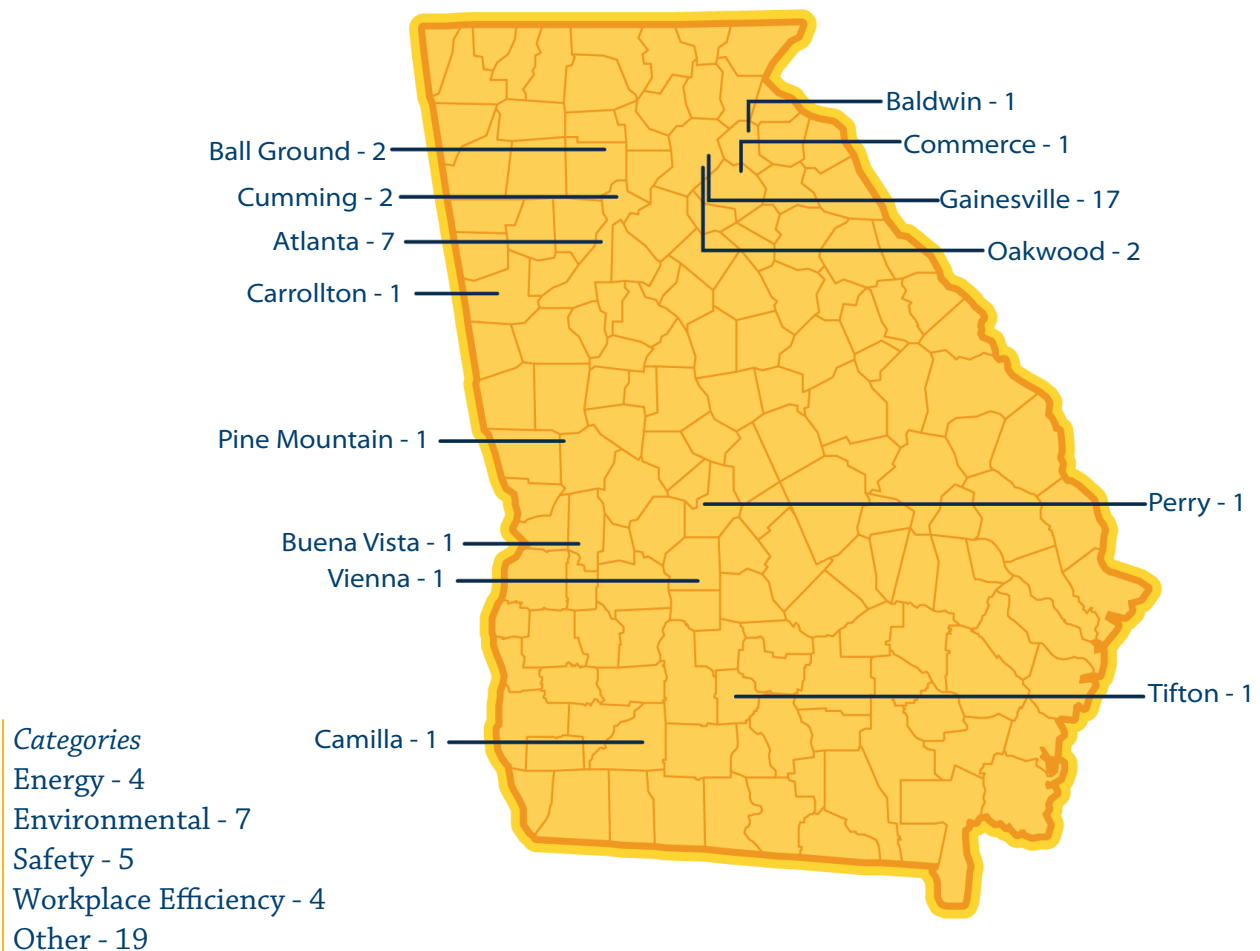
of the research teams developing an automated shackle loader, an automated live transfer system, a portion imaging system, an infrared imaging system for cooking control, an augmented reality laser projection system for product identification, a UV disinfection system, and a biosensor for rapid microbial detection. They were able to ask questions about the problems being addressed, the technology being developed, the challenges in constructing and testing prototypes, and the backgrounds and qualifications of the researchers and students working on the projects. Feedback was very positive, and future job shadow events are anticipated.

TECHNICAL ASSISTANCE

Thirty-nine technical assists were provided to firms 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.

A significant special focus of the Technical Assistance Program in FY 2007 was a series of intensive in-plant energy assessment studies designed to help companies identify strategies for reducing energy usage and costs. The program uses input from all assists to gauge situations calling for new research initiatives.

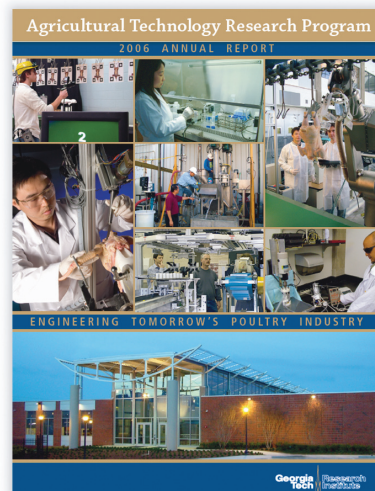
TECHNICAL ASSISTS



Activity Leader J. Craig Wyvill
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TECHNOLOGY TRANSFER

ATRP continued an active technology transfer program. *PoultryTech*, the program's newsletter, received an APEX Award of Excellence for its Spring 2006 Automation issue. In all, three issues (Environmental, Safety, and Automation) of *PoultryTech* were published in FY 2007. Several articles were reprinted in the trade press. A new four-color design of the newsletter was introduced with the Automation issue in Spring 2007. Subscriptions to the newsletter totaled more than 1,500 subscribers, including more than 230 subscribers from foreign countries. A full-length feature article on the program's infrared computer vision system and its use for controlling oven temperatures to prevent undercooking and minimize overcooking in food products was published in Georgia Tech's research magazine, *Research Horizons*. In addition, ATRP researchers under contract to the Georgia Department of Transportation designed and built an automated raised pavement marker (RPM) placement system. The system received extensive coverage in trade publications and on several websites. The design for the system grew out of automation, computer vision, and sensing technologies previously developed for use in the poultry and food processing industries. Research staff also published journal articles and spoke at industry and professional meetings. The FY 2006 Annual Report was published, and the ATRP website was updated.



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ATRP once again participated in the International Poultry Expo, the Georgia Poultry Federation's Spring Meeting and Night of Knights, preparing exhibits for all three. Poultry World continued to be a major draw at the Georgia National Fairgrounds in Perry, Georgia. Working with the Georgia Poultry Federation, Georgia Tech helped coordinate the more than 140 volunteers who staffed the exhibit and also updated the educational displays in the exhibit, featuring new photography, video, and simplified text geared toward middle school-aged children. In conjunction with the Georgia Poultry Federation, the National Chicken Council, and the National Turkey Federation, ATRP hosted the 2007 National Safety Conference for the Poultry Industry in Savannah, Georgia, attracting more than 90 safety professionals and vendors from across the United States. A highlight of the conference was an address by Edwin G. Foulke, Jr., Assistant Secretary of Labor for Occupational Safety and Health. The program also provided tours of the Food Processing Technology Building and demonstrated research projects to four student groups (50, 5th graders from Creek View Elementary School, Alpharetta, Georgia; 50, 4th-6th graders from Pine Ridge Elementary School, Stone Mountain, Georgia; 24, 10th and 11th graders from various schools in Columbia County, Georgia, participating in a Youth Leadership Class; and 20, kindergarten-middle school students from The Study Hall at Emmaus House, a non-profit organization with year-round programs focusing on academics and enrichment for children).



PUBLICATIONS AND PRESENTATIONS

TRADE PUBLICATIONS

Holmes, J. November 2006. Robots take on the dirty work in the processing plant. Poultry International. 45(12):24, 26.

Sanders, J.M. Fall 2006. Seeing the unseen. Research Horizons. 24(1):36.

Walsh, J. Summer 2006. Industrial storm water: a look at Georgia's new permit. PoultryTech. 18(2):3, 8.

Wyvill, J.C. August 28, 2006. Poultry and robotics a perfect match. Poultry Times. 53(18):4.

Wyvill, J.C. Fall 2006. Conference highlights the potential and risks of nanotechnology for the food industry. PoultryTech. 18(3):4-5.

JOURNAL ARTICLES

Lan, C.-C. and K.-M. Lee. July 2006. Generalized shooting method for analyzing compliant mechanisms with straight and curved members. ASME Journal of Mechanical Design. 128(4):765-775.

Lee, K.-M., Q. Li, and H. Son. September 2006. Effects of numerical formulation on magnetic field computation using meshless methods. IEEE Transactions on Magnetics. 42(9):2164-2171.

Lee, K.-M., Q. Li, and W. Daley. January 2007. Effects of classification methods on color-based feature detection with food processing applications. IEEE Transactions on Automation Science and Engineering. 4(1):40-51.

Li, Q. and K.-M. Lee. August 2006. An adaptive meshless method for magnetic field computation. IEEE Transactions on Magnetics. 42(8):1996-2003.

Tezel, U., J.A. Pierson, and S.G. Pavlostathis. November 2006. Fate and effect of quaternary ammonium compounds on a mixed methanogenic culture. Water Research. 40(19):3660-3668.

Tezel, U., J.A. Pierson, and S.G. Pavlostathis. March 2007. Effect of polyelectrolytes and quaternary ammonium compounds on the anaerobic biological treatment of poultry processing wastewater. Water Research. 41(6):1334-1342.

Xu, J., D. Suarez, and D.S. Gottfried. May 2007. Detection of avian influenza virus using an interferometric biosensor. Analytical and Bioanalytical Chemistry. (Online publication).

THESES/DISSERTATIONS

Chessin, M. 2006. An experimental investigation on the effects of buffering regulation on time-critical delivery of objects on a multi-conveyor system. M.S. Thesis, Georgia Institute of Technology. 92 pp.

Li, Q. 2007. Effects of adaptive discretization on numerical computation using meshless method with live object handling applications. Ph.D. Dissertation, Georgia Institute of Technology. 161 pp.

Ye, Z. 2007. UV disinfection between concentric cylinders. Ph.D. Dissertation, Georgia Institute of Technology. 152 pp.

CONFERENCE PROCEEDINGS

Lan, C.-C. and K.-M. Lee. 2006. An analytical contact model for design of compliant fingers. Proceedings of the 2006 International Symposium on Flexible Automation. Osaka, Japan, July 10-12. pp. 905-911.

Lan, C.-C. and K.-M. Lee. 2006. Forward/inverse models using global coordinates for analytical design of compliant mechanisms. Proceedings of the 2006 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2006). Beijing, China, October 9-15. pp. 4175-4180.

Li, Q. and K.-M. Lee. 2006. An adaptive meshless computation method for design of electromechanical actuators. Proceedings of the 2006 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2006). Beijing, China, October 9-15. pp. 5453-5458.

Li, Q. and K.-M. Lee. 2007. An adaptive meshless method for modeling large mechanical deformation and contacts. Proceedings of the 2007 IEEE International Conference on Robotics and Automation (ICRA 2007). Roma, Italy, April 10-14. ON CD-ROM.

Lee, K.-M., Q. Li, and H. Son. 2006. Effects of numerical meshless formulation on magnetic field computation for transfer automation. Proceedings of the 2006 International Symposium on Flexible Automation. Osaka, Japan, July 10-12. pp. 381-388.

Zhou, D. and G. McMurray. 2007. Formulation of the relationship between tension loading rate and internal stress for uni-axial bio-materials. Proceedings of the IASTED 2007 Modeling and Simulation Conference. Montreal, Canada, May 30-June 1. ON CD-ROM.

Zhou, D., J. Holmes, W. Holcombe, K.-M. Lee, and G. McMurray. 2007. Automation of bird front half deboning procedure: design and analysis. Proceedings of the IFToMM 2007 World Congress in Mechanism and Machine Science. Besancon, France, June 17-21. ON CD-ROM.

PUBLICATIONS AND PRESENTATIONS

LECTURES AND PRESENTATIONS

Daley, W.D.R. 2006. Addressing future processing challenges through flexible automation and intelligent processing. 2006 National Poultry Waste Management Symposium, Springdale, AR, October 23-25.

Gottfried, D.S., J. Xu, and D. Suarez. 2006. A sensitive and rapid biosensor for avian influenza virus. American Chemical Society Southeast Regional Meeting, Augusta, GA, November 1-4.

Gottfried, D.S., J. Xu, J. Cobb-Sullivan, and D.P. Campbell. 2006. Optical interferometry for sensing of terrorism threat agents. American Chemical Society Southeast Regional Meeting, Augusta, GA, November 1-4.

Gottfried, D.S. 2006. Sensing at the speed of light. College of Wooster Department of Chemistry Seminar, Wooster, OH, December 7.

Harbert, S. 2006. IS survey overview. U.S. Poultry & Egg Association Information Systems Seminar, Hilton Head Island, SC, July 24-26

MacIntyre, B. 2006. Emerging technology. U.S. Poultry & Egg Association Information Systems Seminar, Hilton Head Island, SC, July 24-26.

McMurray, G. 2007. Formulation of the relationship between tension loading rate and internal stress for uni-axial bio-materials. IASTED 2007 Modeling and Simulation Conference, Montreal, Canada, May 30-June 1.

Pierson, J. and A. Georges. 2006. Advanced UV disinfection treatment with taylor-couette flow. Smithfield Foods Annual Engineers Meeting, Atlanta, GA, September 28-29.

Pierson, J. 2006. Biofuels and the poultry processing industry. ConocoPhillips Biofuels and Long Range Projects Meeting, Atlanta, GA, October 18.

Pierson, J. 2007. TSS versus fecal: a storm water case study. U.S. Poultry & Egg Association Environmental Management Seminar, Memphis, TN, March 7-8.

Wyvill, J.C. 2006. An overview of Georgia Tech's poultry research activities and an update on FoodPAC. 2006 Georgia Poultry Federation Summer Poultry Leadership Conference, Ponte Vedra, FL, July 12-15.

Wyvill, J.C. 2006. An overview of GTRI's food processing research. Georgia Council for International Visitors, Atlanta, GA, July 21.

PUBLICATIONS AND PRESENTATIONS

Wyvill, J.C. 2006. An overview of GTRI's food processing research. Invest Australia, Atlanta, GA, August 15.

Wyvill, J.C. 2006. GTRI's food processing technology research. Georgia Tech Alumni Association Homecoming Event, Atlanta, GA, October 27.

Wyvill, J.C. 2007. An overview of the poultry industry, the changes taking place within it, and opportunities for innovative energy concepts. Southern Company Engineering Group Meeting, Atlanta, GA, January 23.

Wyvill, J.C. 2007. An update on labor saving technologies in poultry processing operations. 2007 International Poultry Expo, January 24-26.

Wyvill, J.C. 2007. Emerging technology trends integrating the processing plant floor. U.S. Poultry & Egg Association Poultry Processor Workshop, Atlanta, GA, May 16-17.

Wyvill, J.C. 2007. GTRI and the food processing division's efforts to stimulate commercialization in the food industry. The Americas Competitiveness Forum, Atlanta, GA, June 11-12.

INVENTION DISCLOSURES

Daley, W.D.R. and J.M. Stewart. Integrated overline portion/part sensing for quality, process and equipment control.

Holmes, J., M. Gatti, G. McMurray, H. Lipkin, and P. Scharle. Passive methods for shackling poultry products in a manufacturing environment.

Holmes, J.F. and W.D. Holcombe. Packing robot for working in washdown environment.

Zhou, D., G. McMurray, and W. Daley. Sensor and model based intelligent cutting system.

PATENTS

Daley, W.D.R. and D.F. Britton. March 13, 2007. Systems and methods for inspecting natural or manufactured products. U.S. Patent No. 7,190,813.

Lee, K.-M. November 14, 2006. Automated feet-gripping system. U.S. Patent No. 7,134,956.

PROVISIONAL PATENTS

Daley, W.D.R., D.F. Britton, J. Stewart, and B. Myers. May 4, 2007. Dynamic control of EM energy sources to enhance the extraction of object features for machine vision sensing.

ATRP: FIVE-YEAR PLAN

The five-year goal of the Agricultural Technology Research Program (ATRP) at Georgia Tech is to provide state-of-the-art applied engineering research and service to the poultry industry. The research program will continue to focus on automation, information technology, environmental, and safety areas, while service activities will continue to concentrate on broad information dissemination and one-on-one general assistance.

Automation/electronics research studies over the next five years will focus heavily on integrated, “intelligent” automation systems. These systems offer major opportunities to further enhance productivity in the poultry industry. They incorporate advanced sensors, robotics, and computer simulation and control technologies in an integrated package and tackle a number of unique challenges in trying to address the specific needs of the industry. Research will also continue in the area of computer vision. As a leader in this exciting research field, the program has already introduced several commercially viable designs. Work has also begun focusing on the emerging areas of stereo 3D, IR, and UV imaging concepts. These technologies, perhaps more than any other, offer the potential to revolutionize the way in which processes are controlled and optimized.

Information technology research studies will continue focusing heavily on streamlining the flow of information among machines, people, and the integrated enterprise. Efforts to work with statistical process control and database management concepts will continue, as will studies to develop practical augmented reality tools capable of simplifying the dynamic transfer of information among production workers, databases, and processing equipment.

Environmental research studies will continue to focus on emerging technologies that help to reduce water usage and waste generation. Improved recycling technologies, in particular, will continue to be pursued to assist not only in recycling water, but also in recycling marinades, brines, etc., thereby reducing their impact on waste treatment operations. Studies will also continue focusing on enhancing the program’s understanding of how waste is generated and how to more effectively remove it from air and water streams. And finally, efforts will expand into the area of value-added byproduct recovery.

Safety research will continue to take two paths. Personnel safety research will focus on finding new ways to reduce the risk of worker injury. The newly activated worker safety thrust will build on research previously conducted into ergonomic risk quantification. The industry needs a more scientific base for assessing and controlling injury, and the program is committed to helping with this pursuit. Product safety research, on the other hand, will continue to focus on technologies to improve control over process and product quality. The program’s efforts to develop an innovative biosensor have been groundbreaking and are transitioning into exploratory studies designed to use it and other such sensing technologies as screening and control systems for microbial intervention and water recycling processes. Studies will also be pursued into developing advanced x-ray and other screening tools for food safety determination and control.

Finally, ATRP will continue to actively support industry needs through its technical assistance program and will use newsletters, seminars, research reviews, topical reports, research reports, technical papers, and articles in industry trade publications to transfer its research findings and expertise. The program will also work to promote a better understanding of and appreciation for Georgia’s dynamic poultry industry and increasing opportunities for engineering and technical careers in the industry.



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