Agricultural and Biosystems Engineering

Departmental Strategic Plan (2010-2015)

- ☑ Problems defined
- ☑ Constraints Identified
- ☑ Teams constructed

Tasks:

Sustainable agriculture

Sustainable manufacturing

Renewable nonpolluting energy

Abundant clean water

Human health and safety

Approved April 23, 2010

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

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The Vision

ISU's Department of Agricultural and Biosystems Engineering: The premier team serving society through engineering and technology for agriculture, industry, and living systems.

The Mission

The mission of the Agricultural and Biosystems Engineering Department is:

to promote undergraduate student learning in agricultural and biosystems engineering and industrial and agricultural technology,

to promote graduate student learning in agricultural engineering and industrial and agricultural technology,

to discover and improve new technologies for all stakeholders, and

to provide engineering and technology expertise in the fields of agriculture, industry and biosystems for the state, nation, and world.

Values and Guiding Principles

As the Agricultural and Biosystems Engineering department works toward achieving our mission, all members of the department are requested to act in harmony with Iowa State University's core values and the identified departmental values and guiding principles. These departmental values and guiding principles are:

Diversity of students, staff, faculty, stakeholders, and viewpoints

Partnerships with stakeholders

Sustainability of resources and infrastructure

Systems approach

Lifelong learning

The Process of Strategic Planning

The strategic planning process for the department was conducted over a course of one and a half years beginning at the Fall 2002 departmental retreat. Invited stakeholders and faculty participated in our strategic plan by drafting the vision and mission statements. Over the course of a year, several faculty group meetings were used to explore goals, strategies, and benchmarks addressing the adopted departmental vision and mission in the context of discovery, learning, and engagement.

The strategic writing committee (Tom Brumm, Mary Ellen Hurt, Ramesh Kanwar, Manjit Misra, Stewart Melvin, and Chuck Schwab) used the information gathered during the retreat and these other meetings to formulate a unified strategic plan. This strategic plan was shared with the faculty and staff and refined based on active participation and discussion. The original three focus areas were developed into four themes: Environmental Stewardship Engineering, Plant and Animal Production Engineering, Processing Engineering for Food Safety and Value Addition, Advanced Machinery Engineering with an additional fifth crosscutting theme of Implementing Values and Guiding Principles.

The five theme areas were presented at a faculty meeting and approved. These themes were developed into this current strategic plan that was passed during the January 2004 faculty retreat. The strategic plan was reviewed at the 2005 faculty retreat. From that review a sixth theme area of Occupational Safety was added and a revision process based on the CREES review was begun to reflect the inclusion of the Industrial Technology degree program, additional faculty, and newly acquired industrial partners.

The strategic plan was reviewed at the 2006 faculty retreat. The six theme areas were charged with reviewing their sections. These sections were modified to reflect changes and keep the departmental strategic plan current and voted upon by the faculty.

During 2008 the department began the process of review using the Strengths, Weaknesses, Opportunities, and Threats (SWOT) to identify changes necessary to construct the new 2010-2015 departmental strategic plan. Focus groups reviewed their themes and the faculty modified and approved the new performance indicators. The new departmental strategic plan was approved on April 23, 2010 at the faculty meeting.

Themes and Goals

The department has identified six themes of excellence that best describe our current and future learning, discovery, and engagement activities. These themes share three common goals that encompass our talents, strengths, and expertise. This combination of Themes and Goals gives us an efficient system for collaboration and communication within our department. The following section presents the ABE Themes of Excellence with goals, strategies, and success indicators. They are:

Environmental Stewardship Engineering

Animal Production Systems Engineering

Process Engineering and Technology

Advanced Machinery Engineering

Occupational Safety

Implementing Values and Guiding Principles





THEME 1 – Environmental Stewardship Engineering ***Quality soil and water resources are socially and economically important to Iowa, the U.S., and the world. Environmental stewardship engineering is needed to develop and disseminate information and technology that allows those resources to be efficiently used to produce food, feed, energy and fiber while maintaining or improving their quality.***		
Goals	**Strategies**	**Success Indicators**
Improve soil and water resource management systems	• Generate knowledge/information needed in developing new components for improved systems • Develop sensors to monitor environmental indicators for agricultural production systems • Assess and develop improved agricultural management practices (including use of tillage, crop rotations, fertilizer and animal waste application, and agricultural chemicals) to reduce environmental impacts form crop and bioenergy production • Evaluate new soil and water management practices to reduce chemical losses • Quantify and where needed, develop methods to reduce transport of bacteria and emerging contaminants • Evaluate off-site practices for treatment/pollution control where on-site practices may not be adequate • Develop information systems, models, and decision support systems for evaluating impacts of management systems on soil and water quality • Educate the next generation of engineers, scientists and technologists	• Publication record relative to knowledge/information, improved practices/systems, and instructional approaches • Patent applications on innovative ideas, equipment, and methods for resource protection/pollution control • Hardware and software tools for monitoring of environmental indicators in agricultural production systems • New options for determining appropriate agricultural management practices • Assessment of importance of emerging contaminants and possible control • Establishment of design parameters for practices for pollution control • Invited research projects and presentations
Optimize environmental systems	• Adapt, evaluate, and utilize mathematical models/information systems to optimize design of pollution prevention systems • Optimize cropping, tillage, chemical, soil, and water management practices to reduce negative environmental impacts while sustaining productivity • Assess benefits of off-site landscape modification/engineering for environmental enhancement • Provide input into TMDL planning and watershed protection	• Publication record relative to knowledge/information, improved practices/systems, and instructional approaches • Validated models available for assessment of cost/benefits of improved systems • Release of recommendations on appropriate combinations of cropping, tillage, chemical, soil, and water management practices for pollution control and environmental enhancement • Release of recommendations for use of off-site practices for pollution control • Invited research projects and presentations
Integrate and implement technology for environmental systems	• Sponsor regional/national/international conferences on agricultural environmental issues • Develop electronic delivery systems and education modules for dissemination of scientific and technical information on nonpoint source pollution control • Take active role in communicating with action agency personnel implementing pollution control programs • Continue to educate the public of the needs and opportunities relative to improved resource management systems	• Regional/national/international conference held in Iowa • Electronic education modules developed • Faculty serving as members on government and industrial advisory panels/boards • Documented evidence of educational impacts on producer performance

THEME 2 – Animal Production Systems Engineering

The demand for efficient, safe and sustainable production of food animals continues to increase. Iowa has a vital interest and position to advance the related science, engineering and technology. APSE strives to discover relationships between living systems and their development variables, investigate engineering solutions to alleviate adverse impacts of environment on living systems and disseminate the latest information to our stakeholders.

Goals	Strategies	Success Indicators
Quantify, develop, and evaluate animal production systems	• Develop sensors to monitor emission of pollutants (particulates and odorous, greenhouse, and other gases) from agricultural production systems • Conceive and test equipment/techniques to reduce/control atmospheric pollutant emissions • Quantify animal responses to modified environmental conditions that will advance the understanding of the synergistic impacts of environmental factors on modern animals • Investigate engineering strategies for animal stress relief to enhance health and well-being • Develop intelligent sensors and/or control systems for precision animal production systems to reduce cost of production and environmental impact • Quantify aerial emissions from animal feeding operations and evaluation of means to mitigate the emissions to enhance the sustainability of animal production agriculture • Develop methods to evaluate economic and environmental consequences of variable rate management for precision agriculture • Encourage involvement and leadership roles in multi-state, multi-nation scholarly activities • Develop and test methods, equipment, and testing protocols for safe, beneficial, and environmentally friendly storage, treatment, and utilization of potentially infectious or environmentally polluting byproducts of animal production.	• Institutional and professional awards in recognition of faculty accomplishments • Faculty serving in leadership or advisory roles with professional societies, government agencies, and commodity groups • International invitations for academic exchanges (e.g., sabbatical), serving on graduate program committees, presentation at special workshops or symposia • Publication record of refereed journal articles • Recognized experts by college/university administrations, state and federal agencies, and commodity groups to address issues that face the animal industry • Increased joint authorships with internationally prominent overseas scholars
Optimize animal production systems	• Systematically integrate research-based information and methods both independently and collaboratively with cross-disciplinary colleagues to optimize animal production systems • Work toward integrated management systems (IMS) that will prove sound with respect to animal welfare, product safety and quality, impact on the environment, and cash return • Enhance partnerships with interdisciplinary and intra- and inter-institutional colleagues to maximize the efficiency of resources utilization, the likelihood of success, and the magnitude of impacts • Optimize animal production models (e.g., downwind dispersion of aerial emissions from animal feeding operations)	• New measurement or sampling systems or methods developed for monitoring emissions and downwind concentrations of aerial pollutants associated with animal feeding operations • Innovative control systems or algorithms developed for optimal operation of equipment used to control micro-environment in animal and plant production systems • Patents or intellectual disclosures granted or filed that result from our research and development efforts • New systems or control strategies derived from our scholarly activities are implemented

THEME 2 – Animal Production Systems Engineering (continued) ***The demand for efficient, safe and sustainable production of food animals continues to increase. Iowa has a vital interest and position to advance the related science, engineering and technology. APSE strives to discover relationships between living systems and their development variables, investigate engineering solutions to alleviate adverse impacts of environment on living systems and disseminate the latest information to our stakeholders.***		
Goals	**Strategies**	**Success Indicators**

Integrate and implement technology for animal production systems	• Share faculty knowledge of air quality expertise through reciprocal faculty visits and hosting of training workshops on air quality
	• Work closely with ABE field specialists to effectively deliver departmental animal programs
	• Offer a web-based delivery of production-oriented decision support tools
	• Augment local, national and international impacts of our programs by having faculty
	  o serve in leadership capacities inside professional societies
	  o serve on advisory boards/review panels with governmental or industry organizations
	  o present invited lectures at national and international events
	  o consult for prominent national or international clients or institutions
	• Enhance undergraduate and graduate programs through
	  o early involvement of undergraduates in research activities
	  o new dual-listed (graduate and undergraduate) course on air quality and measurement techniques as related to animal feeding operations
	  o efforts to recruit domestic students into graduate programs (particularly Ph.D.)
		• Regional/national/international conference held Air quality conferences and workshops that are hosted
		• Newspapers around the state will carry articles on ABE success stories
		• Grants written by department faculty will have an outreach component
		• Partnership with industries in development of new products or improvement of existing products
		• Increased domestic and minority students in undergraduate and graduate programs
		• Number of M.S. and Ph.D. awarded

THEME 3 – Process Engineering and Technology ***Biorenewables can replace carbon from traditional carbon sources as a feedstock for industrial processes and as a source of energy. Efficient utilization of biorenewables is crucial to sustainability, while food safety and security continue to be critical. We will be leaders in these areas for Iowa and beyond, through research, outreach, and teaching of engineering principles related to biorenewables..***		
Goals	**Strategies**	**Success Indicators**
Design and develop novel processing systems for biorenewable feedstocks	• Generate knowledge and information needed to develop new systems that process biorenewable materials • Develop sensors and other measurement technology for effectively measuring properties of biorenewable materials, including those related to food safety • Develop supply chain management technology for biorenewables	• Strong grant funding and high number of graduate students • Productive publication record relative to new knowledge/information • Establishment of new processes and/or products based on research results • Significant collaboration with ISU research centers, such as: The Center for Crops Utilization Research; The Biosafety Institute for Genetically Modified Agricultural Products; and The Office of Biorenewables Programs
Optimize processing systems for biorenewable feedstocks	• Model process operations for understanding of value and efficiencies • Quantify food safety risks in processing operations • Optimize product and co-product management systems • Create integrative information systems for biorenewable supply chains	• Productive publication record relative to new knowledge/information • Establishment of new processes and/or products based on research results
Integrate and implement technology for biorenewable feedstocks	• Implement a degree in Biological Systems Engineering to provide engineers for the emerging bioeconomy • Integrate supply chain management into biorenewables processing through Quality Management Systems and traceability • Engage Iowa's bio-based industries, using their input to guide discovery, learning, and outreach efforts, and provide them with engineering expertise to address their problems and opportunities • Continue development of the Seed Conditioning outreach program • Develop instructional programming in biorenewable manufacturing management	• Launching of the Biosystems Engineering degree program • Industry adaptation of biorenewable and food safety products and processes • Significant input from industry in Process engineering programs • Strong enrollment in the Seed Conditioning outreach program





THEME 4 – Advanced Machinery Engineering ***The agricultural and bioproduction industry producing biorenewables, food, feed, and fiber for Iowa, the U.S. and the world is dependent on machinery systems. Advanced machinery engineering has a critical role in designing, developing, manufacturing, and implementing emerging technologies to improve machinery systems for the emerging bioeconomy.***		
Goals	**Strategies**	**Success Indicators**
Design and develop advanced machines and systems for agriculture, bioproduction, and off-road	• Generate knowledge/information needed in Solve fundamental engineering and technology questions related to agricultural and off-road equipment • Expand research program on advanced and emerging technologies related to agricultural machinery and equipment in the areas of: o Machine systems for biorenewables o intelligent and autonomous machines o mechatronics o sensors • Expand research partnerships with key industries • Pursue a funded endowed engineering chair in advanced machinery • Pursue endowed graduate fellowships	• Industry partnerships and sponsored projects • Technologies transferred and adopted • Faculty invitations to present at national and international venues • Innovative designs, modeling, systems, or algorithms developed for optimal operation of agricultural equipment and equipment systems • Endowed chair funded
Optimize machinery and systems	• Develop research programs investigating o Integration of information technology (IT) in agricultural machinery and systems o Impacts of agricultural machinery on sustainability o Sensors and artificial intelligence for agriculture o Human machine interaction and simulation	• Implementation of technology derived from our scholarly activities • Partnerships with industry • Level and continuity of support • Number of publications
Provide highly qualified graduates for the agricultural, bioproduction, and off-road machinery industry	• Strive to achieve the 1st choice status for students searching for agricultural machinery undergraduate and graduate education • Improve curriculum with state of the art technology, equipment, and facilities • Add a new faculty position to reach a critical mass in the Advanced Machinery Engineering group • Assist clients in decision-making, economic analysis, and operation of machinery systems • Develop high-quality international educational programs.	• Undergraduate and graduate students enrolled in the curriculum for agricultural machinery • Competencies and placement of graduates • Level and continuity of external research support



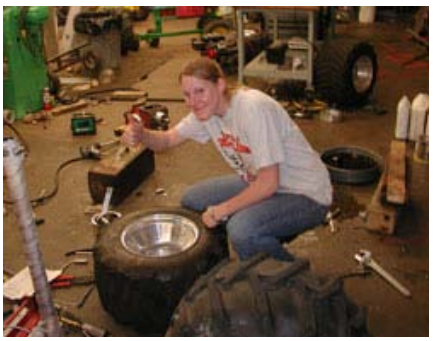

THEME 5 – Occupational Safety

Health and safety of populations are socially and economically important to industries in Iowa, the U.S., and the world. Occupational Safety engineering/technology is required to develop and disseminate injury and loss prevention measures and strategies to provide safer places to live and work. Occupational safety engineering/technology has the major role of developing, evaluating, and implementing injury and loss prevention measures and strategies for a safer future.

Goals	Strategies	Success Indicators
Design and develop injury and loss prevention tools and strategies	• Generate knowledge and information needed to develop new ways to prevent injuries and loss among industries • Generate knowledge and information needed to develop new ways to prevent injuries and loss among rural populations • Investigate engineering strategies for injury and loss prevention • Pursue a funded endowed chair in occupational safety research and education	• Faculty are invited for local, national, and international presentations • Innovated injury prevention intervention strategies and tools are developed • Publication record of referred journal articles • Textbook developed by focus group team • Endowed chair funded • Industrial partnerships and sponsored projects/activities
Analyze and evaluate injury and loss prevention tools and strategies	• Develop measurement technologies for effectively understanding the behavioral aspects of injury and loss prevention • Develop methods to evaluate the effectiveness of injury and loss prevention tools and strategies	• Faculty are invited for local, national, and international presentations • Faculty scholarly activities result in a record of refereed journal articles
Integrate and implement technology for injury and loss prevention	• Strive to be the 1st choice for students seeking technology-based safety undergraduate and graduate education • Prepare occupational safety professionals that are recognized as future leaders in their • Provide outreach programming effort to serve industry, public entities, and society as a whole • Provide safety education and training to traditional and non-traditional audiences • Develop electronic delivery systems for dissemination of technical and training information on injury and loss prevention	• Undergraduate and graduate students enrolled in the safety curriculum increases • Faculty and staff develop a local, national, and international reputation as the source for customized safety training and resources • Faculty and staff are recognized as experts in safety and loss prevention by industry, commodity groups, and rural populations • Industrial partnerships and sponsored projects/activities




THEME 6 – Implementing Values and Guiding Principles ***Values and guiding principles are at the heart of any successful learning, discovery, and engagement programming. The department's values and guiding principles are in harmony with Iowa State University's core values and those identified by the colleges of agriculture and engineering.***		
Goals	**Strategies**	**Success Indicators**
Boost diversity in people and thought	• Recruit non-traditional ABE students in at least 2 large Iowa high schools and through SWE • Target and develop several undergraduate scholarships for increasing our diversity • Develop/market curricula with broader appeal • Establish 2+2 programs with community colleges • Encourage international experiences for students and faculty • Encourage diversity in the department with visiting international scholars and relationships with 1890's and 1994's schools	• Percentages of women and minorities in the undergraduate program • Number of 2+2 programs with community colleges • Students and faculty with international experiences • Inclusion of a dean from an external institution and a representative of a 1890/1996 institution on the ABE Industrial Advisory Council • Partnerships and relationships that include diversity
Improve engagement with stakeholders	• Develop an advisory committee • Host an annual ABE industry appreciation day • Implement an outstanding alumni recognition program • Provide monthly/semester email updates to our stakeholders	• Accomplishments of the advisory committee • Participation in the annual ABE industry appreciation day • Quality and numbers of recognized ABE alumni • Monthly/semester communications with stakeholders
Advance learner-centered pedagogy and implement outcomes assessment	• Develop and implement outcomes assessment plan through existing curriculum committees • Provide departmental assessment/learning workshops • Allocate faculty release time and staff time for learning/assessment • Obtain further support to development of ABE Learning communities • Secure external funding for learning/assessment efforts (NSF, USDA, foundations, etc.) • Further emphasize SoTL through release time, resources, etc.	• Implementation outcomes assessment plan • Workshops offered on assessment/learning • Faculty release time • Grants dollars generated for ABE learning communities • SoTL papers published each year
Reinforce resources and departmental infrastructure	• New building – Just Do It! • Increased support staff in identified critical needs areas o an electronics technician for research and teaching technology o a professional student specialist for outcome assessments	• Groundbreaking for new departmental building • Positions funded and filled



Departmental Performance Objectives

This strategic plan outlines how the Agricultural and Biosystems Engineering department will achieve success on the six themes identified. The department will annually evaluate its plans and programs to ensure steady progress towards the vision and mission of this strategic plan. In addition to the success indicators outlined in each theme, the department will measure success with the set of key performance indicators given below.

Key Performance Indicators (2010 – 2015)
• 350 SCHs/teaching FTEs Agricultural and Life Sciences College • 30 AST students graduating/year and 60 IT students graduating/year • 100% student placement in profession at 6 months after graduation Agricultural and Life Sciences College • 100% of undergraduate technology students completing a professional internship of more than 400 hours • 10% of undergraduate technology students completing a study-abroad or international experience of 15 days or more • 15% of undergraduate technology students engaged in leadership roles in organizations/clubs/societies • 15% of technology undergraduates are women and 10% are minority
• 150 SCHs/teaching FTEs Engineering College • 35 AE students graduating/year and 15 BSE students graduating/year • 95% student placement at 6 months after graduation Engineering College • 85% of undergraduate engineering students completing a professional internship of more than 400 hours • 10% of undergraduate engineering students completing a study-abroad or international experience of 15 days or more • 90% of undergraduate engineering students passing the FE exam • 15% of undergraduate engineering students engaged in leadership roles in organizations/clubs/societies • 15% of undergraduates engineering students are women and 10% are minority • Receive accreditation for the B.S. degree curriculum in Biological Systems Engineering
• 3.0 Ph.D. or M.S. students/Faculty FTEs • 3.0 Peer-Reviewed Publication/Faculty FTEs/year • 100% Tenured/Tenured Track Faculty as PI or Co-PI for external funding • $7.0 million in departmental expenditures from External Funding • $0.25 million in awards from External Funding/Faculty FTEs • 85% of ABE faculty are participating in cross departmental or interdisciplinary cooperative programming efforts • 80% of ABE faculty traveling internationally per year
• 5 Extension Programs Achieving Positive Change • 5 Strategic[1] industrial/institutional/organizational partnerships • 50% of faculty providing leadership at national/international professional societies/organizations

[1]The ABE department defines our “strategic partnership” as a partner engaged in at least three of the following eight criteria. The eight criteria for strategic partnerships are: 1) engaged for 5 years or more, 2) representation on ABE external advisory committee, 3) hire ABE students interns every year, 4) hire ABE graduates every year, 5) participates in collaborative research for 200K/yr or more, 6) provides scholarships, endowments, or gifts to the department, 7) provides mentors for learning communities, senior design projects, or senior capstone projects, and 8) actively engaged with ABE student organizations, clubs, or societies.

Departmental Milestones

In addition to the success indicators outlined in each theme and the departmental performance indicators, the department will also measure success with a set of milestones given below. These are linked to the Agricultural and Biosystems Engineering department ability to achieve success.

Milestones (2010 – 2015)
• Replacement of faculty position in the area of advanced manufacturing by fall 2010 • Hire first teaching laboratory technician position by fall 2012 • Hire second teaching laboratory technician position by fall 2013 • Add two new endowed professorships by 2012
• Differential tuition for technology degrees approved by regents and implemented by Fall 2011 • Reach $13.5 million raised from private gifts by Spring 2012 • New Agricultural and Biosystems Engineering building construction started by 2011 • Move into new building before 2013

Historical Relevance of Department

Leadership in developing a discipline to apply engineering and agricultural sciences and technologies to biological systems has its roots in Iowa. At the turn of the 20th century this emerging discipline was focused on providing engineering solutions for mechanizing agriculture. This endeavor led to establishment of the agricultural engineering profession. In 1905, the name of the farm mechanics program within the Department of Agronomy at Iowa State College was changed to "Agricultural Engineering," and given department status. Dr. J. Brownlee Davidson joined the staff as assistant professor and head of this new department.

The 1906-07 college catalog announced "the degree of Bachelor of Agricultural Engineering," coordinated through the College of Engineering. This was the first agricultural engineering degree offered in the United States and Mr. Jacob E. Waggoner earned the first degree in 1910.

The Master of Science degree in Agricultural Engineering at Iowa State College was first offered in 1918. The Doctor of Philosophy degree was established in 1938 as a co-major between Agricultural Engineering and other departments. Dr. Henry J. Barre was the first recipient of a Ph.D. in Ag Engineering-Physics at Iowa State in 1938 and is believed to be the first Ph.D. recipient in Agricultural-Engineering in the United States. In 1962, the Ph.D. in Agricultural Engineering was offered as a single major. The Agricultural Engineering undergraduate curriculum at Iowa State became one of the first three accredited Agricultural Engineering programs in the United States in 1936 and has maintained accreditation by the Accreditation Board for Engineering and Technology (ABET) since that time. During 1974, the Agricultural Mechanization degree was developed and offered through the College of Agriculture.

July 1, 2004, marked the beginning of a new era in the history of the department when the Department of Industrial Education and Technology merged with the Agricultural and Biosystems Engineering Department. This merger added a National Association of Industrial Technology (NAIT) accredited technology degree along with a master and doctorate degree programs in technology. In 2008 the department reaccredited the Industrial Technology degree with two options and accredited for the first time a technology program with agriculture in the title, Agricultural Systems Technology with two options. Also in 2008, the department established the Biological Systems Engineering degree program.

Through 2009, 1,819 agricultural engineering students have received their Bachelor of Science degrees in Engineering at Iowa State University, 475 students have graduated from the Agricultural System Technology program, and 855 students have graduated from the Industrial Technology program. The M.S. agricultural engineering degree has been awarded to 493 students and 237 students have been granted the agricultural engineering Ph.D. from the Department. These Engineering graduates form one of the largest alumni groups of any Agricultural Engineering Department in the United States. The M. S. technology degree has been awarded to 51 students and 97 students have been granted the technology Ph.D. from the Department. These Technology graduates are distributed around the world as academic and industry leaders.

The Iowa State Agricultural Engineering Department is currently ranked in the top 5 engineering departments in the nation. Departmental statistics for several years:

Category	1990	2003	2006	2009
1) Total Faculty	23	24	30	30
Undergraduate enrollment	98	264	506	538
Graduate enrollment	41	39	75	82
2) Total FTE				
Teaching	7	9	13.35	12.10
Research	9	9	13.95	14.05
Extension	7	4	2.7	2.85
3) Ranking US World News Report				
Undergraduate programs	na	5	na	4
Graduate programs	na	9	na	3

Summary

The Agricultural and Biosystems Engineering department celebrated the 100th year anniversary in 2005. During that time the department has lead the way in many endeavors that supported the profession, served the stakeholders, and contributed to the university. It is through the updated strategic plan that the department continues its second century of service with expectations of continued leadership. This department remains committed to the Land Grant philosophy of serving the people of Iowa, our nation, and the world through learning, discovery, and engagement, especially as human needs become more global in nature and population growth requires increased food supplies and security.