2012
Department of Biosystems and Agricultural Engineering
Periodic Program Review

Submitted March 2013

Self Study

Department of Biosystems and Agricultural Engineering Periodic Program Review
Self-Study Report Checklist

Background: The self-study document is the primary resource used by the external review committee to complete the second phase of the program review process. The better the quality of the self-study the more likely the work of the review committee will be productive and yield helpful feedback for the unit.

This checklist is provided as a guideline for items to include in self-study documents. It is intended **to be useful to the full range of programs that undergo review on our campus. Further, it reflects the** required elements identified in part 4 of AR II-1.0-6.

This checklist may also be used to identify elements of accreditation reports that are acceptable substitutions for required elements of the self-study.

Submitted for:
Unit Name: Biosystems and Agricultural Engineering
By: Sue E. Nokes, Chair
Date: October, 2011

Year of Program Review: 2011-2012

Name of Accreditation Agency: (if applicable) ABET

List or describe documents available for review: Self-Study and ABET Self-Study

Unit Self-Study Report Checklist

This narrative must describe, analyze and synthesize information about the unit. The report should include the components detailed below. Some documents may be tabled features within the text. Others may be featured as appendices. An electronic version of the report and supporting documentation is required for archival purposes.

Part 1	**Included (✓ or NA)**	**Page(s)**	**Other Comments**
Executive summary	✓	ii	
• Brief account of self-study process	✓	ii	
• Committee composition names and Affiliation	✓	ii	
• List of major recommendations	✓	ii	

Written Summary Report *This narrative report must describe, analyze and synthesize information about the unit. The report should include the components detailed below. Some documents may be tabled features within the text. Others may be featured as appendices. An electronic version of the report and supporting documentation is required for archival purposes.*	**Included (✓ or NA)**	**Page(s)**	**Other Comments**
Program Documents	✓	p. 1	
• Strategic plan	✓	p. 25, 45	
I. Mission Statement	✓	p. 45	
➢ Instruction	✓	p. 45	
➢ Research	✓	p. 45	
➢ Service	✓	p. 45	
II. Goals/Objectives	✓	p. 45	
III. Criteria for measuring progress	✓	p. 45	
• Organization chart/Structure	✓	p. 1	
• Annual reports (SPRS or other) since the last Self-Study (List years of any missing reports:_____)	✓	p. 31	
Resources	✓	p. 15	

• **Budget** summary information & adequacy	✓	p. 27	ABET p. 50
• **Facilities** summary information & adequacy	✓	p. 26	ABET p. 48
• **Equipment** summary information & adequacy	✓	p. 26	ABET p. 113
• **Personnel** summary information & adequacy *(including faculty & staff numbers & demographics)*	✓	p. 15	
• **Support from other university units essential to effective operations** *(e.g. research, engagement, development, alumni affairs, human resources, facilities management, financial units, and information technology)*	✓	p. 27	
Input from Affected Constituents	✓		
• Evaluation data from **faculty**	✓	p. 49	
• Evaluation data from **staff**			
• Evaluation data from **students**	✓		ABET p. 19
Adherence to Policies and Procedures	✓		
• Evidence of adherence to **educational policies and procedures** established through the faculty governance process *(including consistency in applying policies related to grading, probation, & termination)*	✓		ABET p. 27
• Evidence of consistent review and monitoring course substitution, course equivalency credits and course transfers toward degree completion	✓		ABET p. 11
• Evidence of adherence to procedures on **faculty personnel actions and budget request preparation** *(established jointly by the unit faculty and the unit head)*	✓	p. 21	
Evaluation of Quality and Productivity	✓		
• Evidence of quality of collegial environment *(include climate for equity and diversity)*	✓	p. 18	

• Evidence of quality & productivity in instruction, research, public service, or operations *(as applicable, include degree program enrollment, student credit hours generated, retention rates, degrees awarded, grant and contract awards, outreach and engagement activities, and operational efficiencies)*	✓	p. 15	
• Evidence of Distance Learning Review of Distance Learning course offerings, services and outcomes to ensure compliance with best practices, SACS policies, and federal rules	N/A		
• Quality of faculty & staff employees, communications and interactions	✓	p. 18	
• Quality of orientation, advising and other student service programs	✓		ABET p. 11
• Quality of student learning outcomes (go to part 2)	✓		ABET p. 22
• Evaluation of course grade distribution by level and rank. Identify strategies to monitor grade distribution	✓		ABET
Analysis of Strengths and Recommendations for Quality Enhancement			
• Summary of strengths	✓	p. 49	
• Recommendations for quality enhancement	✓	multiple	Recommendation sections through-out self-study

Part 2	**Included (✓ or NA)**	**Page(s)**	**Other Comments**
Student Learning Outcomes (Program Level)	✓		ABET p. 22
• Undergraduate Student Learning Outcomes statements for each degree program offered	✓		ABET p. 15
• Graduate Student Learning Outcomes statements for each degree program offered	✓	p. 18	
• Curriculum Map (Course X Objectives Matrix demonstrating alignment of goals with instructional sequences)	✓		p. 36 ABET

• Assessment Results	✓		
I. Implementation plan for all major instructional objectives	✓		p. 27 ABET
II. Summary of major findings/results	✓		p. 28 ABET
III. Communications regarding key results	../		p. 30 ABET
IV. Follow-up action taken	../		p. 28 ABET

BIOSYSTEMS AND AGRICULTURAL ENGINEERING

DEPARTMENTAL REVIEW
SELF-STUDY DOCUMENT
2011

EXECUTIVE SUMMARY

SELF-STUDY PROCESS

Our department has a somewhat unique administrative structure, whereby the majority of our administration is through the College of Agriculture, however our degree program is administered through the College of Engineering. As part of the engineering college, our department undergoes a thorough on-site accreditation review conducted by ABET, the Accreditation Board for Engineering and Technology. Our department underwent this accreditation review in 2010, and the majority of our self-study regarding the undergraduate curriculum was conducted in conjunction with that visit. Dr. Sue Nokes was then serving as the Director of Undergraduate Studies, and Dr. Czar Crofcheck was the Chair of the Undergraduate Curriculum Committee. These two individuals worked closely with faculty to create the self-study for ABET. The remainder of the self-study was written by the Department Chair, with the assistance of faculty and staff as needed.

COMMITTEE COMPOSITION NAMES AND AFFILIATIONS

Internal Committee: Sue Nokes, Chair; Czar Crofcheck, Director of Undergraduate Studies; Dwayne Edwards, Director of Graduate Studies; Mark Purschwitz, Extension Head; Julie Tolliver, Departmental Business Officer; Dustin Mattingly, Student Services Coordinator.

External Committee: Gary Palmer, Assistant Dean of Extension (Committee Chair), College of Agriculture; Mark Purschwitz, Extension Head, BAE; Mike Montross, Associate Professor, BAE; Larry Holloway, Professor and Chair, Electrical Engineering; Seth DeBolt, Associate Professor, Horticulture, and Alicia Modenbach, PhD Candidate, BAE.

LIST OF MAJOR RECOMMENDATIONS

1. Work with the Career Services office in the College of Engineering to develop a more robust internship program by canvassing our alumni.
2. Develop alternative models to support the Ag Development Board while providing financial support for program development or delivery.
3. Balance the drive for grant dollars with targeted opportunities so that publications rates, our primary metric of productivity, are maintained at the current high levels.
4. Continue successful recruitment of domestic graduate students while capitalizing on opportunities to bolster graduate student enrollment with selective, high quality foreign nationals.
5. Update the Departmental Rules of Procedure to reflect recent changes in committee structures, including the creation of a Promotion and Tenure Committee, and the combining of the Research and the Graduate Committees.

TABLE OF CONTENTS

DEGREE PROGRAMS AND STUDENT LEARNING

OVERVIEW

The Biosystems and Agricultural Engineering (BAE) Department is fortunate to enjoy a structure where our undergraduates are in a position to take advantages of opportunities in both the Colleges of Agriculture and Engineering (Fig. 1). In accordance with the Accreditation Board for Engineering and Technology (ABET), the BAE undergraduate program is accredited under programs in the College of Engineering, and as such our students are enrolled in and receive degrees from the College of Engineering. Funding for undergraduate instruction in the BAE program is borne by the College of Agriculture. Additional benefits that accrue to the BAE program are the extended scholarship opportunities for BAE students in both colleges, and an expanded pool of entering students from recruiters in either College. Within the Department, the Director of Undergraduate Studies, Dr. Czar Crofcheck, works to insure that students are progressing with regard to the timely completion of degree requirements, and that the curriculum is administered in keeping with University, College, and accreditation requirements.

The Graduate degree program is administered through the Graduate School. Support for graduate students is derived from several sources including tuition scholarships from the Graduate School, tuition and graduate assistantship form state and federal resources provided through the College of Agriculture, and competitive grants. Dr. Dwayne Edwards, Director of Graduate Studies, is responsible for tracking the progress from the application process through to completion of degree requirements in keeping with the policies of the University, Graduate School, College, and Department.

In addition to the above degree responsibilities, the BAE program also provides service-related instruction for other degree programs within the College of Agriculture, which are further described below.

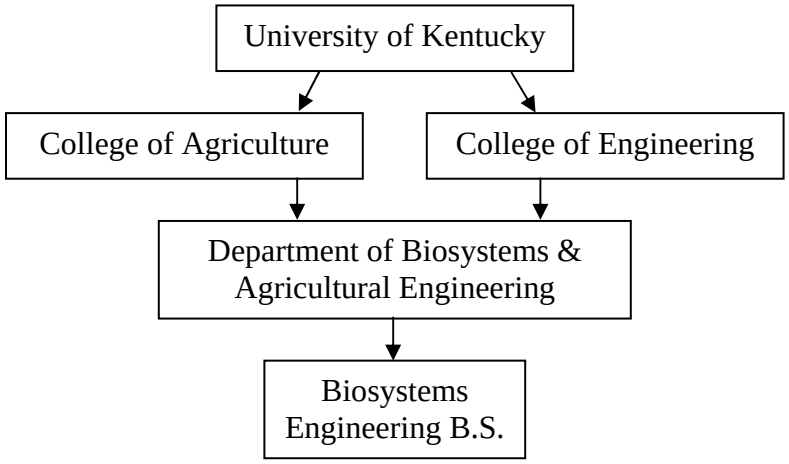


Figure 1. Organizational Administrative Structure of the Biosystems Engineering Program.

Table 1.1: Biosystems and Agricultural Engineering Majors by Gender and Ethnicity								
Calendar Year		2005	2006	2007	2008	2009	2010	2011
Bachelor's	Female	27	20	23	18	27	27	30
	Male	47	43	53	49	34	37	65
	TOTAL	74	63	76	67	61	64	95
Master's	Female	4	7	10	10	6	7	5
	Male	12	13	13	14	10	11	13
	TOTAL	16	20	23	24	16	18	18
Doctorate	Female	2	2	2	3	5	4	3
	Male	11	6	4	2	5	7	7
	TOTAL	13	8	6	5	10	11	10
Post-Doctorate	Female	3	2	2	2	1	1	1
	Male	5	4	6	2	1	0	1
	TOTAL	8	6	8	4	2	1	2
TOTAL		111	97	113	100	89	94	125
Bachelor's	Nonresident Alien	0	0	0	0	0	0	0
	African American	3	3	3	3	3	2	3
	Asian	3	3	2	0	1	2	4
	Hispanic	0	0	0	0	0	1	3
	White	67	57	71	64	57	58	83
	Missing	1	0	0	0	0	1	2
	TOTAL	74	63	76	67	61	64	95
Master's	Nonresident Alien	3	3	4	4	2	3	5
	African American	0	0	0	0	0	0	0
	Asian	1	1	1	1	1	1	0
	Hispanic	0	0	0	1	1	1	0
	White	12	16	18	18	12	13	13
	Missing	0	0	0	0	0	0	0
	TOTAL	16	20	23	24	16	18	18
Doctorate	Nonresident Alien	2	2	3	2	6	4	1
	African American	0	0	0	0	0	0	0
	Asian							
	White	8	5	3	3	4	5	5
	Missing	3	1	0	0	0	1	1
	TOTAL	13	8	6	5	10	11	10
Post-Doctorate	Nonresident Alien	6	5	4	1	1	1	2
	White	0	0	0	0	0	0	0
	Missing	2	1	4	3	1	0	0
	TOTAL	8	6	8	4	2	1	2
MAJOR TOTALS		111	97	113	100	89	94	125

For reference, student enrollment, by gender and by ethnicity, are provided in Table 1 for undergraduate, graduate, and post-doctoral categories. Females comprise about 31% of the student population (up from 25% in 2004). Minorities are underrepresented in all programs, for example 4.2% undergraduate population was African American in 2011 (essentially equal to the % in 2004), and four Hispanic students were in the program during this review period. Asian enrollment numbers in the undergraduate program are also low. The graduate program enrolled 1 African American, 3 Hispanics and 0 Asians over the review period. University data for the Ph.D. program also have a "missing" category that is unexplained.

B.S. Program

The Biosystems and Agricultural Engineering curriculum meets the requirements set forth in *ABET Criteria for Accrediting Engineering Programs 2010-2011*. The self-study prepared for our recent accreditation visit presents a listing of the basic curriculum of the BAE Bachelor of Science program by semester. Required BAE-UK courses in calculus, and basic sciences total 44 semester credits and therefore meets and exceeds the 32 credits required under ABET Criterion 5. Similarly, the BAE-UK program curriculum requires a total of 51 semester credits of engineering science and design courses (minimum possible and still receive a degree), also meeting and exceeding the 48 credits required by Criterion 5. The balance of program curriculum requirements are writing and oral communication (8 credits), university social studies, humanities and cross-cultural requirements (15 credits) and one free supportive elective (3 credits). The BAE program received a full 6-year accreditation as of July 1, 2011. A copy of the self-study report utilized by the review team is available at the following URL: http://www.bae.uky.edu/academics/abet/BAEUKSelfStudyReport2010June18.pdf.

The BAE program requires students to complete a two-course, four-credit capstone design sequence. One of three credits of oral communication required by the university is satisfied by this sequence. Students receive instruction in preparing and delivering technical oral presentations and are required to present four formal presentations of their design work (proposal, preliminary design, progress, and final design). Students are assigned to three- or four-person teams and select problems submitted by professional advisors. The student teams research the problems and propose design solutions, specifying measurable design requirements. Design solutions are developed and presented for evaluation. After responding to recommendations of the professional advisors and the instructor, design prototypes are fabricated or constructed. The student teams design and conduct experiments whereby the prototypes are tested to assess the attainment of design requirements. Student teams prepare a final design report, as well design drawings and specifications.

The capstone design sequence consists of 1 hour per week of lecture and two hours per week of team collaboration. Instruction is presented in team roles and teamwork, technical oral presentation, technical writing, design modeling, design analysis, estimating design costs, selection of design materials, design reliability, statistical hypothesis testing, engineering ethics, environmental protection, design safety, multidisciplinary design teams, and other topics. Students evaluate themselves and their peers' relative contributions to the design effort. The professional advisors meet with the design teams throughout the two-semester period to offer suggestions and advice. Finally, the advisors are asked to complete a survey whereby they

evaluate their student team with regard to various educational outcomes.

The BAE student branch encourages students to join one of three professional societies, namely American Society of Agricultural and Biological Engineers (ASABE), American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE) or Institute of Biological Engineers (IBE). Regular biweekly meetings of the student branch are held during the academic year, with officers elected to represent the Engineering Student Council and the Agriculture Student Council. Faculty involvement with student branch activities includes facilitation of meetings and topics, assistance with fund-raising, and organization of annual regional trips (typically the Southeast Regional Student Rally and the Midwest Regional Student Rally). Each year a different faculty member is the primary advisor, with prior year and next year advisors also involved for continuity.

Students have also been actively involved in the annual ASABE ¼-Scale tractor design competition. This competition draws membership from the full array of BAE undergraduates, not only those with a machinery systems focus. They are involved in all aspects of the project, including securing the majority of direct expenses. Several faculty (Shearer (through 2011 competition), Wells, and Stombaugh) and engineers on staff assist the students.

A grant from the U.S. Department of Education, in concert with the Brazilian CAPES Foundation was awarded to a multi-state, multi-national and multi-institutional group of engineering educators. Led by faculty at the University of Kentucky, and the Federal University of Viçosa in Brazil, the project includes six Universities in the two countries and eighteen faculty. The Consortium has developed semester-long exchanges for both US and Brazilian students to learn engineering design and analysis, with credit applied to their home institution program. A major component of the US grant is to facilitate increased cooperation between colleagues in Brazil and the United States. At UK, student exchanges began in August 2004, and continues through today. The project web site is: www.bae.uky.edu/FIPSE.

The BAE Department has an excellent record of placing its graduates in industry. For example, recent graduates specializing in the Machine Systems Automation area found employment with John Deere Company, CNH America LLC, LinkBelt, Hyster-Yale, Altech Industries, Cummins, Firestone, FKI Logistex (E.C. Matthews Company), Ohi Atwood, YH America, AP Technoglass, and Toyota Motor Manufacturing. Similarly students from the Controlled Environment area have been employed by Trane, and several local engineering/HVAC firms. Students specializing in Food and Bioprocess Engineering are employed with Chiquita, Haskell Construction, and Martek. Graduates who specialized in the Bio-Environmental option of our program are employed in a variety of consulting firms in the Central Kentucky region including Fuller, Mossberger, Scott and May, Tetra Tech EM Inc., CDP Engineers, GRW Engineers, and Mac Tech. In addition we have placed graduates in this area with Carroll Engineering in Philadelphia, NRCS in Georgia, and the Lexington-Fayette Urban County Government here in Kentucky, and the Kentucky Natural Resources and Environmental Protection Cabinet. Many BAE graduates pursue graduate degrees, typically either in Biosystems Engineering or in Biomedical Engineering.

M.S. and Ph.D. Programs

The BAE Department offers programs leading to both M.S. and Ph.D. degrees in Biosystems and Agricultural Engineering. The official graduate student enrollment in Fall, 2010 was a total of 29 (11 PhD and 18 MS), roughly 80% of whom are domestic students. A total of 34 (7 PhD and 27 MS) graduate degrees have been awarded over the past five years.

To aid in graduate student recruitment, our department initiated a graduate student recruitment weekend in the Spring, 2010. Of the five students attending the event, 3 enrolled in graduate school this fall, and the other two have yet to finish their previous degree to be eligible for graduate school. This year we moved the graduate student recruitment weekend to the Fall semester, because we lost several good candidates by holding our recruitment weekend in the Spring – they had already decided on a graduate school before our event occurred. Fall, 2011 we had four prospective graduate students attend: from Michigan, Illinois, Florida, and Kentucky.

All BAE faculty are members of the Graduate Faculty, with nearly all being full members. BAE faculty are involved in instructing a total of over 20 regular graduate courses that collectively provide advanced information on all specialties within the department. Each BAE faculty member is actively engaged in graduate programs from the standpoint of advising, graduate committee service, graduate instruction, or a combination of activities.

BAE graduate students are supported by assistantships through a combination of external and internal funds. Additional support is provided in the form of tuition scholarships (most of which are borne by the Department or through Dean's credits). Graduate students have access to the range of available Departmental support: current computing hardware and software, wireless internet access, laboratory facilities and equipment, technician and engineering support, fabrication support, and excellent office space.

Service Courses

The BAE Department teaches a variety of service courses in support of the greater College of Agriculture's mission of educating students to work in the food and fiber industries, along with protecting the natural resource base. Examples of such coursework include AEN 103 for Landscape Architecture majors, AEN 220 and 252 for Agricultural Education majors, AEN 340 for Animal/Food Science majors, and AEN 462 for Plant and Soil Science majors. A course in Precision Agriculture was added during this review period, at the 500 level, which is cross listed with Agricultural Economics (AEC) and Plant and Soil Sciences (PLS).

Recommendations

The undergraduate program is fundamentally healthy. More active recruitment and changing our undergraduate program name to Biosystems Engineering have helped to build student enrollment compared with our previous two reviews. Continued emphasis on recruitment is recommended. We have initiated work with the Career Services office in the College of Engineering to develop a more robust internship program by canvassing our alumni.

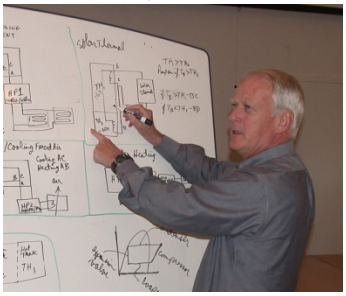
The graduate program has a high proportion of domestic graduate students. A significant

challenge to our graduate program is the level of funding needed to attract students, compared to the cost of post-doctoral scholars. The danger is that in faculty's efforts to attract extramural funding we increase the number of post-doctoral scholars and professional staff at the expense of funding graduate students.

RESEARCH AREAS

FACULTY SPECIALIZATIONS

In general all research efforts can be rather loosely grouped into one of four major thrusts; Controlled Environment Systems, Machine Systems Automation Engineering, Food and Bioprocess Engineering, or Bioenvironmental Engineering. While these grouping, suggest segmentation of the overall research program into four major areas, expertise of individual faculty members often straddles two or more groupings. The following list provides an overview of current faculty expertise.

Table 2: BAE faculty members areas of expertise	
Carmen Agouridis, Ph.D. 	My program focuses on using applied research to address current issues in the natural resources community, particularly in the field of ecosystem restoration as it applies to streams impacted by mining, urban or agricultural activities; wetlands; and mined land reclamation. My research is also examining methods of improving stormwater management using green infrastructure such as rain gardens and stormwater wetlands as well as novel approaches such as weep berms and woodchip bioreactors. Additionally, I work in the area of geospatial analysis as it pertains to environmental impacts from grazing livestock and identification of headwater stream types (e.g. ephemeral, intermittent, and perennial).
Don Colliver, Ph.D. 	I work with residential housing and environmental design; analysis and simulation of building envelope heat transfer and renewable energy production and use, and analysis of building design weather data. My principal research area is in the determination of appropriate design and operation of energy efficient and healthy buildings; I have a special interest in solar energy.
Czar Crofcheck, Ph.D. 	Some of my research emphasis at UK is in bioprocessing, specifically downstream processing of value-added proteins and the conversion of biomass to chemicals and fuels. My other area of interest is in biomass conversion. The conversion of agricultural and forestry biomass into value-added chemicals and materials holds great promise for increasing industrial sustainability and increasing markets available for US producers. In one project, we are focusing on the thermochemical conversion of biomass to value-added chemicals and materials by catalytic mediated liquefaction (CML), emphasizing the yield of heavy products.
Dwayne Edwards, Ph.D. 	My research is in the area of surface water hydrology, water quality and statistical analysis. I use plot, field and watershed-scale studies and data to assess the impacts of both agricultural and urban activities on the quality and quantity of storm runoff. I am also involved in using simulation models to describe those impacts and to improve their usefulness by using statistical techniques to improve the quality of model predictions.

Sam McNeill, Ph.D. 	I maintain a broad-based program that includes engineering aspects of grain production, harvesting and post-harvest processing systems (handling, drying, and storage) and link new technologies with precision agriculture and grain production. My expertise has led me to share my work and gather data in Nigeria and Ghana.
Mike Montross, Ph.D. 	My research can be divided into two main areas: 1. Drying, storage, and granular mechanics of grains and oilseeds, and 2. Biomass collection, characterization, and processing. Two specific new areas of research are to create controlled environment experiments designed to simulate environmental conditions for different regions of the US to be performed for switchgrass and forage sorghum and to obtain new field and laboratory data to refine and calibrate a science-based model for determining the packing of grains within upright storage structures.
Sue Nokes, Ph.D. 	Dr. Nokes' lab works on converting bioresources into industrial chemicals (cellulases) and fuels (ethanol and butanol). Her group looks at enzymatic conversion and fermentation of plant biomass, including the mathematical modeling of kinetics and microbial metabolism.
Doug Overhults, Ph.D. 	My extension research studies and aids Kentucky livestock and poultry growers and the challenges faced in adapting to rapidly changing housing systems and environmental standards. I work out of the UK Agricultural Experiment Station in Princeton, Kentucky.

Fred Payne, Ph.D. 	Dr. Payne's research area includes development of optical sensors for food process control. More recently, he has been project director of two food safety engineering projects including the development of a milk transport security system for securing milk between the farm and processor, and a project for developing optical technology for detection of microbial contamination in food matrices.
Mark Purschwitz, Ph.D. 	Safety is my area of interest; I am involved with extension and applied research programs in agricultural safety and health, particularly in the prevention of traumatic injuries involving farm tractors and machinery. Currently, I have been conducting research on the prevention of occupational disease and injury among agricultural workers and their families and have studied how to develop, implement, and evaluate education and outreach programs to promote the safety and health of agricultural workers and their families.
Tim Stombaugh, Ph.D. 	Dr. Stombaugh conducts research and extension programs in the area of Precision Agriculture. In particular, he is interested in the performance of GPS receivers and associated systems such as automated steering systems and automatic section control. He has also worked with remote sensing platforms and field-based sensors.
Joe Taraba, Ph.D. 	Working as an Extension Professor, my area of expertise is manure management methodologies, including microbial dynamics, composting and anaerobic treatment. I have led a 10-year study of water quality impacts from livestock on the Animal Research Center. My team has developed a multidisciplinary research and extension program focused on compost bedded pack barn management. I have led the Environmental Stewardship session of a 9 session Master Cattleman Program. I have an interest in biofilters and the impact of barn design on CBP.

Steve Walker, Ph.D. 	My current research focuses on finding new ways to detect and identify pathogens and toxins in food. Our team is working on optimizing the extraction of bacteria from food and using hyperspectral imaging to identify the bacteria. In general, I am interested in sensors and control systems related to food and agriculture.
Richard Warner, Ph.D. 	My three main research areas are: • Design, monitoring and modeling of surface water, erosion, sediment and water quality control systems for large-scale land disturbance, • Designing surface mines to enhance environmental protection and minimize hydrologic and water quality impacts, and • Flocculation systems to increase effectiveness of sediment ponds.
Larry Wells, Ph.D. 	Soil-machine interaction and burley tobacco mechanization are my two principal areas of interest. I conduct research to develop an economical method of assessing soil compaction. Soil penetration resistance data is costly to acquire, thus we are attempting to develop a means by which producers could measure soil resistance during field operations such as planting. A prototype mechanical harvesting system for burley tobacco has being fabricated. We are designing a high-capacity mechanical system for processing cured burley tobacco.
John Wilhoit, Ph.D. 	The focus of my research program in the area of Specialty Crops Mechanization is on mechanization innovations to help reduce manual labor requirements and improve production. Research activities in burley tobacco production are investigating new harvesting and stripping concepts. Research activities in vegetable production are looking at lower cost automation and mechanization to benefit the widely diverse operations of market growers (selling at farmers markets, on-the-farm, and through CSA's).

RESEARCH PROGRAM RECOMMENDATIONS

The UK-BAE research expenditures increased by 88% over the previous periodic review period ($1,195,214 and $2,252,334 five year averages in 2003-2004 and 2010-2011 respectively). Our department is fortunate to have skilled staff to work with faculty to ensure compliance of regulations, timeliness in spending, and related grant administration. The faculty should continue to build on key strength areas in their research programs, and continue to engage in both primary and collaborative projects.

EXTENSION PROGRAMMING

The BAE Extension program provides a unique service by applying sound engineering principles and practices to the entire Kentucky Cooperative Extension Service and their clientele as well as taking an active roll in providing practical uses for basic engineering research results through applied research. BAE faculty cooperate with Agricultural Economics, Animal Science, Forestry, Entomology, Family and Consumer Sciences, Plant Pathology, and Plant and Soil Science faculties and county Extension personnel in educational activities and applied research related to engineering aspects of crop production, livestock production systems, energy conservation and environmental stewardship. The BAE Extension focus areas include agricultural weather, energy issues, farm safety, grain storage systems, hay storage, irrigation systems, livestock systems, precision agriculture, residential housing, tobacco equipment and facilities and water quality.

In addition to Extension publications, the BAE Extension program makes extensive use of the Web as a distribution tool. Web sites have been developed to support the precision agriculture, radon and energy programs. Whenever possible the BAE Extension program includes their PowerPoint presentations on the Web. The department has made some purchases of software to enhance the ability to create Web based presentations and Web based decision aids.

Irrigation Systems **-** As the interest in alternative crops has increased so has the demand for more information on irrigation systems, more specifically drip irrigation systems. To meet this demand the department provides an irrigation program that focuses on teaching the agents basics of drip irrigation systems by having them participate in hands-on training and in demonstration field days in addition to providing provide basic design assistance. Contact: Richard Warner

Livestock Systems **-** The department continues to have an Extension program that focuses on livestock building ventilation, layout and design. In addition, the department has been a participant in the Master Cattleman Program, presenting the Environmental Stewardship component. The primary focus issues are the stream riparian zone management for grazing systems, alternate water supply, winter paddock management, and geotextile gravel pads for high traffic areas and stream crossings. There is an increasing emphasis placed on the design of manure handling and treatment systems which has resulted in an increased level of support provided by the department. At this time there is a major effort related to the planning of buildings to reduce odorous emissions including involvement nationally in applied research project related to poultry production facilities. Contact: Doug Overhults/Joseph Taraba.

Precision Agriculture **-** One of the newer program areas being supported by the department is precision agriculture. Among the topics covered in this program have been yield monitoring capabilities. This work has included conducting on-farm research, drawing meaningful conclusions from the results and disseminating this information to other producers. Another topic of interest by producer has been variable-rate technology (seed, fertilizer and chemicals) to optimize grain production while considering the economics of variable-rate practices. The department's work on this program is nationally recognized for its quality. The use of grant funding the program has been able to develop a portable GPS/GIS training lab. This has resulted

in a high quality training experience for producers and agents. Contact: Tim Stombaugh

Biomass Education Modules – On-line courses have been developed to teach Fundamentals of Biorenewable Resources, Thermochemical Processing, Biofuels Production and Properties, and Life Cycle Analysis. Contact: Sue Nokes

Educational Programs in Stored Grain Management - Kentucky's grain farmers produced over 225 million bushels of corn, grain sorghum, soybean, wheat and barley in 2003, which is conservatively valued over $ 850 million. Educational programs have focused on sound management practices to preserve the quality and value of grains held in storage and have been presented to farmers, grain buyers, mill managers, elevator operators, bankers and extension educators in 7 county and state-wide meetings (approximately 425 attendees). One impetus for county meetings was to assist farmers with decisions on upgrading grain handling equipment or increasing drying or storage capacity to help compensate for income lost from reduced burley tobacco production. An ongoing multi-state program involves a team of research and extension agricultural engineers and extension entomologists in Kentucky and Tennessee to lead educational efforts on stored wheat management issues. To identify focus topics, a survey of 52 wheat growers and stored grain managers was conducted to assess equipment sanitation practices, bin loading and unloading methods, aeration strategies, and grain monitoring tactics. Survey respondents managed a total of over 4.6 million bushels of wheat from 96,000 acres. As a result, farmers and elevator operators are modifying their storage practices that will result in higher quality grain and lower costs. Extension engineers on this multi-state team developed an animated PowerPoint® presentation to illustrate proven stored grain management practices suitable to Kentucky producers. This presentation is posted on UK's BAE/Stored Grain web page (http://www.bae.uky.edu/ext/GrainStorage/) and received a Blue Ribbon Award by the American Society of Agricultural Engineers' educational aids competition in 2003. Contact: Sam McNeill.

Tobacco Equipment and Facilities - While a traditional program in our department, work on tobacco handling and curing systems is undergoing review. Over the past year major updates and additions on harvesting and curing technology have been added to the department's Extension web site. The question the department must now answer is the future needs for this program given the significant changes in tobacco production industry. Contact: John Wilhoit.

Ag Weather Center - The Ag Weather Center is devoted to providing the weather information needed by CES clientele to aid their decision process. One of the latest enhancements has been the creation of a precision agricultural forecast for every county in the state. To meet the changing needs of the agriculture, they recently added a forecast for fungus spraying conditions to assist in addressing the soybean rust problem. Contact: Tom Priddy.

GPS/GIS Training - Funding was secured to create a mobile training lab for Global Positioning System (GPS) and Geographic Information System (GIS) technologies. Trainings have been conducted for various audiences including Government and Utility Officials, County Agents, Farmers, and College, High School, and Middle School students, as well as 4-H Youth

Development programs. Applications of these technologies range from production agriculture ("precision agriculture") to land use planning, zoning and permitting. The College's GIS instructor provides training for the entire state. Contact: Timothy Stombaugh.

BMP Demonstrations for Suburban Horse Farms – With nearly 200,000 horses in Kentucky, an interdisciplinary team is needed to provide the horse owner with the training and information needed to implement sound management decisions that enhances horse well being and protects the environment. In cooperation with the Department of Animal and Food Sciences, Best Management Practices (BMPs) for water quality protection are being implemented on several suburban horse farms in the central Kentucky area. These farms will be used as the site for educational programs and demonstrations to transfer and promote the knowledge that will be essential for practical strategies and techniques to improve manure handling and reduce mud and runoff, implementation of small composting operations, construction of managed stream crossings, limiting the access of horses to environmentally sensitive areas, and implementation of basic paddock management. Contact: Steve Higgins.

Residential Housing **-** The department's work in the residential housing area has shifted to energy efficiency (conservation) and indoor air quality issues. This work is closely integrated with the department's research efforts in renewable energy and energy efficiency. The energy conservation work is focused on proper insulation levels and techniques and proper sizing of HVAC systems. The indoor air quality work focuses primarily on mold and humidity control. Contact: Robert Fehr.

Energy Issues **-** The department has established a strong working relationship with State Office of Energy Policy in the Commerce Cabinet to develop programs that deal with energy conservation. Through grant funding from this agency the department has been able to hire a full time staff member to provide energy conservation programs throughout the state including some non-traditional Extension audiences such as Home Builder Associations, Realtor Associations, energy suppliers, etc. As a component of this program a major display has been created for the Kentucky State Fair. Contact: Robert Fehr.

Kentucky Extension Disaster Education Network **-** Selected as point-of-contact for the National Extension Disaster Education Network (EDEN) committee developed a committee of specialists in the college to address and improve Kentucky's preparedness for agro-terrorism and natural disaster. After receiving several grants from HRSA and building partnerships with the National Weather Service, UK Medical, University of Louisville, the state Public Health service and the state's Emergency Managers, the committee has established multiple training programs across the state. Created the KY EDEN web site to provide agro-terrorism and nature disaster preparedness training resources and safety tips for CES and Kentucky residents. Also, at the request of the state Emergency Managers, created 120 county severe weather web pages for all first responders, first detectors and storm spotters in Kentucky. Contact: Tom Priddy.

StormReady Program **-** As UK campus StormReady coordinator, lead the campus weather preparedness program using resources from Fayette County emergency manager's office,

students from the meteorology course, and staff in the UK Agricultural Weather Center. Identified severe weather safe places on all floors of over 300 campus building, placed over 250 NOAA weather radios in campus buildings including all dorms, fraternity/sorority houses and classroom buildings. Worked with National Weather Service (NWS) to train all campus first responders with severe weather training. After completing all NWS StormReady criteria, become this effort resulted in UK becoming the fourth university in the nation to be StormReady Campus Certified. Contact: Tom Priddy.

StormReady Supporter Certification **-** Worked with all National Weather Service (NWS) offices in Kentucky to create the StormReady Supporter Certification criteria for Cooperative Extension Offices. The criteria, developed by the UK Agricultural Weather Center, were accepted by the NWS to be used by CES in improving preparedness for county Extension offices across the state. Presented this program at the National Extension Disaster Education Network (EDEN) meeting in November 2005, so all Cooperative Extension offices in the nation would have specific preparedness criteria to complete the StormReady supporter certification. Contact: Tom Priddy.

Water Quality – As a result of the unique geology of Kentucky, groundwater quality is a significant issue addressed by an Extension program in the department. This program includes both educational efforts as well as applied research in areas that include: microbial dynamics of waste, pollution potential and waste management systems. The Environmental Stewardship component of the Master Cattleman Program, previously described, addresses the water quality impacts of cattle grazing systems. In addition, the new US EPA Concentrated Animal Feeding Operations regulations are part of this program. Contact: Joseph Taraba.

Mined Land Reclamation - Approximately 2,000 acres of high-value hardwood trees, on currently mined and reclaimed areas, are being established and monitored for survival and growth. Reclamation methods are being modified by changing current practices, which result in compaction and low tree survivability, to loose dumped spoil which produces a surface topography with 3- to 5-ft depressions. Additionally, ripping of previously reclaimed lands is enhancing tree-growth potential. Peak flow and runoff volume, infiltration rates, sediment loading and effluent sediment and water quality concentrations are being monitored at 11 sites throughout the Commonwealth. These sites consist of various slopes and reclamation techniques. Furthermore, innovative control techniques are being investigated that, not only reduce the potential for flooding, but enhance sediment trapping efficiency and harvest runoff to be passively applied to irrigate down-gradient trees. Since 1980, an estimated 1.2 million acres were permitted for coal mining representing nearly 5% of the state's total land area. Nearly 98% of currently permitted mining is in Eastern Kentucky. The Appalachian area has been historically poor, and the successful establishment of high-value hardwood trees will provide a renewable and sustainable multi-use resource that will create economic opportunities while enhancing local and global environmental conditions. Contact: Richard Warner.

Air Quality – Increased scrutiny by US EPA at livestock and poultry operations with regards to ammonia, methane, hydrogen sulfide and particulates emissions has generated a need for Extension engineering. Specialists are involved in several national research projects with

Extension components, and are leading College efforts to apprise producers of the recent EPA Air Consent Agreement ("Safe Harbor") regulations. Contact: Doug Overhults.

Radon Education – Through a grant from the Kentucky Cabinet for Human Resources the department provides the primary radon education and outreach program for the state. This includes part of an Extension Specialist position in BAE, as well as a fully-funded Extension Associate position stationed in Frankfort at the State Radon Office. The arrangement provides the Cabinet with the flexibility it needs to conduct this program as well as providing the department with funding to enhance other related programs. Contact: Robert Fehr.

Farm Safety - The department continues to have a program in the area of farm safety that includes educational programs on tractor & machinery safety, ROPS promotion, ATV safety and agricultural health issues. In addition, a component of the program is directed at youth with activities such as the Safety Day Camp. Contact: Mark Purschwitz.

EXTENSION PROGRAM RECOMMENDATIONS

Extension faculty should continue to provide leadership and support for programs throughout the state. A concern exists for support required for the Agricultural Development Board's model programs, which have recently generated substantial demand for engineering services but provided no financial support for program development or delivery.

Extension engineering faculty and Specialists must carefully focus programs to avoid over commitment. Current and pending retirements present key opportunities to reflect on which programs should be targeted, and require that some tough decisions be taken by faculty.

FACULTY/STAFF PRODUCTIVITY

PERSONNEL RESOURCES

The BAE faculty consists of sixteen individuals (sixteen tenure-track lines, and one Assistant Research Professor). Fourteen faculty work at the Lexington Campus and two faculty members work at the Princeton Research and Education Center. In addition, Assistant Dean for Research Steve Workman is a member of the BAE faculty. All BAE faculty members have Ph.D. degrees. BAE has one Research Assistant Professor (Dr. Steve Walker) funded off a grant obtained by Fred Payne. Three Research Specialists (Bridges, Day, Priddy) and one Director for Environmental Compliance (Steve Higgins) are also employed in BAE, and regularly participate in faculty decisions. Currently four faculty lines are assigned to the controlled environment area, four faculty lines to machinery systems, four lines to food and bioprocess engineering, and the remaining four lines are dedicated to bioenvironmental engineering. A compilation of Distribution of Effort assignments is provided in Table 3. While primary assignments amongst these program areas are as stated, there is considerable overlap in duties, responsibilities and programs. A listing of awards and recognitions obtained by the faculty are provided in Appendix A.

Of the 16 faculty in BAE (November, 2011), one holds the rank of Assistant Professor, one is an

Assistant Research Professor, five are Associate Professors and nine are Professors. Several members of the faculty have received the top teaching award in both the College of Agriculture and College of Engineering and one has received the University Provost teaching award for non-tenured faculty and a USDA Southeast Region Teaching Award. Two members of the faculty have received the Young Teacher award from the American Society of Agricultural Engineers. The strong tradition of excellence in teaching by BAE faculty is recognized by both Colleges of Engineering and Agriculture administration, the student body, and alumni of the program.

Twelve faculty members hold the P.E. license, one of which was earned by an Associate Professor this past academic year. This rate of licensure is the highest in the College of Engineering. Licensure is considered important by the faculty and a state law requires licensure to teach engineering design.

Extension faculty and specialists cover a broad range of topical areas, as evidenced in the Extension impacts listed elsewhere in this report. An increasing trend in BAE has been for faculty to identify program needs and resources to meet those needs, and to hire Extension Associates or other professionals to assist in program delivery. This has proven a successful tactic for leveraging faculty time, although this places many programs on an uncertain future path as funding allocations change. In addition to Extension Associates, faculty have hired Engineering Associates. A unique aspect of the BAE Extension programs is how tightly integrated many programs are with research and instruction efforts.

Annual grant expenditures for research have greatly increased since the last review, ranging from $1.99M to $3.66M over the past five years. These research projects place greater demand on office administrative staff, as well as faculty. During this review period, departments have been held responsible for graduate student tuition, creating an uneven situation in which it is perhaps more cost effective to hire post-doctoral researchers than graduate students to satisfy granting agency deadlines. Despite this, BAE research graduate enrollments remain stable.

The Department implemented this reorganization of administrative staff in 2003, upgrading two Administrative Staff Support Associate positions, and creating an Administrative Coordinator II, whose duties are to coordinate the fiscal and personnel matters of the department and direct activities of one Administrative Staff Support Associates, an Account Clerk, and our Student Services Coordinator. The Administrative Coordinator has signature authority and is responsible for payroll, monitoring purchases, and providing accounting for extramural grants and Departmental state and federal accounts. One other post-retirement Administrative Staff Support Associate is tasked primarily with travel requests, travel reimbursements, and Extension requests. The Student Services Coordinator is tasked with providing primary support in the administration and documentation associated with the Department's Graduate and Undergraduate degree programs.

The Department also has technical and professional support personnel who assist the faculty in the execution of laboratory exercises and the fabrication of research apparatus and senior design project prototypes. The BAE laboratory facility and the Agricultural Machinery Research Lab are each managed by a Coordinator (Fogle and King, respectively) who are responsible for daily

management of technical support staff assignments. In addition, the department has added a Coordinator specifically for the wet labs, Dr. Manish Kulshrethra. This arrangement requires good communication between faculty and these Coordinators, especially when some staff report directly to particular faculty but utilize common departmental facilities and resources.

TEACHING

Thirteen BAE tenure-track faculty members have formal teaching assignments; the remaining two are Extension only. The average faculty teaching assignment was 33% in 2011 (up from 24% in 2005) based on Instruction to Total FTE (Table 3). This equates to approximately three courses per year. Faculty teaching workload is fairly evenly distributed amongst teaching faculty. The teaching workload includes effort for student advising, administration of undergraduate and graduate programs, and teaching graduate courses. Instructors teaching new courses, and courses with significant laboratory time, are weighted more heavily in the teaching distribution of effort, as recognition of the importance of these activities. This is especially important given the lack of teaching assistant lines.

Student credit hours supported by BAE faculty range from 712-942 (BAE courses) and 153-263 (AEN courses), or 889 to 1205 total hours. Over this period, instruction FTE varied from 3.54 to 5.08. Credit hours per FTE for 2010-2011 were 281.7.

RESEARCH

Research FTE ranged from 7.41 to 10.01 between FY 07 to 11, averaging 8.78 (Table 3). Research productivity has increased since the previous review with respect to sustained growth in extramural grants acquisitions.

Grant productivity is measured in terms of total dollars and per research FTE. The grant information is contained in the BAE Department spreadsheets, Appendix B. Direct grants ranged from $2.2M (FY 08) to $4.4M (FY 06). Grants received annually, expressed per research FTE, ranged from $269K to $452K. Note that Extension faculty were also heavily involved in grants activity over this period, and the annual productivity expressed per combined research/extension FTE might be more appropriate: $116K to $246K.

Direct peer-reviewed journal article totals were 39, 22, 44, 26, 25 and 19 for CY 2005-2010, respectively (Table 4). Over this same period, total peer reviewed publications (journal articles, books and book chapters, and patents) were 41, 31, 46, 28, 27, and 23. Expressed per FY research FTE, using the average academic year research FTE, faculty research productivity was 4.1, 3.0, 5.0, 3.4, 3.6, and 3.3 refereed publications per research FTE each year of the review period. In addition, faculty published 27, 50, 18, 34, 28, and 44 other research products annually over the review period. Combining peer-reviewed and other research articles together, BAE department faculty published an impressive 6.8, 7.9, 7.5, 8.3 and 9.5 publications per year per research FTE. Thus, while substantial economic challenges have been present for much of the review period, faculty and staff have managed to find creative means of maintaining research productivity.

EXTENSION

Extension FTE ranged from 4.81 to 5.75 between FY 06 to 11, averaging 5.31 (Table 3). Not counted in the annual Experiment Station Reports are other measures of Extension productivity, such as web sites, interactive calculators, agent training, special programs such as Master Cattleman and support for Governor's Office of Agricultural Policy model programs, including on-farm water systems, hay, grain and commodity storage, and facilities. Some of these important deliverables are reported above under the various programs as impacts.

INTERACTIONS

Faculty and staff communications and interactions are enhanced through regular departmental social activities. Our department has an active social committee which holds a social event approximately every other month. For example, in early December we held a pancake breakfast and we had over 80 people in attendance. Another popular event is our soup cook-off contest. These regular events foster a collegial environment and a harmonious working environment.

GRADUATE PROGRAM OBJECTIVES

Master's (both Plan A and Plan B) degree program students:

1. Acquire advanced knowledge within a selected field of specialization.
2. Critically assess the scientific merit and practical implications of technical literature and presentations.
3. Learn and apply basic principles required to conceive, conduct, manage and analyze supervised engineering research and/or design.
4. Use state-of-the-art technology as tools in engineering design and in collecting/analyzing experimental data.
5. Gain proficiency in communicating technical subjects in both written and oral forms.

Doctoral degree program students:

1. Combine formal coursework with independent study to achieve subject matter mastery within their selected field of specialization.
2. Gain the competitive skills required to be successful in identifying scientific research topics and acquiring necessary resources.
3. Learn to independently manage personnel, resources, activities and time to accomplish research objectives.
4. Understand the peer-reviewed publication process and successfully use it to disseminate research findings.
5. Competently communicate technical topics to a variety of audiences through proper selection and use of appropriate media and techniques.

RECOMMENDATIONS

Faculty members are motivated and highly productive in the BAE department. Continued emphasis on quality peer-reviewed journal publications should be stressed. While BAE faculty are to be commended on their aggressive and successful extramural funding successes, administration must temper this drive for grant dollars with targeted opportunities so that publications rates, our primary metric of productivity, are maintained at the current high levels.

Table 3: Summary of Faculty Effort, by Person and Year

		Agouridis	Castillo	Colliver	Crofcheck	Edwards	Fehr	Gates	McNeill	Montross	Nokes	Norikane	Overhults	Payne	Puschwitz	Shearer	Stombaugh	Taraba	Walker	Warner	Webb	Wells	Wilhoit	Workman	Total	
2007	Instruction	0.10	0.00	0.62	0.58	0.26	0.00	0.40	0.00	0.07	0.41	0.48	0.00	0.18		0.47	0.15	0.20		0.10	0.13	0.59		0.34	5.08	Instruction
	Research	0.90	1.00	0.33	0.42	0.74	0.20	0.40	0.20	0.88	0.59	0.52	0.30	0.82		0.38	0.35	0.15		0.49	0.21	0.41		0.66	9.95	Research
	Extension	0.00	0.00	0.05	0.00	0.00	0.80	0.20	0.80	0.05	0.00	0.00	0.70	0.00		0.15	0.50	0.65		0.41	0.50	0.00		0.00	4.81	Extension
	Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	0.83	1.00		1.00	19.83	Total
2008	Instruction	0.10	0.00	0.23	0.45	0.46	0.00	0.44	0.00	0.52	0.62		0.00	0.15	0.00	0.26	0.15	0.20		0.10		0.16	0.08	0.25	4.17	Instruction
	Research	0.90	1.00	0.72	0.55	0.54	0.15	0.50	0.20	0.43	0.38		0.15	0.85	0.27	0.64	0.35	0.15		0.49		0.84	0.15	0.75	10.01	Research
	Extension	0.00	0.00	0.05	0.00	0.00	0.85	0.06	0.80	0.05	0.00		0.85	0.00	0.23	0.10	0.50	0.65		0.41		0.00	0.53		5.08	Extension
	Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	0.50	1.00	1.00	1.00		1.00		1.00	0.75	1.00	19.25	Total
2009	Instruction	0.10	0.00	0.50	0.44	0.40	0.10	0.09	0.00	0.43	0.60		0.00	0.27	0.15	0.35	0.18	0.20		0.00		0.37	0.10	0.63	4.90	Instruction
	Research	0.90	1.00	0.40	0.56	0.60	0.05	0.14	0.20	0.49	0.37		0.15	0.73	0.37	0.50	0.37	0.15		0.43		0.63	0.20	0.36	8.60	Research
	Extension	0.00	0.00	0.10	0.00	0.00	0.85	0.03	0.80	0.08	0.03		0.85	0.00	0.48	0.15	0.45	0.65		0.57		0.00	0.70	0.01	5.75	Extension
	Total	1.00	1.00	1.00	1.00	1.00	1.00	0.25	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00	1.00	19.25	Total
2010	Instruction	0.10	0.00	0.25	0.51	0.40	0.00		0.00	0.27	0.58		0.00	0.13	0.10	0.35	0.34	0.00		0.00		0.31	0.20		3.54	Instruction
	Research	0.90	0.17	0.75	0.49	0.60	0.10		0.20	0.68	0.42		0.15	0.87	0.40	0.40	0.31	0.30		0.30		0.69	0.20		7.92	Research
	Extension	0.00	0.00	0.00	0.00	0.00	0.90		0.80	0.05	0.00		0.85	0.00	0.50	0.25	0.35	0.70		0.70		0.00	0.60		5.70	Extension
	Total	1.00	0.17	1.00	1.00	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00		1.00		1.00	1.00		17.16	Total
2011	Instruction	0.14		0.20	0.61	0.40			0.00	0.37	0.65		0.08	0.50	0.10	0.52	0.30	0.00	0.00	0.00		0.21	0.21		4.27	Instruction
	Research	0.77		0.55	0.32	0.60			0.20	0.41	0.35		0.15	0.50	0.40	0.33	0.31	0.30	0.92	0.30		0.79	0.20		7.41	Research
	Extension	0.09		0.25	0.08	0.00			0.80	0.22	0.00		0.78	0.00	0.50	0.15	0.39	0.70	0.00	0.70		0.00	0.59		5.24	Extension
	Total	1.00		1.00	1.00	1.00			1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.92	1.00		1.00	1.00		16.91	Total
Averages	Instruction																								4.39	Instruction
	Research																								8.78	Research
	Extension																								5.31	Extension
	Total																								18.48	Total
	FTE based on DOE and adjusted for partial years.																									
	Includes paid sabbatical.																									

Table 4: Faculty Publications and Productivity

Books & Chapters	2	9	2	2	2	4
Total Peer-Reviewed	41	31	46	28	27	23
Total Other Research	27	50	18	34	28	44
All Research Pubs	68	81	64	62	55	67
Extension Publications				8	4	16

	Calendar Year					
Average Product per FTE	2006	2007	2008	2009	2010	2011
Peer-Reviewed Journals	3.9	2.2	4.8	3.2	3.3	2.7
Books & Chapters	0.2	0.8	0.2	0.2	0.3	0.6
Total Peer-Reviewed	4.1	3.0	5.0	3.4	3.6	3.3
Total Other Research	6.8	7.9	6.9	7.5	8.3	9.5
All Research Pubs	10.9	10.9	11.9	10.9	11.9	12.8
Extension Publications				1.4	0.7	3.1

RECRUITMENT AND RETENTION

FACULTY RECRUITING

Faculty recruitment in BAE is done according to College and University guidelines. Effectively, a vacancy within the unit must exist prior to recruiting for a position. Some exceptions in the case of minority faculty recruitment exist, although the unit is still expected to find resources to support the new faculty line after a preliminary period sponsored by central campus. Accordingly, faculty recruitment has a long time-horizon. Current BAE faculty network with peers and colleagues nationally and internationally, and regularly attend technical presentations of potential hires at international professional meetings. Potential future faculty members from within the student population are encouraged to consider graduate school at institutions other than UK.

Faculty and specialists regularly develop priorities for potential future hires. While a vacancy in an Extension Series position generally will be refilled with another Extension series hire, the subject matter may be changed to better reflect current and projected needs. Faculty members are deeply involved in all aspects of recruitment, interviews, and informal mentoring.

FACULTY RETENTION

A formal faculty mentoring process has been established to guide Assistant and Associate Professors through the promotion and tenure process. This effort is currently overseen by Richard Warner, Chair of the Promotion and Tenure Committee; other members include the Director of Undergraduate Studies, the Director of Graduate Studies, and the Chair. This committee assists with the timely completion of two and four year reviews as required within the University Administrative Regulations. An ancillary benefit is the now routine meetings between the Committee Chair and assistant professors where input from the faculty is summarized and provided to each assistant professor along with recommendations on how to shape their research, extension and teaching efforts to be more productive.

STAFF RECRUITING

The majority of staff recruitment is done by one or several faculty seeking to fill a particular need with grant funds. A limited number funded technical support positions are available, but recent vacancies have been left unfilled until a technical/professional staff strategic plan is executed. Meanwhile, lapsed salary from these vacancies is being used to support other staff in transition between grants, and graduate student assistantships and tuition fees.

GRADUATE STUDENT RECRUITING

Faculty continuously recruit graduate students from within the current student population, from other engineering departments at the University, and utilizing networks of peers from around the world. A reliable stream of highly qualified graduate students is viewed by most faculty members as critical to the ongoing success of the department, as well as for the future of the profession. Accordingly, when viable candidates are located and a BAE faculty expresses strong interest in the student, then the faculty and Chair work together to recruit the student. This typically means a visit to campus. In 2010 and 2011, a graduate student recruitment weekend

was organized by our graduate students to encourage potential graduate students to come visit campus on the same weekend. The graduate student recruitment weekend has been successful and we plan to keep hosting the event.

A graduate student handbook is available on-line, and provides links to other programs in the department. The department admission policy required an interested student to identify and obtain agreement to sponsor from a BAE faculty member prior to be considered for the graduate program. The Research and Graduate Studies committee reviews applicants, and provides a recommendation to the Director of Graduate Studies and Chair. If accepted into the program, the Chair writes a letter to the student informing them of their admittance and any stipend/assistantships available to them.

UNDERGRADUATE RECRUITING

The Department of Biosystems and Agricultural Engineering recruits and educates a diverse and capable student population. Approximately 95 students are currently registered in our undergraduate program, with female and minority components of 32 and 10 %, respectively. The majority of our students are graduates of Kentucky high schools; however, we maintain a substantial component of out-of-state students and a few international students. Approximately one-third of entering freshmen declare an interest in our pre-biomedical engineering program (implemented in 1998-1999 as part of our major curriculum modification), one-third declare the machine systems option, and the remaining third are distributed between the remaining three specializations.

After moving into new facilities in 1990, the number of undergraduate students in our program more than doubled by the end of the decade and remained relatively constant until the Fall of 2010. In 2010, the introductory class had approximately 60 students registered, up from about 25 students the year before. Enrollment in the introductory class was approximately 50 in 2011. The influx of students necessitated finding classrooms large enough, and instituting the use of teaching assistants to help with the computer labs. As these cohorts move up through the ranks, adjustments will need to be made to accommodate the increased numbers. With active student professional organizations and activities, our students and faculty maintain camaraderie that would be difficult in larger programs. Students are encouraged to join ASABE, IBE, or ASHRAE as part of their membership in the University of Kentucky BAE Student Branch.

Our program benefits from student recruitment activities organized by both Colleges of Agriculture and Engineering. The College of Engineering Office of Student Support Services visits several locations throughout Kentucky and bordering states annually to recruit qualified students. Interested students and their families are brought to campus for activities in which the various engineering programs present opportunities in their respective disciplines. The College of Engineering also hosts an Open House annually during Engineers Week at which BAE students and faculty demonstrate projects which are visited by potential students and their families.

The College of Agriculture's Office of Student and Academic Services maintains an active student recruitment effort through the Director of Student Relations. Similar off-campus events are scheduled each year at which potential students can learn about our program. Potential students are invited to campus each year to meet with faculty and students from various programs in the College.

The Department has a Student Services Coordinator (SSC) who hosts students during various activities on campus. This Coordinator also hosts students and their families on numerous tours of the Department throughout the year. Faculty and/or our SSC seek to identify opportunities to meet with prospective students that are invited to campus for a variety of programs. We believe these efforts have been essential in increasing the size of our incoming freshmen classes from approximately 20 students per year to the current 50-60 students.

Prospective students at the University of Kentucky must complete a prescribed curriculum of high school credits and complete the ACT standardized test. Selective admission criteria are then applied based upon the number of seats available. Table 4.1 presents the ACT scores of freshmen admitted to the College of Engineering and specifying BAE as their major since 2005. These data (Table 4) show that our incoming freshmen are comparable to those of the other engineering disciplines.

Table 5 (ABET Table 1-1) History of Admissions Standards for Freshmen Admissions for Past Five Years.

Academic Year	Composite ACT		Composite SAT*		Percentile Rank in High School		Number of New Students Enrolled
	MIN.	AVG.	MIN.	AVG.	MIN.	AVG.	
2005-2006	19	24.9	-	-	18%	79.9%	8
2006-2007	23	26.8	910	910	9%	75.2%	4
2007-2008	17	25.6	1080	1196.7	16%	78.6%	17
2008-2009	20	25.9	1040	1200	9%	79.2%	15
2009-2010	20	26.1	1060	1085	12%	81.7%	14

*There are a small number of students taking the SAT

UNDERGRADUATE RETENTION

A key element in our undergraduate retention strategy has been to revise our curriculum to ensure that most students are involved in a BAE course every semester of their first two critical years. This was implemented around 2000, and was done as a means of addressing the relatively remote location of the department compared to the venue for most engineering courses. Thus, incoming freshman enroll in BAE 102 in the fall semester, BAE 103 in spring semester, and BAE 201 and BAE 202 in the sophomore year. Students are encouraged to form cohorts, and the requirement for them to attend a BAE class each semester of the first two years provides opportunity for faculty to build these cohorts, encourages participation in student branch and other activities, and enables the students to become acquainted with other BAE faculty. We

judge this approach to be critical to retention and to an enhanced undergraduate engineering experience.

Approximately 14.4 students have graduated each year from the BAE program during the evaluation period (Table 6, and Department spreadsheets, Appendix B). The average number of students enrolled during that time was 66.6 students, or 16.6 students per class. The average graduation rate was 72% of the average number of freshmen enrolled (20 students/year) and was approximately 86.7% of the average enrollment per class (16.6 students). Students transferring into the BAE program from other institutions, as well as other programs in the College of Engineering, tended to offset the attrition of students registering as freshmen.

Table 6. (ABET Table 1-3) Enrollment Trends for Past Five Academic Years.

	05-06	06-07	07-08	08-09	09-10
Full-time Students	38	43	41	47	55
Part-time Students, Student FTE[1]	3	4	3	4	5
Graduates	12	8	26	17	9

[1] FTE = Full-Time Equivalent

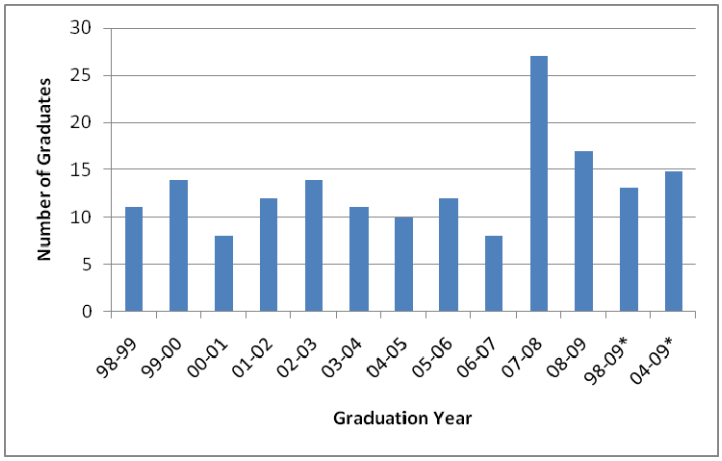


Figure 2. University of Kentucky BAE Graduates since 1999. Averages for 1998-2009 and 2004-2009 are also shown (*).

RECOMMENDATIONS

Undergraduate recruiting is going well. The department has started working with Kim Sayre in the College of Engineering to develop more internships to accommodate our growing student population. Students acquiring internships and jobs upon graduation will be critical to our department's continued enrollment growth.

Continued successful recruitment of domestic graduate students is critical. Opportunities to bolster graduate student enrollment with selective, high quality foreign nationals, such as being done with the Brazilian Consortium grant, should be continued and expanded.

MANAGEMENT, ADHERENCE TO POLICIES AND COLLEGIAL ENVIRONMENT

ADMINISTRATION

The BAE program is administered by the Chair of the program in cooperation with the faculty per University Administrative Regulations, Departmental Operating Policies and Procedures, and with the approval of the Dean and Associate Deans of the College. Signatory authority rests primarily with the Department Chair, or her designee in her absence. Matters requiring faculty input are discussed at regularly scheduled faculty meetings. These meeting are scheduled once a month during the academic year, or as required for the timely completion of business. Meeting minutes are maintained by an elected Secretary.

For matters requiring investigation, development of policy or practices, or to meet reporting obligations of the program there are standing committees tasked with variety of duties. These committees are formed annually at the beginning of a new academic year through consultation between the faculty, staff, and Department Chair. The committees are required to meet as needed. Work products of these committees are then forwarded to the faculty for final approval at the regularly scheduled faculty meetings. For more detailed explanation of program administration see the BAE Departmental Operating Procedures and Policies in Appendix C.

FACULTY DEVELOPMENT

Faculty professional development is regularly supported and encouraged. An annual professional meeting (ASABE, IBE, ASHRAE) is attended by most faculty members. Budget shortfalls generally require that faculty secure funding from alternate sources, however partial expense reimbursement is still a goal. Faculty also attend many regional, national and international meetings and find support from a variety of sources including their grants, the sponsoring agency, and the Associate Dean for Research in the College of Agriculture's program for refund of some grant indirect costs ("incentive fund").

RECOMMENDATIONS

Departmental Rules of Procedure should be updated to reflect recent changes in committee structures, including the creation of a Promotion and Tenure Committee, and the combining of the Research and the Graduate Committees. Continued faculty involvement and leadership should be encouraged.

PLANNING, EVALUATION, AND RESOURCE ALLOCATION

STRATEGIC PLAN DEVELOPMENT AND REVIEW

The BAE Strategic Plan was developed according to guidelines provided by College and University administration. In 2009, a document to supersede the 2005 Strategic Plan was developed by the Chair for faculty review. The BAE Strategic Plan was ratified after an appropriate review and comment period. An abbreviated version of the Strategic Plan can be found in Appendix D.

In the summer of 2011, with the transition to a new department chair, the faculty participated in a half-day retreat held at the Cardone Center in Georgetown, KY. The outcome of the retreat was a departmental hiring plan and list of priorities. The minutes for the retreat are included in Appendix E.

SPACE UTILIZATION

The Department of Biosystems and Agricultural Engineering has been housed in the C.E. Barnhart Building since 1990. This is located in the College of Agriculture complex south of central campus. The BAE Department has 4,600 m^2 (50,000 ft^2) space in offices, classrooms, and laboratories. It is approximately a 20 minute walk to the College of Engineering buildings. The Barnhart Building four-story office tower is shared with the Department of Agricultural Economics (top two floors). Each floor has a gross area of 600 m^2 (6,500 ft^2) and contains central rooms and 21 perimeter offices. The University maintains one classroom on the second floor; the Department maintains a computer laboratory on the first floor (18 personal computers, networked printers, and restricted access for BAE students, staff and faculty), and an engineering design laboratory (Room 236) on the second floor that is used heavily for instruction. This room includes internet access, computer-based projection, and audio-visual equipment.

Attached to the Barnhart office tower is the department's laboratory facilities, featuring 3,400 m^2 (36,000 ft^2). These laboratories include a long (>100m) central hallway with electronics, shop, wet chemistry, material properties analysis, and fermentation technologies on one side and large high-bay laboratories for controlled environment systems, grain handling, machinery systems, food engineering, biomechanics, and bioprocess engineering. Two large arms off this central corridor provide additional labs housing controlled temperature-humidity units, fabrication areas for student and research projects, and a series of bays for soil and machinery interaction testing, surface and sub-surface hydrology, and waste management. One laboratory (Lab 153) is dedicated to electronics and instrumentation instruction.

The Department also maintains the Agricultural Machinery Research Laboratory (AMRL), a steel structure located near the football stadium. Four full-time staff are employed and housed in this facility, providing key engineering, fabrication and machining support for the wide variety of research projects. Typically, four to twelve undergraduate students are employed on various projects in this facility. Adjoining the AMRL is an HVAC training facility. The AMRL and Heating Ventilation and Air Conditioning (HVAC) Training facilities are now connected through that addition of a 3600 ft^2 of enclosed space between the two existing structures. The new space is utilized as a wash bay and paint preparation area.

The Department has storage space located at both the North Farm and Woodford County Animal Research Center. Space at the North Farm is primarily dedicated to storage of surplus equipment, or equipment where the frequency of use is insufficient to justify space in the C.E. Barnhart Building. Storage at the Woodford County Animal Research Center is primarily for agricultural field machinery. In the case of tobacco mechanization, most of the equipment is utilized at this location. With regard to precision agriculture the ARC is somewhat of a

centralized location with regard to transportation of equipment to farmer cooperators in Central Kentucky because of its close proximity to either the Bluegrass Parkway or I-64.

BUDGET ALLOCATION

The annual budget over the period of review was approximately $2.7M in state funds ($3.4M including benefits), and $735K in federal funds. Funds in the federal research line are used to partially support graduate student assistantships, but cannot be used for tuition.

In FY 2007 the Department state budget realized a recurring $17k cut in current operating expenses in order to fund merit raises for BAE staff on federal salary lines. Per standard College procedure, a vacant faculty line was reduced by $35k in FY 2007. During fiscal year 2008 mid-year raises were provided to most faculty and staff. However, shortly following the mid-year raises the Department state budget realized a $29k non-recurring cut to vacant staff lines. Fiscal year 2009 included the elimination of one vacant $72k faculty line to meet recurring budget cut. The Department state budget sustained another recurring cut of $12k in fiscal year 2010. Vacant staff line budgets were used to fund the cut. Merit raises were not provided during fiscal years 2009, 2010 or 2011.

In addition to the $4M budget, the Department has been aggressive in pursuing extramural funding. Annual direct awards averaged $2.9M over the review period while collaborative awards averaged $5.7M. Through the Research Enrichment Program (REP), 10% of actual F&A (indirect) charges on these grants are returned to the Department, but with a two-year lag, so that in FY 2007 the F&A return from FY 2005 is made available. Beginning in FY 2011, collaborative departments the amount shared increased to 16% of actual F&A charges. Over the review period, our F&A allocation averaged $39K. These funds are used to purchase lab supplies, equipment and to offset the cost of student travel and participation in professional meetings.

The budget is allocated in a historical manner, with 93% currently tied to existing salary lines. This provides a significant challenge because expenditures for current expenses such as travel, vehicle fuel, telephone and network charges, copy paper, and computer equipment typically exceed budgeted amounts. The difference is made up with the use of salary savings to balance these deficits which continue to accelerate.

Responsibility for compliance with all appropriate sponsor and University regulations and guidelines has devolved to the department level significantly over this review period. Tracking the state, federal, and extramural budgets and expenditures is a substantial task and occupies a majority of the Accounts Clerk's and Administrative Coordinator's time, as well as that of the Chair and the Principal Investigators for each grant.

SUPPORT FROM OTHER UNIVERSITY UNITS ESSENTIAL TO EFFECTIVE OPERATIONS

We rely on support from the College Research office, Human Resources, Facilities Management, and Financial Units such as OSPA and Purchasing. We rely to a lesser extent on Development, Alumni Affairs and Information Technology.

APPENDIX A: FACULTY AWARDS

BIOSYSTEMS AND AGRICULTURAL ENGINEERING

BAE Faculty Achievements and Awards

Don Colliver	ASHRAE President, ASHRAE Distinguished Lecturer, US Green Buildings Council Leadership Award for Research, Stars of Energy Runner-up Award for the Advanced Energy Design Guide for Small Office Buildings
Czar Crofcheck	Tau Beta Pi Department Teaching award, Wethington Award, attained Professional Engineer licensure
George Duncan	Inducted as Fellow of ASABE
Dwayne Edwards	ASAE New Holland Young Researcher Award, ASAE Blue Ribbon Award for Educational Aids/Web Page.
Sam McNeill	ASAE Blue Ribbon Award for Educational Aids/Bulletins.
Mike Montross	Attained Professional Engineer licensure
Sue Nokes	2012 Fellow of the American Institute for Medical and Biological Engineers, Henry Lutes Teaching Award, ASAE A.W. Farrall Young Educator Award, ASAE Superior Paper Award, USDA Science Excellence in Teaching Award.
Doug Overhults	Promoted to Full Professor, July 2011.
Fred Payne	IAFIS/FPEI Food Engineering Award
Tim Stombaugh	ASAE Honorable Mention Paper Award, ASAE Blue Ribbon Award for Educational Aids/Bulletins, attained Professional Engineer licensure
Richard Warner	Wethington Award
Steve Workman	Henry Lutes Teaching Award, College of Engineering Master Teacher Award, Outstanding Reviewer Awards from ASAE Transactions (2) and Journal of Environmental Quality, Tau Beta Pi Departmental Teaching Award, ASAE Blue Ribbon Award for Educational Aids/Web Page.

APPENDIX B: DEPARTMENTAL SPREADSHEETS OF SUMMARY STATISTICSS

BIOSYSTEMS AND AGRICULTURAL ENGINEERING

2010-2011 Biosystems and Agricultural Engineering Departmental Report
CIP Code 140301

2010-2011 Degrees Awarded

	Total	Female	Male	Minority	African American
Bachelor's	18	7	11	0	0
Master's	4	2	2	1	0
Doctoral	2	1	1	0	0
Total	24	10	14	1	0

Degrees Awarded Five-Year Trend

	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011
Bachelor's	11	26	17	9	18
Master's	6	4	12	3	4
Doctoral	2	1	1	1	2
Total	19	31	30	13	24

2010-2011 Enrollment (majors)

	Total	Female	Male	Minority	African American
Bachelor's	95	30	65	10	3
Master's	18	5	13	0	0
Doctoral	10	3	7	3	1
Post-Doc	2	1	1	0	0
Total	125	39	86	13	4

Enrollment (majors) Five-Year Trend

	2006-2007	2007-2008	2008-2009	2009-2010	2010-2011
Bachelor's	76	67	61	64	95
Master's	23	24	16	18	18
Doctoral	6	5	10	11	10
Post-Doc	8	4	2	1	2
Total	113	100	89	94	125

2010-2011 Student Credit Hours Enrolled

	Total	Summer	Fall	Spring
AEN	263	0	98	165
BAE	942	3	447	492
Total	1,205	3	545	657

Direct Awards Five-Year Trend

2006-2007	2007-2008	2008-2009	2009-2010	2010-2011
$3,449,746	$2,971,839	$2,210,598	$3,394,482	$2,407,530

Grant Expenditures Five-Year Trend

2006-2007	2007-2008	2008-2009	2009-2010	2010-2011
$2,615,552	$2,664,559	$3,656,941	$2,252,334	$1,795,662

2010-2011 Primary Grant Dollar/Faculty Ratio

	FT Faculty (head count)	FTE Research Faculty
	17	7.06
Total Primary Grant Dollars	$2,407,530	$2,407,530
Average	$141,619	$341,010

Research Faculty with Formula Funded Projects as of 8/11

25% or higher research DOE	11
Active Project	7
Percentage	64%

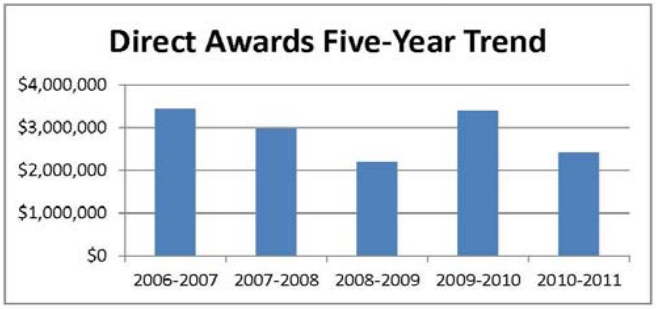
2010-2011 Fiscal Year Grants

Direct Awards	$2,407,530
Federal Competitive	$0
% Federal Competitive	0%
Collaborative	$5,233,626

2010 Calendar Year Publications

Books and Chapters	4
Refereed Journal Articles	19
Other Research Articles	44
Total	67

2010 Calendar Year Patents	0



2009-2010 Biosystems and Agricultural Engineering
CIP Code 140301

2009-2010 Degrees Awarded

		Female	Male	Minority	African American
Bachelor's	9	5	4	0	0
Master's	3	1	2	1	0
Doctoral	1	0	1	0	0
Total	13	6	7	1	0

2009-2010 Enrollment (majors)

		Female	Male	Minority	African American
Bachelor's	64	27	37	5	2
Master's	18	7	11	2	0
Doctoral	11	4	7	1	0
Post-doc	1	1	0	0	0
Total	94	39	55	8	2

2009-2010 Student Credit Hours Enrolled

		SSI	SSII	Fall	Spring
AEN	178	0	0	28	150
BAE	825	0	6	361	458
Total	1003	0	6	389	608

2009-2010 Primary Grant Dollar/Faculty Ratio

	FT Faculty (head count)	FTE Research Faculty
	17	7.51
Total Primary Grant Dollars	$3,394,482	$3,394,482
Average	$199,675	$451,995

2009-2010 Fiscal Year Grants

Direct Awards	$3,394,482
Federal Competitive	$0
% Federal Competitive	0%
Collaborative	$9,061,746

2009 Calendar Year Publications

Books & Chapters	2
Refereed Journal Articles	25
Other Research Articles	28
Total	55

2009 Calendar Year Patents	0

Degrees Awarded Five-Year Trend

	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010
Bachelor's	12	11	26	17	9
Master's	2	6	4	12	3
Doctoral	2	2	1	1	1
Total	16	19	31	30	13

Enrollment (majors) Five-Year Trend

	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010
Bachelor's	63	76	67	61	64
Master's	20	23	24	16	18
Doctoral	8	6	5	10	11
Post-doc	6	8	4	2	1
Total	97	113	100	89	94

Direct Awards Five-Year Trend

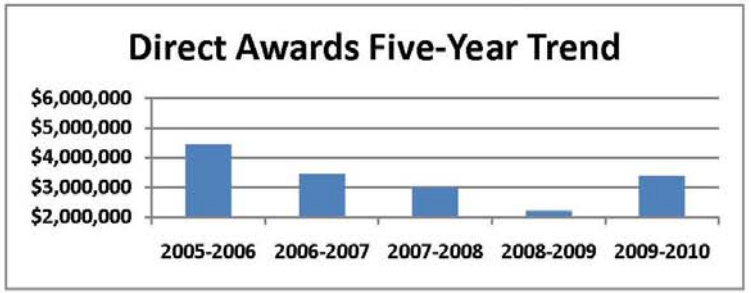
2005-2006	2006-2007	2007-2008	2008-2009	2009-2010
$4,430,217	$3,449,746	$2,971,839	$2,210,598	$3,394,482

Grant Expenditures Five-Year Trend

2005-2006	2006-2007	2007-2008	2008-2009	2009-2010
$1,993,100	$2,615,552	$2,664,559	$3,656,941	$2,252,334

Research Faculty with Formula Funded Projects as of 8/10

25% or higher research DOE	13
Active Project	10
Percentage	77%



2008-2009 Biosystems and Agricultural Engineering

2008-2009 Degrees Awarded

		Male	Female	Minority	African American
Doctoral	1	1	0	0	0
Master's	12	6	6	0	0
Bachelor's	17	11	6	1	1
Total	30	18	12	1	1

Degrees Awarded Five-Year Trend

	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
Doctoral	3	2	2	1	1
Master's	9	2	6	4	12
Bachelor's	10	12	11	26	17
Total	22	16	19	31	30

2008-2009 Enrollment

		Male	Female	Minority	African American
Doctoral	10	5	5	0	0
Master's	16	10	6	2	0
Post-doc	2	1	1	0	0
Bachelor's	61	34	27	4	3
Total	89	50	39	6	3

Enrollment Five-Year Trend

	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
Doctoral	13	8	6	5	10
Master's	16	20	23	24	16
Post-doc	8	6	8	4	2
Bachelor's	74	63	76	67	61
Total	111	97	113	100	89

2008-2009 Student Credit Hours Enrolled

		SSI	SSII	Fall	Spring
AEN	177	0	0	72	105
BAE	712	0	0	312	400
Total	889	0	0	384	505

Direct Awards Five-Year Trend

2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
$2,365,220	$4,430,217	$3,449,746	$2,971,839	$2,210,598

Grant Expenditures Five-Year Trend

2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
$1,424,060	$1,993,100	$2,615,552	$2,664,559	$3,656,941

2008-2009 Primary Grant Dollar/Faculty Ratio

	FT Faculty (head count)	FTE Research Faculty
	19	8.22
Total Grant Dollars	$2,210,598	$2,210,598
Average	$116,347	$268,929

Research Faculty With Formula Funded Projects as of 6/09

25% or higher research DOE		14
Active Project		14
Percentage		100%

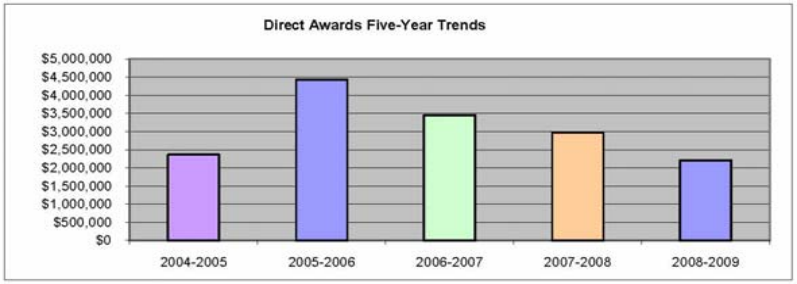
2008-2009 Fiscal Year Grants

Direct Awards	$2,210,598
Federal Competitive	$100,000
% Federal Competitive	5%
Collaborative	$4,687,513

2008 Calendar Year Publications

Books & Chapters	2
Refereed Journal Articles	26
Other Research Articles	34
Total	62

2008 Calendar Year Patents 0



12/23/2009

2006-2007 Biosystems and Agricultural Engineering

2006-2007 Degrees Awarded

		Male	Female	Minority	African American
Doctoral	2	2	0	0	0
Master's	6	2	4	1	0
Bachelor's	11	6	5	0	0
Total	19	10	9	1	0

Degrees Awarded Five-Year Trend

	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
Doctoral	2	2	3	2	2
Master's	1	9	9	2	6
Bachelor's	14	11	10	12	11
Total	17	22	22	16	19

2006-2007 Enrollment

		Male	Female	Minority	African American
Doctoral	6	4	2	0	0
Master's	23	13	10	1	0
Post-doc	8	6	2	0	0
Bachelor's	76	53	23	5	3
Total	113	76	37	6	3

Enrollment Five-Year Trend

	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
Doctoral	7	11	13	8	6
Master's	20	19	16	20	23
Post-doc	1	3*	8	6	8
Bachelor's	74	70	74	63	76
Total	102	100	111	97	113

2006-2007 Student Credit Hours Enrolled

		SSI	SSII	Fall	Spring
AEN	223	0	0	100	123
BAE	886	0	5	447	434
Total	1109	0	5	547	557

Direct Awards Five-Year Trend

2002-2003	2003-2004	2004-2005	2005-2006	2006-2007
$1,252,739	$1,195,214	$2,365,220	$4,430,217	$3,449,746

Faculty/Primary Grant Dollar Ratio

	FT Faculty (head count)	FTE Research Faculty
	20	10.1920
Total Grant Dollars	$3,449,746	$3,449,746
Average	$172,487	$338,476

Research Faculty With Formula Funded Projects as of 3/07

25% or higher research DOE	13
Active Project	12
Percentage	92%

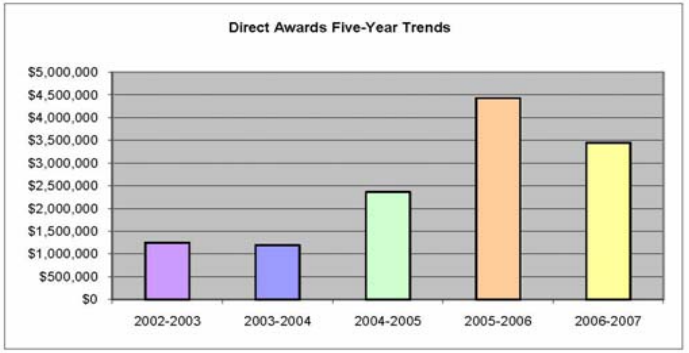
2006-2007 Fiscal Year Grants

Direct Awards	$3,449,746
Federal Competitive	$547,087
% Federal Competitive	16%
Collaborative	$3,987,388

2006 Calendar Year Publications

Books & Chapters	9
Refereed Journal Articles	22
Other Research	50
Total	81

2006 Calendar Year Patents 0



2005-2006 Biosystems and Agricultural Engineering

2005-2006 Degrees Awarded

		Male	Female	Minority	African American
Doctoral	2	1	1	0	0
Master's	2	2	0	0	0
Bachelor's	12	8	4	2	1
Total	16	11	5	2	1

Degrees Awarded Five-Year Trend

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006
Doctoral	1	2	2	3	2
Master's	3	1	9	9	2
Bachelor's	12	14	11	10	12
Total	16	17	22	22	16

2005-2006 Enrollment

		Male	Female	Minority	African American
Doctoral	8	6	2	0	0
Master's	20	13	7	1	0
Post-doc	6	4	2	0	0
Bachelor's	63	43	20	6	3
Total	97	66	31	7	3

Enrollment Five-Year Trend

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006
Doctoral	8	7	11	13	8
Master's	18	20	19	16	20
Post-doc	1	1	3*	8	6
Bachelor's	63	74	70	74	63
Total	90	102	100	111	97

2005-2006 Student Credit Hours Enrolled

		SSI	SSII	Fall	Spring
AEN	268	0	0	58	210
BAE	882	0	9	425	448
Total	1150	0	9	483	658

Direct Awards Five-Year Trend

2001-2002	2002-2003	2003-2004	2004-2005	2005-2006
$2,235,765	$1,252,739	$1,195,214	$2,365,220	$4,430,217

Faculty/Primary Grant Dollar Ratio

	FT Faculty (head count)	FTE Research Faculty
	18	9.94
Total Grant Dollars	$4,430,217	$4,430,217
Average	$246,123	$445,696

Research Faculty With Formula Funded Projects as of 5/06

25% or higher research DOE	11
Active Project	9
Percentage	82%

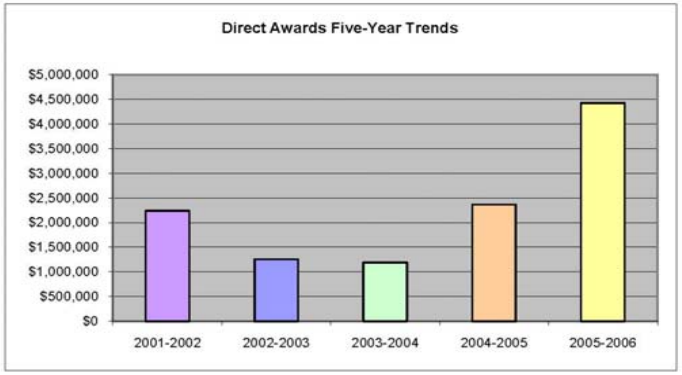
2005-2006 Fiscal Year Grants

Direct Awards	$4,430,217
Federal Competitive	$0
% Federal Competitive	0%
Collaborative	$6,381,791

2005 Calendar Year Publications

Books & Chapters	2
Refereed Journal Articles	39
Published Abstracts	0
Other Research	27
Total	68

2005 Calendar Year Patents 0



APPENDIX C: DEPARTMENT RULES OF PROCEDURE

BIOSYSTEMS AND AGRICULTURAL ENGINEERING

RULES OF PROCEDURE

DEPARTMENT OF BIOSYSTEMS AND AGRICULTURAL ENGINEERING

These Rules of Procedure are intended to be consistent with the Governing Regulations and the Administrative Regulations of the University of Kentucky and the laws of the Commonwealth of Kentucky and of the United States of America. In the event that these rules of procedure are inconsistent or contrary to the above-mentioned regulations and laws, then those regulations and laws control.

1) Organizational Structure

The Departmental Faculty. – The Faculty of the Department shall consist of the Chair and the members of the Department who are members of the Faculty of the College of Agriculture (i.e. tenure track personnel). In addition, membership may be extended by the Departmental Faculty to any other member of the Departmental staff or to any person assigned to it for administrative work, teaching, research, or service. Adjunct Faculty do not have voting rights on personnel matters.

Department Chair. – The Department Chair serves as Chair of the Department Faculty in the development of the Department's policies on such matters as academic requirements, courses of study, class schedules, graduate and research programs, service functions, faculty Distribution of Effort, and course evaluation. The Chair presides over all Departmental meetings, except as he or she may delegate this function. The Chair has administrative responsibility for implementing the Department's programs within the limits established by the Governing and Administrative regulations of the University, Policies of the University Senate, and the rules of the College of Agriculture. The Chair shall consult

with the Directors of multidisciplinary Centers and Institutes regarding the performance of Departmental Faculty who are or will be associated with these units. The Chair, with appropriate faculty input, according to the procedures and criteria established by the University, the College of Agriculture, and the Department, is responsible for recommendations to the Dean of the College of Agriculture on personnel and budget items as outlined in GR 8.0 Part VII.B.5.

Faculty Secretary. – A member of the Faculty will act as Secretary and shall make a record of the meetings of the Departmental Faculty, prepare the minutes of the Faculty meetings, and distribute the minutes to the Faculty Members of the Department. This person shall be elected on an annual basis by the Faculty at the first Departmental Faculty Meeting of the academic year.

2) Committee Structure

The following Committees shall serve in an advisory role to the Department Chair and Faculty:

Undergraduate Curriculum and Course Content Committee. – This Committee makes recommendations on teaching objectives, undergraduate curriculum planning, course content, and scheduling. This Committee coordinates the development of courses and makes a continuing evaluation of the course offerings, as well as making suggestions for adding, deleting, revising, or renumbering the courses. This Committee shall be responsible for developing the information required for periodic ABET reviews.

The Committee shall include at least one upper division undergraduate or UK BAE alumni graduate student majoring in Biosystems and Agricultural Engineering who shall have full voting rights on the Committee. The Director of Undergraduate Studies is an ex officio member of this committee.

The Chair of the Committee will serve as the Departmental representative in the development of educational policies for the College of Agriculture and the College of Engineering. Also, this committee shall advise the Committee Chair on issues related to the development of educational policies of the College.

Research Committee. – This Committee reviews all Experiment Station project proposals of the Department for appropriateness of the research in view of the goals of the Department. Structuring of the proposal itself shall include justification, literature review, objectives, methodology, and otherwise conform to Kentucky Agricultural Experiment Station requirements. Written recommendations shall be made to the Department Chair outlining conditions for approval or disapproval. Furthermore, this Committee is responsible for the periodic review of current research programs and shall recommend on the future research direction of the Department.

This Committee shall include at least one graduate student member majoring in Biosystems and Agricultural Engineering who shall have full voting rights on the Committee.

Extension Committee. – This Committee develops means for evaluation and strengthening of extension and outreach programs. Special consideration should be given to (1) interdisciplinary efforts, (2) communication and coordination between clientele, county staff, state specialists and teaching-research faculty, (3) applied research programs, and (4) extension publications. Written recommendations for continuance or discontinuance of existing programs, and for initiation of new programs shall be made to the Department Chair.

Graduate Committee. – This Committee reviews and recommends to the Director of Graduate Studies acceptance or rejection of applications for admission which are submitted to the Department as well as coursework plans for MS candidates. Final decisions on awarding stipends to graduate students will be made by the Department Chair. Furthermore, this Committee will give general guidance to the graduate program,

coordinate graduate course needs, and take an active role in recruiting new graduate students.

The Committee shall include one graduate student member who shall have full voting rights on the Committee. The Director of Graduate Studies is an ex officio member of this committee.

Seminar Committee. – This Committee will plan the Department's seminar program for the mutual benefit of the students, faculty, and staff.

The membership of this committee shall include one student member who shall have full voting rights on the Committee.

Student Recruitment Committee. – This Committee develops and executes programs to recruit undergraduate students for the Biosystems and Agricultural Engineering Curriculum and promotes scholarship activities.

The membership of this Committee shall include one undergraduate student who shall have full voting rights on the Committee. The Director of Undergraduate Studies is an ex officio member of this committee.

Advisory Committee. – This Committee shall consist of the full Professors on the Department's Faculty. The Departmental Chair shall serve as the Chair of this Committee. The Committee will advise the Chair on Departmental procedures and policies on matters of appointment of new members of the Department, promotions, reappointments, terminal appointments, decisions not to reappoint, post-retirement appointments, and granting of tenure and the Chair and Faculty on matters relating to faculty performance evaluations and preparation of budget requests.

3) Appointment to Departmental Committees

The Department Chair shall appoint members to Departmental committees with staggered terms as appropriate and shall determine the number of committee members. Appointments to Departmental committees will be announced prior to September 15, and the assignment shall be for two years except for student members who will serve for one academic year. The Department Chair will appoint each committee chair annually.

In addition to the regular committees listed in the Rules of the Faculty of the Department, the Chair may appoint such additional and/or ad hoc committees as are needed.

4) Departmental Faculty Meetings

Departmental Faculty Meetings will be scheduled after the Departmental Seminar on the first Friday of each month during the academic year. Cancellation of a regularly scheduled Faculty Meeting shall be the responsibility of the Department Chair. Special Faculty Meetings can be called by the Chair or by petition of 3 Faculty members. Items for the agenda at such meetings are submitted to the Chair in advance by Faculty Members and may be added to the agenda during the course of any Faculty meeting. Notices of Faculty meetings are to be circulated two days in advance of the regular and called meetings and agenda items are to be announced. Proxy voting on agenda items previously circulated will be allowed provided it is granted in writing to another member of the Faculty. A quorum will consist of one more than half the voting faculty.

The procedure for publishing notice of the Departmental Faculty meetings shall conform to the University Guidelines or AR and GR policy regarding open meetings.

5) Voting Privileges

Voting rights are extended to all members of the Biosystems and Agricultural Engineering Faculty who are also members of the Faculty of the College of Agriculture.

Other members of the Departmental Faculty may be given voting privileges by a majority vote of the Department's Faculty members described in the previous sentence.

6) Appointments, Tenure, and Promotion

Appointments, reappointments, terminal appointments, post-retirement appointments, decision to not reappoint, granting of tenure, and promotion of Faculty are handled, in accordance with the provisions set forth in the Administration and Governing Regulations of the University and in accordance with policies and procedures of the College of Agriculture. Adjunct faculty do not have voting privileges on personnel matters.

7) Performance Evaluation

Performance evaluation of Faculty is carried out in accordance with the policies and procedures of the College of Agriculture.

8) Review of Rules of Procedure

These rules may be changed by a majority of the Department's voting Faculty. The meeting at which the vote is taken shall have been announced in writing three weeks in advance by the Department Chair.

These rules of procedure have been created and approved by the faculty of the Department of Biosystems and Agricultural Engineering, pursuant to the authority granted by the Administrative and Governing Regulations of the University of Kentucky. These rules do not become effective until and unless approved by the Dean and Chancellor as indicated by their signatures below. Any modifications to these rules must also be approved by the Dean and Chancellor before the modifications take effect. These rules

contain a total of 5 pages, each of which are initialed and dated by the undersigned persons. A current copy of the approved rules is available in the office of the Chairperson of the Department.

_____

_____

Chair, Department of Biosystems and Agricultural Engineering
Date

_____

Dean, College of Agriculture
Date

_____

Chancellor, University of Kentucky, Lexington Campus
Date

Updated and approved by faculty vote on January 26, 2001.

APPENDIX D: ABBREVIATED STRATEGIC PLAN

BIOSYSTEMS AND AGRICULTURAL ENGINEERING DEPARMTNENT

STRATEGIC PLAN

MISSION STATEMENT: Serve and benefit the people of Kentucky and beyond through learning, discovery, and engagement in engineering for food, energy, agricultural, biological, and environmental systems.

Instruction: Attract and retain students and produce skilled engineering graduates, and graduate students who represent the population in diversity.

Research: Sustain and grow grant and contract research support and increase program recognition for outstanding research.

Outreach: Ensure faculty are available with the expertise to meet constituents' needs, keep extension programming relevant, and broaden sources of external extension funding.

GOALS/OBJECTIVES:

Goal 1: Prepare students for leadership in an innovation-driven economy and global society.
- Objective 1.1: Attract and retain students.
- Objective 1.2: Produce skilled engineering graduates.

Goal 2: Promote research and creative work to increase the intellectual, social, and economic capital of Kentucky and the world beyond its borders.
- Objective 2.1: Grant and contract research support.
- Objective 2.2: Program recognition.

Goal 3: Develop the human and physical resources of the department to achieve Top 20 stature.
- Objective 3.1: Faculty expertise.
- Objective 3.2: Reward expertise.

Goal 4: Promote diversity and inclusion.
- Objective 4.1 Graduates from Diverse Backgrounds

Goal 5: Improve the quality of life for Kentuckians through extension, outreach, and service.
- Objective 5.1: Extension programming.
- Objective 5.2: Expand external extension funding.

CRITERIA FOR MEASURING PROGRESS:

Objective 1.1: BAE standard 1.1: Increase the size of the BAE undergraduate student program from the most recent five-year average of 68.2 by 5% per year until reaching the desired program goal of 145 enrolled students.

Objective 1.2: BAE standard 1.2: Increase the 4-year and 6-year graduation rates to the average for the College of Agriculture (we're already above the College of Engineering, which are 8.3% and 31.4%) by 2% per year until reaching the desired goal.

Objective 1.2: BAE standard 1.3: Increase the number of undergraduates (or recent graduates) taking the Fundamentals in Engineering exam to 90% of the graduating class.

Objective 1.2: BAE standard 1.4: Increase the number of undergraduate taking advantage of an international experience by 5% per year, with a goal of 50% of the students participating.

Objective 1.2: BAE standard 1.5: Increase to or maintain graduation rates of three PhD's and six M.Sc. students based on a 5-year average.

Objective 1.2: BAE standard 1.6: Publish 0.5 peer-reviewed articles and make 1.0 scientific presentation per supported-graduate-student-year.

Objective 1.2: BAE standard 1.7: Maintain a balance of international graduate students enrolled in our program, with a goal of 50% international students.

Objective 1.2: BAE standard 1.8: Increase the number of foreign national students we host for "sandwich" programs and internships to 0.25students/research faculty FPE.

Objective 1.2: BAE standard 1.9: Include graduate assistantships on 90% of the grants written in the department.

Objective 2.1: BAE standard 2.1: Increase the total Wethington Award values from the most recent departmental total of $80,453 (at the time of writing of the original Strategic Plan FY10) by 5% per year.

Objective 2.1: BAE standard 2.2: Maintain the annual external awards at over $250K per research faculty FTE and/or $150K per faculty FTE.

Objective 2.1: BAE standard 2.3: Increase program financial support generated through non-research contracts such as gifts, scholarships, fellowships, and professorships.

Objective 2.2: BAE standard 2.4: Increase the 5-year average of peer reviewed publications from 3.41 to 3.75 per research FTE.

Objective 2.2: BAE standard 2.5: Increase the 5-year average number of patent disclosures submitted to the Intellectual Property Committee to 3 per year.

Objective 2.2: BAE standard 2.6: Increase the number of faculty members appointed to state and national boards.

Objective 2.2: BAE standard 2.7: Increase authorship of professional standards, design guides, and policy-directing documents.

Objective 3.1: BAE standard 3.1: Increase the number of full-time faculty from 18 in 2009 to 21 in 2014.

Objective 3.1: BAE standard 3.2: Create an endowed faculty chair.

Objective 3.1: BAE standard 3.3: Maintain a five-year average of two or more post-doctoral scholars and two or more research professors supported per year.

Objective 3.2: BAE standard 3.4: Position the faculty to receive university, regional, national, or international achievement honors at the rate of 0.1 per faculty FTE.

Objective 3.2: BAE standard 3.5: Maintain professional engineering registration of faculty members at 80% or above.

Objective 4.1: BAE standard 4.1: Increase the 5-year average percentages of undergraduate students, graduate students, technical staff, and professional staff from under-represented groups by 5%.

Objective 4.1: BAE standard 4.2: Increase the number of candidates from under-represented groups applying for tenure-track faculty positions.

Objective 5.1: BAE standard 5.1: Continue to develop programs to support agents and clientele needs, with their effectiveness measured via existing extension program evaluation metrics.

Objective 5.1: BAE standard 5.2: Maintain the visibility, quality, and usefulness of engineering web-based resources as measured by an increase in the number of users accessing resources and downloading articles by 5% per year, including extension series publications and topical web pages.

Objective 5.1: BAE standard 5.3: Increase the number of extension programs submitted for awards to 1 per extension faculty FTE per year.

Objective 5.1: BAE standard 5.4: Increase the number of new and revised extension series publications to 4 per extension faculty FTE per year.

Objective 5.2: BAE standard 5.5: Increase the level of grant activity as measured by the numbers of proposals submitted and funded to 2 per extension faculty FTE per year.

Objective 5.2: BAE standard 5.6: Maintain a critical balance of faculty appointments between extension and research to insure program support for key areas.

APPENDIX E: MINUTES FROM THE SUMMER 2011 FACULTY RETREAT

BIOSYSTEMS AND AGRICULTURAL ENGINEERING DEPARTMENT

Biosystems and Agricultural Engineering Department
Faculty Retreat
Meeting Minutes
Prepared by John Wilhoit

Date: Tuesday, August 16, 2011
Time: 1:00 – 4:30 PM (approximately)
Where: Cardome Centre, Georgetown, KY
In attendance: Sue Nokes, Sam McNeil, Mike Montross, Tim Stombaugh, Fred Payne, Carmen Argouridis, Czar Crofcheck, Joe Taraba, John Wilhoit, Doug Overhaults, Mark Purschwitz, Steven Walker, Richard Warner.

Sue Nokes called the meeting to order.

She passed out a copy of a draft version of the position announcement in **Machine Systems and Automation Engineering** and asked if there were any revisions that should be made to have a final version ready to send to the dean. Small editorial suggestions were made.

Sue said that she had reviewed the files from several previous faculty retreats, going back about 25 years, under several different department heads. She discussed some of the things that she came across in the summaries of those retreats.

Sue gave an update on the Energy Extension position. Barret Mooney, who was offered the position, has not called back, and apparently will not take the position. There was discussion about how to proceed with trying to fill this position. In particular, there was discussion about James Bush, who is at least a year from finishing his Ph.D. in BAE at UK, as being someone who would be a particularly good fit for this position. A motion was made by Mike Montross that no offer be extended to candidates from the current pool of applicants (that the two interviewees were chosen from). Richard Warner seconded the motion, and it passed. We can still interview for this position, but we would have to find new applicants.

Sue discussed some of the important themes put forth by Larry Turner for our department, including the "Sacred Bundle," the "Four Minute Mile" (need to strive to break imaginary barriers/push the envelope), and "Straight Rows" (keep eyes on the horizon to plant in straight rows). She handed out the current mission statement for the department, and asked that each of us write down five things that are good qualities of our department, sort of our "Sacred Bundle" for BAE. Everyone told their choices and they were listed on wall sheets. The selections were then prioritized by placing stars. The results are as follows:

1. Produce students that get jobs (**)
2. Faculty with leadership national /international (**)
3. Diversity of skills and backgrounds (*****)
4. Applying sciences to real world problems (***)
5. Mentors (****)
6. Discover solutions to KY problems ("real") (**)
7. Faculty (and staff) have ability to work well together (***)
8. Cohesive, educated, cooperative, inventive, professional, productive
9. Awesome facilities (****)
10. Unique in that we deal w/ traditional to cutting edge (*****)

11. Shared vision/burden (*)
12. Excellence in teaching (*****)
13. Personal touch when dealing with clientele/students (*)
14. Influence/tie into KY's economic future (productivity, profitability) (*****)
15. More open to collaborating with other disciplines (*)

Sue gave a handout of all the BAE courses, separated into required, service, frequent electives, and graduate courses. The instructors for each course were listed, with holes (lacking instructors) highlighted in yellow. There was some discussion about the concerns of meeting our instruction needs, especially with the "tsunami" of students in BAE in coming years. Instruction needs/holes breakdown approximately into 1/3 machinery, 1/3 environment, and 1/3 other (lot of bioprocessing/bio-energy) courses.

Sue gave a handout of the survey responses of BAE faculty on first, second, and third choices for priorities in filling the next position in the department (after filling the **Machine Systems and Automation Engineering** position). Research "gaps" were discussed, and listed on wall sheets as follows:

Research (gaps)

a. Structures & environment (BAE 427) (3g, 1r)
b. Green buildings
c. Machine systems (3g, 2r)
d. Bioprocessing (5g)
e. Environmental remediation (air quality) (1r)
f. Instrumentation (1g)

Then extension "gaps" were discussed.

Extension (gaps)

a. Storm water management (urban) passive treatment systems/water quality
b. Animal housing/structures & environmental control—dairies, beef to greenhouses (landscape, fruit & vegys) (small producers/operators)
c. Bioenvironmental –> Machine systems/mechanization –> biological processing

There was discussion of the needs in the animal housing area, with dairy housing needs being big, but producers going to consultants more, and the need for extension maybe diminishing. Jobs for students/graduates may be increasing in this area, especially for controlled-environments/growth facilities. There was discussion about looking at the overall system of BAE needs/issues as more of a continuum of connected parts, including: (this was in a graphic with boxes around each, but I am not good at producing that sort of thing!)
Production (growing, plant/animal)
Harvest/Post-Harvest Handling (machinery systems, housing, etc.)
Processing/Packaging (bioprocessing/bio-energy, etc.)

Sue asked each of us to list our BAE clientele. The following clients were listed:

1. CNH global, John Deere, Trimble, etc.
2. Large farmers
3. Altech
4. Martek
5. Energy audits (100)
6. Fruit and vegetable farmers in KY
7. Coal producers (environmental regulatory)
8. Engineering consultants
9. Regulators (environmental)
10. NRCS
11. Fish and wildlife,
12. Lexington / Fayette Co. Government
13. Landowners (streams)
14. Utilities
15. State energy office
16. Food processing companies (Kraft, GM, Agri-mark)
17. USDA—food/milk security systems
18. Dairy farmers of America (DFA)
19. County extension agents
20. Equipment companies
21. Tyson/Perdue/Pilgrim's Pride/poultry integrators
22. Tobacco farmers
23. Homeland security (NIHS)
24. Farm bureau
25. Commodity boards (KSA, KCGA, KSGGA)
26. College of Public Health
27. Medical Center
28. 4-H
29. ISO—ASABE standards
30. Dairy farms (70)
31. Beef producers (350)
32. Private drinking water (wells, cisterns)
33. ASHRAE
34. Building codes

Then we listed the growth areas for jobs for our students in the future.

1. Equipment (JD will need 90 engineers in near term)
2. Bioenergy
3. Bioprocessing—industrial biochemical
4. Regulators /environmental impact

5. Sustainable mining

We went through an exercise of prioritizing the items listed as research and extension "gaps" for top choices for hiring, using green colored dots for top choice to hire, and red for least favorite choice, placing the colored dots placed next the item on the wall sheets. Bioprocessing was selected the most as the top priority, followed by machine systems and structures & environment (about the same) among research items. Several extension items were chosen as lowest priority, including storm water management with the most red dots, followed by animal housing and structures, and bioprocessing (about the same number of red dots). This was followed by a discussion of who is out there that would be possibilities for applying for jobs in BAE in the Bioprocessing and Machine Systems areas. Many names were put forth and discussed, with most of them being past BAE graduates currently in faculty positions at other universities, or current BAE Ph.D. students who will graduate soon.

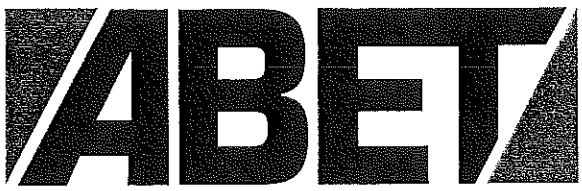
Fred Payne said that the COA is sponsoring a "Food Innovation Center" and that he is our representative with the center. He pointed out that we tried to hire a food processing extension person when Rich Gates was chair of the department, but we did manage to hire anyone and we lost the position.

Discussion about the Energy Extension position was re-opened. A suggestion was made that maybe the position should be broadened to include more coverage of the structures and environment area. Sue said that it is it is critical that we not re-advertise the position, because we cannot risk losing it, but that it would be possible to "tweak" it a little without rewriting/re-advertising it. A motion was made by Czar Crofcheck, seconded by Mike Montrose, that the position be informally broadened to cover the structures and environment area more, to try to get another round of applicants to apply. The motion was approved.

A vote was made on what area the next faculty position hire should be in. The results were eight in favor of Bioprocessing, and four in favor of Machine Systems.

Sue gave a handout of committee assignments and asked that each faculty member list the committees that would be interested/willing to serve on, as well as the committees that they would prefer not to serve on. She took up the committee assignment sheets with faculty responses.

The meeting was adjourned about 4:30 PM.



Engineering Accreditation Commission

Final Statement of Accreditation
to
University of Kentucky
Lexington, Kentucky

2010-11 Accreditation Cycle

Leadership and Quality Assurance in Applied Science, Computing, Engineering, and Technology Education

ABET, Inc.

Engineering Accreditation Commission

Summary of Accreditation Actions
for the
2010-2011 Accreditation Cycle

University of Kentucky
Lexington, KY

Biosystems Engineering (B.S.)
Chemical Engineering (BSChE)
Civil Engineering (BSCE)
Computer Engineering (BSCoE)
Mechanical Engineering (BSMEE)
Mining Engineering (BSMIE)

Accredit to September 30, 2017. A request to ABET by January 31, 2016 will be required to initiate a reaccreditation evaluation visit. In preparation for the visit, a Self-Study Report must be submitted to ABET by July 01, 2016. The reaccreditation evaluation will be a comprehensive general review.

Electrical Engineering (BSEE)
Materials Engineering (BSMAE)

Accredit to September 30, 2013. A request to ABET by January 31, 2012 will be required to initiate a reaccreditation report evaluation. A report describing the actions taken to correct shortcomings identified in the attached final statement must be submitted to ABET by July 01, 2012. The reaccreditation evaluation will focus on these shortcomings. Please note that a visit is not required.

ABET, Inc.
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Baltimore, MD 21202
Phone: 410-347-7700
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accreditation@abet.org

Applied Science Accreditation Commission
Computing Accreditation Commission
Engineering Accreditation Commission
Technology Accreditation Commission

August 04, 2011

Thomas W. Lester
Dean, College of Engineering
University of Kentucky
351 Ralph G. Anderson Building
Lexington, KY 40506-0503

Dear Dr. Lester :

Engineering Accreditation Commission (EAC) of ABET recently held its 2011 Summer Meeting to act on the program evaluations conducted during 2010-2011. Each evaluation was summarized in a report to the Commission and was considered by the full Commission before a vote was taken on the accreditation action. The results of the evaluation for University of Kentucky are included in the enclosed Summary of Accreditation Actions. The Final Statement to your institution that discusses the findings on which each action was based is also enclosed.

The policy of ABET is to grant accreditation for a limited number of years, not to exceed six, in all cases. The period of accreditation is not an indication of program quality. Any restriction of the period of accreditation is based upon conditions indicating that compliance with the applicable accreditation criteria must be strengthened. Continuation of accreditation beyond the time specified requires a reevaluation of the program at the request of the institution as noted in the accreditation action. ABET policy prohibits public disclosure of the period for which a program is accredited. For further guidance concerning the public release of accreditation information, please refer to Section II.L. of the 2010-2011 Accreditation Policy and Procedure Manual (available at www.abet.org).

A list of accredited programs is published annually by ABET. Information about ABET accredited programs at your institution will be listed in the forthcoming ABET Accreditation Yearbook and on the ABET web site (www.abet.org).

ABET, Inc.
ENGINEERING ACCREDITATION COMMISSION

UNIVERSITY OF KENTUCKY
Lexington, KY

FINAL STATEMENT
Visit Dates: October 24-26, 2010
Accreditation Cycle Criteria: 2010-2011

Introduction & Discussion of Statement Construct

The Engineering Accreditation Commission (EAC) of ABET, Inc. has evaluated the biosystems, chemical, civil, computer, electrical, materials, mechanical and mining engineering programs of the University of Kentucky.

This statement is the final summary of the EAC evaluation, at the institutional and engineering-program levels. It includes information received during due process, including information submitted with the seven-day response. This statement consists of two parts: the first deals with the overall institution and its engineering operation, and the second deals with the individual engineering programs. It is constructed in a format that allows the reader to discern both the original visit findings and subsequent progress made during due process.

A program's accreditation action is based upon the findings summarized in this statement. Actions depend on the program's range of compliance or non-compliance with the criteria. This range can be construed from the following terminology:

- Deficiency: A deficiency indicates that a criterion, policy, or procedure is not satisfied. Therefore, the program is not in compliance with the criterion, policy, or procedure.

- Weakness: A weakness indicates that a program lacks the strength of compliance with a criterion, policy, or procedure to ensure that the quality of the program will not be compromised. Therefore, remedial action is required to strengthen compliance with the criterion, policy, or procedure prior to the next evaluation.

- Concern: A concern indicates that a program currently satisfies a criterion, policy, or procedure; however, the potential exists for the situation to change such that the criterion, policy, or procedure may not be satisfied.

- Observation: An observation is a comment or suggestion that does not relate directly to the accreditation action but is offered to assist the institution in its continuing efforts to improve its programs.

The University of Kentucky is a comprehensive, land grant, state university comprised of 17 colleges. The College of Engineering has seven departments with nine undergraduate and graduate programs and three graduate programs. The college has approximately 1,900 undergraduate engineering and computer science students, 380 graduate students, 129 full-time faculty members, and a total of 155 full-time-equivalent faculty members. Faculty members are active in the scholarship of both teaching and research. Ninety percent of the students enrolled in the University are from Kentucky.

The following units were reviewed and found to adequately support the engineering programs: mathematics, physics, biology, chemistry, library, information technology, writing, arts and sciences, career services, finance, freshman advising, co-operative education, registrar, and admissions.

Institutional Strengths

1 The College has recently instituted a new student recruiting program that has been highly successful in increasing both the quantity and quality of incoming freshman students.

2. The Engineering Library has undergone significant renovations, making it a highly efficient and desirable place for students to learn.

Biosystems Engineering
Program

Introduction

The biosystems engineering program evolved from the biosystems and agricultural engineering program with a name change in 2008. The program offers six areas of specialization. For 2009-10, the program had 55 full-time students, five part-time students and 3.0 full-time-equivalent faculty teaching appointments.

Program Strengths

1. The program has faculty with the vision to lead a four-college project that was one of 20 selected for the U.S. Department of Energy's Solar Decathlon.

2. The program has an Advisory Council with many members very interested in assisting the department in maintaining a sound undergraduate program with a strong student design experience.

3. The program has made a strong commitment to written and oral presentations by providing a variety of presentation types related to different types of audiences, including videotaping the presentations so that the students can see their performance.

Program Concern

1. Criterion 2. Program Educational Objectives This criterion requires a program to have published program educational objectives that are consistent with the mission of the institution and the criteria. Program educational objectives are defined to be broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve. The program educational objectives focus on what the program is to do rather than describing the career and professional accomplishments of the graduates. As worded, the statements cannot be assessed and evaluated to provide guidance for improving the program.

- Due-process response: The EAC acknowledges receipt of documentation demonstrating that the program has developed and approved new program educational objectives that better describe what their graduates should be able to achieve after graduation.

- The concern is resolved.

Program Observation

1. Continued emphasis on non-technical issues in the capstone design will better prepare the students for career and professional assignments.

ABET
Self-Study Report

for the

Biosystems Engineering Program

at

University of Kentucky

Lexington, KY

July 2010

CONFIDENTIAL

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Self-Study Report
Biosystems Engineering Program
Biosystems Engineering
University of Kentucky

BACKGROUND INFORMATION

A. Contact Information

The pre-visit contact person is:
Sue Nokes, Ph.D., P.E.
Professor and Director of Undergraduate Studies
Biosystems and Agricultural Engineering
215 Charles E. Barnhart Building
University of Kentucky
Lexington, KY 40546-0276
Phone: 859-257-3000 ext 215
E-mail: sue.nokes@uky.edu

B. Program History

The Department of Biosystems and Agricultural Engineering (formerly the Department of Agricultural Engineering) at the University of Kentucky began its professional engineering curriculum with seven upper class transfer students and the first freshman class of three students in the fall of 1957. The department immediately sought to join the other engineering programs at the University of Kentucky in seeking accreditation of undergraduate engineering programs granting Bachelor of Science degrees by what was then the Engineers' Council for Professional Development (ECPD). Through May 2010, the program has granted over 400 B.S. degrees.

The American Society of Agricultural and Biological Engineers (ASABE), formerly the American Society of Agricultural Engineers, has collaborated with the ECPD and, more recently, with ABET Inc. in prescribing the body of knowledge which must be mastered by students receiving B.S. degrees in Agricultural, Biological, and Biosystems Engineering.

Bachelor of Science degrees in Agricultural Engineering were granted from 1957 to 1991, which culminated in senior-level design courses in the four traditional technical areas of Power and Machinery, Soil and Water, Structures and Environment, and Agricultural Processing. In 1991, a major curriculum revision added two semesters of general biology and microbiology to the undergraduate degree requirements. Some traditionally required engineering science courses, such as dynamics and electrical engineering, as well as the traditional departmental design courses were not required. Instead, students selected seven technical electives to develop individualized curricula with greater specialization and focus. The degree name changed to Bachelor of Science in Biosystems and Agricultural Engineering. Subsequent revisions of the curriculum replaced microbiology with a biological elective, added dynamics, and required all students to take three of the four senior-level departmental design courses.

Program changes since the 2004 ABET site visit include adding a new course BAE 503, Fundamentals of Biorenewable Resources, to offer students a technical elective covering the essential aspects of this emerging area of technology. Finally, in 2008, the faculty of both the BAE Department and the College of Engineering (COE) voted to change the name of the degree to Bachelor of Science in Biosystems Engineering. The first UK degrees in Biosystems Engineering were awarded in December 2009.

C. Options

The degrees offered by the University of Kentucky Department of Biosystems and Agricultural Engineering are:

a. Bachelor of Science in Biosystems Engineering (BSBN)
b. Master of Science in Biosystems and Agricultural Engineering (MSBAE)
c. Doctor of Philosophy (Ph.D.)

The areas of specialization offered are:

a. Bioenvironmental Engineering
b. Food and Bioprocess Engineering
c. Machinery Systems Automation Engineering
d. Controlled Environmental Systems
e. Pre-Biomedical Engineering
f. Pre-Veterinary Medicine

D. Organizational Structure

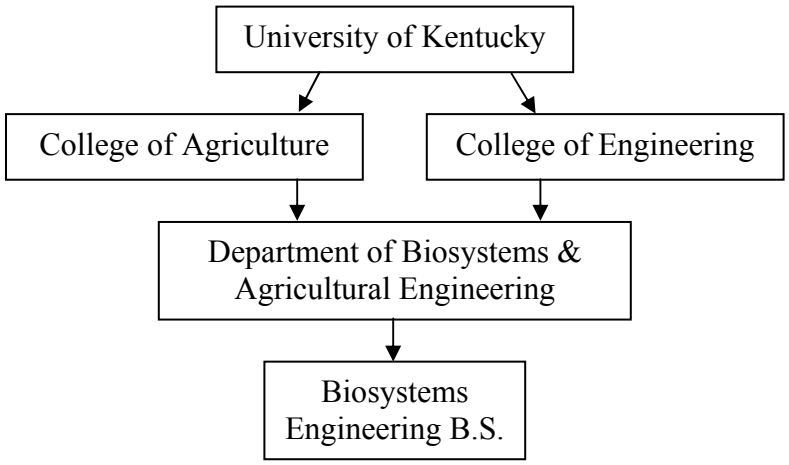

Figure 1. Organizational Administrative Structure of the Biosystems Engineering Program.

The Department of Biosystems and Agricultural Engineering is a part of the College of Agriculture (COA) and the College of Engineering (COE), as shown in Figure 1. Faculty funding, promotion, and tenure fall under the purview of the College of Agriculture while undergraduate education is administered by the College of Engineering.

E. Program Delivery Modes

The undergraduate program is a day program, occasionally extending into the late afternoon and early evening and delivered on the Lexington campus of the University of Kentucky. Courses consist of traditional lecture/laboratory experiences.

F. Deficiencies, Weaknesses or Concerns from Previous Evaluation(s) and the Actions Taken to Address Them

The most recent ABET review of the program was in 2004. The department had implemented the continuous program improvement process with a limited history. The weaknesses and concerns regarding Criteria 2, 3 and 6 were noted in the 2004 review as resolved. The program was accredited through 2010; however, a Program Concern was noted regarding Criterion 4: Professional Component. The review noted a lack of consideration of non-technical topics such as safety, environmental, sociological and economic issues appearing in the capstone design course reports. While incorporation of some of these topics in specific projects can be challenging, a concerted effort has been made to implement these non-technical topics, whereby student design teams are required to consider these issues in their design development. Generally, safety and economic considerations are addressed, with social and environmental issues addressed as appropriate. The general quality of the design projects has been excellent as evidenced by student design teams placing second (twice) and third in the American Society of Agricultural and Biological Engineers AGCO Student Design Competition since the 2004 review.

The department has fully and formally implemented the Continuous Improvement Process with regard to program educational objectives and outcomes. Although the assessment techniques change as the process matures, with regard to the achievement of educational objectives and outcomes, we remain resolute in the desire to continuously improve our educational effectiveness.

CRITERION 1. STUDENTS

A. Student Admissions

Prospective students at the University of Kentucky must complete a prescribed curriculum of high school credits (see Appendix D) and complete the ACT standardized test. Selective admission criteria are then applied based upon the number of seats available. Table 1 presents the ACT and SAT scores of freshmen admitted to the College of Engineering and specifying BAE as their major since 2005. These data, along with similar results in Appendix D, show that the quality of our incoming freshmen is comparable to the quality of those in the other engineering disciplines.

Table 1. (ABET Table 1-1) History of Admissions Standards for Freshmen Admissions for Past Five Years.

Academic Year	Composite ACT		Composite SAT*		Percentile Rank in High School		Number of New Students Enrolled
	MIN.	AVG.	MIN.	AVG.	MIN.	AVG.	
2005-2006	19	24.9	-	-	18%	79.9%	8
2006-2007	23	26.8	910	910	9%	75.2%	4
2007-2008	17	25.6	1080	1196.7	16%	78.6%	17
2008-2009	20	25.9	1040	1200	9%	79.2%	15
2009-2010	20	26.1	1060	1085	12%	81.7%	14

*There are a small number of students taking the SAT.

Recruiting

Our program benefits from student recruitment activities organized by both the College of Agriculture and the College of Engineering. The College of Engineering Office of Student Support Services annually visits several locations throughout Kentucky and bordering states to recruit qualified students. Interested students and their families are brought to campus for activities in which the various engineering programs present opportunities in their respective disciplines. The College of Engineering also hosts an Open House during the annual Engineers Week; potential students and their families visit exhibits and projects, demonstrated by BAE students and faculty.

The UK College of Agriculture Office of Student and Academic Services also maintains an active student recruitment effort through the Director of Student Relations. Similar off-campus events are scheduled each year at which potential students can learn about the BAE program. Potential students are invited to campus each year to meet with faculty and students from various programs in the College.

The Department has an active Student Recruitment Committee that hosts students during various activities on campus. This committee also hosts students and their families on numerous tours of the Department throughout the year. Committee personnel seek to identify opportunities to meet with prospective students who have been invited to campus for a variety of programs. We believe that these efforts have been essential in maintaining incoming freshmen classes of approximately 15-20 students per year.

B. Evaluating Student Performance

A student's performance in each class is summarized through the semester grade for the class. The University of Kentucky uses a 4.0 grading scale. The performance of individual students is then monitored through several processes. The processes of monitoring a student's progress and advising the student are shown in Figure 2, and discussed below.

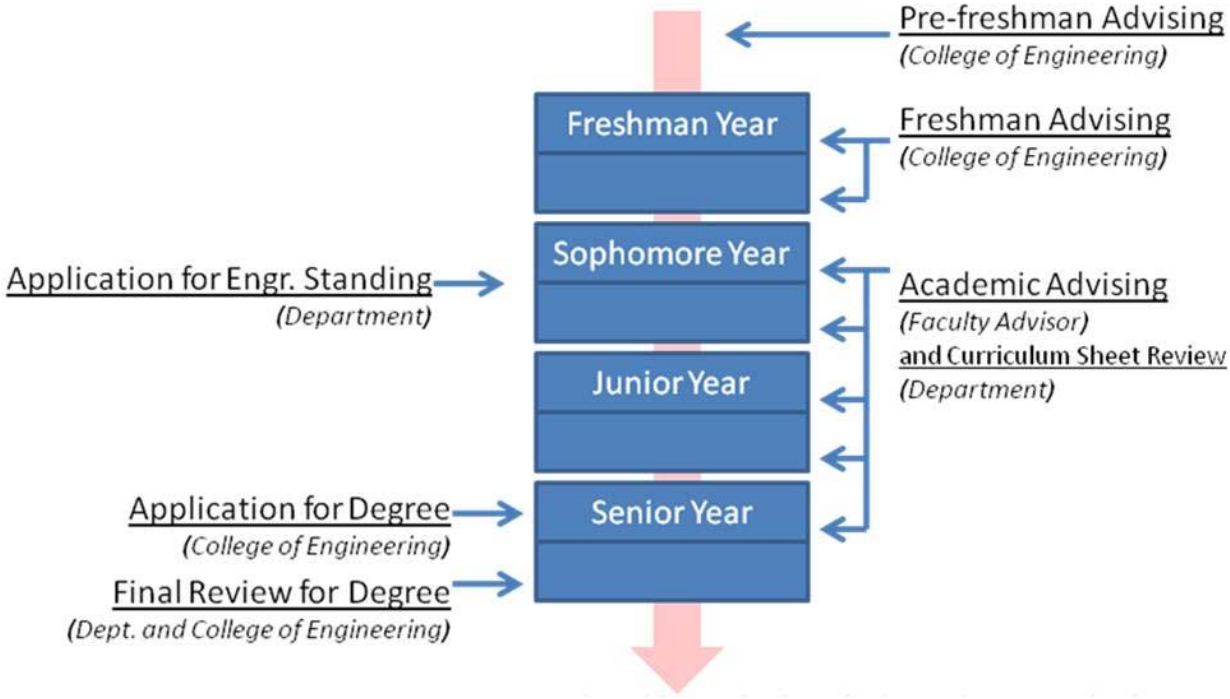

Figure 2. Advising and Progress Evaluation of Students.

During Student Advising Each Semester

Each semester, students must meet with their academic advisors in order to be able to register for classes for the following semester. Prior to these meetings, advisors have on-line access to the academic records for each student, indicating what classes have been completed, the grade received in each class, and the required classes that remain to be taken. In addition, the Department keeps student curriculum sheets, which are updated by the Departmental Student Services Coordinator each semester. Typically, during the advising appointment, the advisor and student discuss the student's past performance, the courses that are in progress, and the courses that must be taken in order to complete the degree. In 2009, the University of Kentucky implemented mandatory mid-semester grades for all undergraduates. The university course drop-date is after the mid-term grades come out and after the advising appointments. Therefore, the advisor and student can have an informed conversation about the student's progress that semester. The advisor also counsels students in regards to their summer plans and/or professional school applications.

During Application to Engineering Standing

Students are in "Pre Biosystems Engineering" standing when they enter as freshmen and remain approximately through the end of the first semester of their sophomore year. To move from Pre Biosystems Engineering to Biosystems Engineering requires that the student achieve

Engineering Standing. In Biosystems Engineering, Engineering Standing requires (from the *2009-2010 UK Bulletin*) the following:

> Requirements for Engineering Standing for Biosystems Engineering: "Completion of a minimum of 35 semester hours acceptable towards the degree in biosystems engineering with a minimum cumulative grade-point average of 2.50. Completion of ENG 104, MA 113, MA 114, MA 213, CHE 105 and PHY 231 with a minimum cumulative GPA of 2.5 in these courses. University repeat options may be utilized as appropriate. Students who do not meet these GPA requirements may request consideration based upon departmental review if both of these GPA values are 2.25 or greater."

Students request Engineering Standing through the BAE Department Student Services Coordinator. Situations requiring departmental review are brought to the Director of Undergraduate Studies. Engineering Standing is necessary for the student to progress in the degree, as it is a prerequisite for several upper-level courses. The requirement for Engineering Standing works as an early stop in the program for students who are unlikely to meet graduation requirements.

Upon Academic Probation Review

The College of Engineering reviews students' records each semester for academic probation or suspension issues. A student is placed on academic probation by the College of Engineering if he/she has a GPA of less than 2.0 for a given semester. A student who is on probation and fails to earn a 2.0 semester GPA in the following semester will be dropped from the College of Engineering and will not be readmitted until he/she has obtained a semester GPA of 2.0 or greater for one semester and the student's cumulative GPA is 2.0 or greater.

In addition to the above three review processes, the college and university have implemented APEX (Academic Program Evaluation and eXploration), a computer-based system that compares a student's academic work – at any point in the student's career – with the requirements of the degree program. APEX prepares a comprehensive report detailing the student's progress toward meeting those requirements. The reporting from APEX is available to both the student and the advisor, in order to monitor the progress of a student towards their degree. The Department of Biosystems Engineering became active on APEX prior to the start of the Spring 1999 semester. The report generated by APEX is used as a guide, but does not have final authority as some students have course equivalencies that the APEX system cannot recognize unless entered in the system separately. For example, many of our students take the Civil Engineering fluid dynamics course, followed by heat transfer taught in Mechanical Engineering, which has a pre-requisite of ME 330, the Mechanical Engineering fluid dynamics. The ME department accepts the Civil Engineering fluids course; however, APEX must be programmed to accept this course substitution.

Upon Application for Degree

During the registration and advising period prior to the last expected semester before graduation, the student must submit an Application for Degree. This initiates a review by the College of Engineering academic records staff to verify for that student that all requirements for graduation are expected to be met. The Criterion 5 section of this document contains more information on requirements for graduation in the Biosystems Engineering curriculum. Although the Application for Degree is due the semester prior to the student's final semester, students are

asked to submit the application during the semester before, so that problems can be detected early enough that they might be rectified in the last semester.

A final review of the student's progress is undertaken immediately after completion of the student's final semester to ensure that all requirements have been completed before the degree is awarded.

C. Advising Students

Freshmen are enrolled in the College of Engineering and are advised by personnel in the Office of Student Support Services. The BAE Director of Undergraduate Studies (DUS) regularly confers with that office concerning students who have selected BAE as a major. The BAE curriculum includes freshman courses offered in BAE during both fall and spring semesters; our intention is to introduce our students to the BAE profession and to expose our students to the BAE faculty as well as to the types of support that are available in the department.

The BAE Director of Undergraduate Studies advises second year and transfer students until they either achieve Engineering Standing or select an area of curriculum specialization. Advising emphasizes satisfying requirements to achieve Engineering Standing in the BAE program. Sophomore courses offered in both the fall and spring semesters provide students with background in probability, statistics, and economics and provide continued exposure to the BAE facilities and faculty.

All BAE faculty have an area of specialization. When a student selects an area of curriculum specialization, a faculty member with the same specialization area will then advise the student. The areas of specialization within the BAE curriculum include: 1) bioenvironmental engineering, 2) food and bioprocess engineering, 3) machine systems automation engineering, and 4) controlled environmental systems. Students can also concentrate in pre-veterinary medicine or pre-biomedical engineering as preparation for pursuing advanced degrees in those fields. The BAE Director of Undergraduate Studies serves on the College of Engineering Undergraduate Studies Team and thereby serves as liaison between the BAE faculty and the College of Engineering regarding matters of undergraduate education. Usually during the fall semester of the student's junior year, the student selects an area of specialization. At that time, the advising for that student is transferred from the DUS to a faculty member in the specialization area to assist the student in selecting appropriate technical electives and finding contacts for future job searches.

The Director of Undergraduate Studies or his/her designee advises all transfer students selecting the BAE program. The Associate Dean for Administration and Academic Affairs regularly schedules advising conferences for transfer students. The Director of Undergraduate Studies reviews student records and recommends courses during the transfer student's initial semester of enrollment, until the student designates an area of specialization.

D. Transfer Students and Transfer Courses

Appendix D includes the policies regarding admittance of students transferring from other institutions to the University of Kentucky. Transfer students apply for admission through the University Registrar. Each transcript is reviewed and referred to the appropriate college. Students requesting admittance to the College of Engineering are referred to the Associate Dean for Administration and Academic Affairs.

Appendix D describes the methods employed by the University Registrar to validate credit hours transferred from courses taken at other institutions. Science, mathematics, writing, social studies and humanities courses taken at most community colleges in Kentucky are directly transferable. Most of the students transferring to the BAE program come from these institutions.

The University of Kentucky has established a list of equivalent courses with each college and university in Kentucky. The registrar analyzes transcripts of transfer students and assigns equivalent credit hours for courses completed. The Student Records Administrator refers all transcripts of transfer students desiring to major in the BAE program to the departmental Director of Undergraduate Studies, who also reviews the transcripts. The Director confers with each transferring student; they select courses for the next semester, discuss all transfer credit hours that were accepted and all that were denied. When the transferability of credit hours is in doubt, the Director of Undergraduate Studies can request that the applicant produce copies of syllabi of any courses in question for evaluation.

Table 2. (ABET Table 1-2) Transfer Students for Past Five Academic Years.

Academic Year	Number of Transfer Students Enrolled
2005-2006	0
2006-2007	2
2007-2008	1
2008-2009	1
2009-2010	1

E. Graduation Requirements

The Student Records Administrator in the College of Engineering determines whether each BAE major meets the undergraduate degree requirements of the College of Engineering. The BAE Director of Undergraduate Studies maintains a file for each BAE student to monitor courses taken and academic standing. The BAE Department maintains an Excel spreadsheet for each student, recording the completion of courses. This spreadsheet is the primary means by which the BAE Department monitors student attainment of Engineering Standing (see Appendix D). When BAE students achieve Engineering Standing, the Director of Undergraduate Studies advises the Student Records Administrator, who then confers that status. Engineering Standing status indicates that the student has shown potential to successfully complete the advanced courses offered by the College of Engineering.

The Student Records Administrator monitors all students in the College of Engineering relative to academic standing. The Associate Dean for Administration and Academic Affairs executes such actions as placing students on academic probation, dismissing students from the college, and readmitting students to the college in accordance with published academic requirements.

The Student Records Administrator certifies, by conducting degree audits, that each student in the College of Engineering meets all requirements for graduation. The Director of Undergraduate Studies and the Student Records Administrator resolve any questions concerning BAE students.

On average 14 students have graduated each year from the BAE program during the evaluation period (see Appendix D). The average number of students enrolled during that time was 67 students, or 13 students per class. The average graduation rate was approximately 80% of the

average number of freshmen enrolled (15 students/year) and was approximately 76% of the average enrollment per class. Thus, students transferring into the BAE program from other institutions, as well as other programs in the College of Engineering, tend to offset the attrition of students registering as freshmen.

F. Enrollment and Graduation Trends

The Department of Biosystems and Agricultural Engineering recruits and educates a diverse and capable student population. Approximately 64 students are currently registered in our undergraduate program, with female and minority components of 43% and 7.8%, respectively. The majority of our students are graduates of Kentucky high schools; however, we maintain a substantial component of out-of-state and international students. A majority of entering freshmen declare an interest in our pre-biomedical engineering program implemented in 1998-1999 as part of our major curriculum modification.

After moving into new facilities in 1990, the number of undergraduate students in our program more than doubled by the end of the decade and has remained relatively constant since 2000. Table 3 shows the enrollment trends for the past five academic years and Figure 3 shows total number of graduates each year, since 1998-1999. Class sizes have remained relatively small, from 24 in freshman courses to 5-15 in senior-level courses. With active student professional organizations and activities, our students and faculty maintain a camaraderie that would be difficult in larger programs. Students are encouraged to join the American Society of Agricultural and Biological Engineers (ASABE), Institute of Biological Engineering (IBE), or the American Society of Heating, Refrigerating and Air-Conditioning (ASHRAE) as part of their membership in the University of Kentucky BAE Student Branch.

Table 3. (ABET Table 1-3) Enrollment Trends for Past Five Academic Years.

	05-06	06-07	07-08	08-09	09-10
Full-time Students	38	43	41	47	55
Part-time Students, Student FTE[1]	3	4	3	4	5
Graduates	12	8	26	17	9

[1] FTE = Full-Time Equivalent

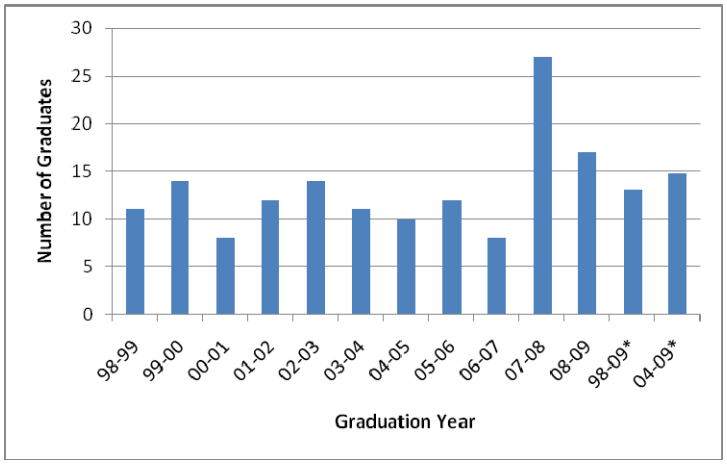

Figure 3. University of Kentucky BAE Graduates since 1999. Averages for 1998-2009 and 2004-2009 are also shown (*).

Table 4. (ABET Table 1-4) Current Employment of Program Graduates from December 2008 through May 2010.

Numerical Identifier	Year Matriculated	Year Graduated	Current Employment Title
1	Fall 2000	Dec '08	Project Engineer
2	Fall 2004	Dec '08	Test Engineer
3	Fall 2004	Dec '08	Validation Engineer
4	Fall 2004, T	Dec '08	Grad School, Ohio State Univ.
5	Fall 2004	Dec '08	Environmental Engineer
6	Fall 2004	Dec '08	Maintenance Engineer
7	Fall 2001	Dec '08	n/a
8	Fall 2004	Dec '08	MBA School, Purdue
9	Sum 2006, T	May '09	n/a
10	Fall 2003, T	May '09	Grad School, UK
11	Fall 2006, T	May '09	Pharmaceutical Engineer
12	Spr 2005, T	May '09	Small business owner
13	Fall 2001	May '09	n/a
14	Fall 2005	May '09	Engineer, UK-BAE
15	Fall 2005, T	May '09	n/a
16	Fall 2005, T	May '09	Grad School, UK-ME
17	Fall 2005	Dec '09	Grad School, UK-BAE
18	Fall 2007, T	May '10	n/a
19	Spr 2008, T	May '10	n/a
20	Fall 2006	May '10	Grad School, UK-BAE
21	Fall 2006	May '10	Grad School, UK-BAE
22	Fall 2006	May '10	Grad School, UK-BAE
23	Fall 2008	May '10	n/a
24	Fall 2006	May '10	Vet School, Texas A&M
25	Spr, 2007	May '10	Test Engineer
26	Spr 2006	May '10	Grad School, UK-BAE

* Transfer students indicated with a T.

CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

A. Mission Statements
Department of Biosystems and Agricultural Engineering Mission Statement

"The mission of the Department of Biosystems and Agricultural Engineering is to serve and benefit the people of Kentucky and beyond through learning, discovery, and engagement in engineering for food, energy, agricultural and biological systems."

-http://www.bae.uky.edu/AboutBAE/

College of Agriculture Mission Statement

The mission of the College of Agriculture is:

- to promote sustainable farming and food systems, from production through consumption;
- to enhance the health and well-being of people and the environment in which they live; and
- to expand economic opportunity by sharing the knowledge and tools for wise, innovative uses of natural resources and development of human potential.

As full partners in the University of Kentucky and in every Kentucky county we:

- facilitate lifelong learning, informed by scholarship and research,
- expand knowledge through creative research and discovery, and
- serve Kentuckians by sharing and applying knowledge.

The College shall sustain the land-grant heritage of achievement in this challenging new century.

-The Land-Grant Vision: College of Agriculture Strategic Plan 2007-2012* Submitted March 25, 2007, http://www2.ca.uky.edu/deanadmin-files/Strat_Plan_Final_3-25.pdf

College of Engineering Mission Statement

To provide education, research, and service in a scholarly environment in a way that:

- prepares our students for successful professional career;
- addresses the changing needs of our other constituents; and
- responds to the technological challenges facing the Commonwealth and the nation.

-http://www.engr.uky.edu/general/mis_vis_val.html

University of Kentucky Mission Statement

The University of Kentucky is a public, research-extensive, land grant university dedicated to improving people's lives through excellence in teaching, research, health care, cultural enrichment, and economic development.

The University of Kentucky:

- Facilitates learning, informed by scholarship and research.
- Expands knowledge through research, scholarship and creative activity.
- Serves a global community by disseminating, sharing and applying knowledge.

The University, as the flagship institution, plays a critical leadership role for the Commonwealth by contributing to the economic development and quality of life within Kentucky's borders and beyond. The University nurtures a diverse community characterized by fairness and equal opportunity.

-http://www.uky.edu/webuk/subpages/mission.html

B. Program Educational Objectives

The program educational objectives are to:

1. Educate students so that when they become engineers they can successfully design components and/or processes for advancement of agricultural, biological, or environmental systems.
2. Prepare students to be engineers with successful careers in industry, government, consulting firms, or academia. Successful careers begin with employment in their chosen field, continue with steady advancement, and include professional development.

These objectives are published on the web at
http://www.bae.uky.edu/Instruction/ABET/objectives_outcomes.htm

C. Consistency of the Program Educational Objectives with the Mission of the Institution

As a land grant university, the University of Kentucky's mission to improve people's lives extends to all of the citizens of Kentucky. The economy of the Commonwealth of Kentucky is driven in large part by the agricultural industries in the state, and large portions of Kentucky's citizens are impacted daily by environmental and/or agricultural systems. Our educational objectives are consistent with the Mission of the Institution because the engineers that we educate to design components and processes for agricultural, biological and environmental systems (i.e. Biosystems Engineers) are the future of Kentucky's economic development and the global economy. It is essential that Kentucky educate Biosystems Engineers to move these industries forward in a safe and an environmentally sustainable way.

Objective 2 relates to the ability of our students to transition successfully from the University into society, which is necessary if the University is to fulfill its mission of playing a critical leadership role. Some of the future leaders will emerge from the Biosystems Engineering graduates, and professional advancement and development are essential to retain relevancy to the Commonwealth and the global community.

D. Program Constituencies

For purposes of ongoing evaluation of Program Educational Objectives (PEO), we have selected recent graduates for feedback and our BAE Advisory Council for strategic planning and initiatives. The BAE Advisory Council includes members representing our constituencies including employers of our students and alumni of our program. Our constituents include students, employers of our graduates, and graduate programs.

E. Process for Establishing Program Educational Objectives

Program Educational Objectives were established in 1997, and revised in 2003 and 2010. The revisions in 2003 were made after a faculty retreat that focused on continuous quality improvement. These revisions were implemented to more clearly articulate the capabilities and

accomplishments desired of engineers who are our graduates. These revisions were intended to facilitate measurement of the program's success in meeting the Objectives in an ongoing process of program improvement. In the last review period, the faculty reviewed our program educational objectives and changed some wording to fully reflect that we mean graduates three to five years out of school, and not our graduating engineers. The wording of the Program Objectives was vetted with and approved by the BAE Advisory Council in June of 2010 meeting (Appendix F).

Metrics for Assessing Accomplishment of Program Educational Objectives

The metrics for assessing our program's accomplishments towards achieving the PEO were initially developed by the Undergraduate Curriculum Committee (UGCC). Our criteria in determining the metrics were: 1) relevance to the objectives and 2) sustainable availability of data for ongoing tracking and analysis. The metrics were presented to the full faculty in 2003 and approved. In April 2010, the UGCC revised the metrics based on feedback from a mock ABET review. The revised metrics and standards/goals were thoroughly reviewed by and approved as shown by the BAE Advisory Council (Appendix F). The revised metrics are:

Objective 1 - Metrics:

a) Graduate performance on the Fundamentals of Engineering examination as a predictor of competence in the first 3-5 years post-graduation;
b) Performance on the Professional Engineering (PE) examination as a measure of attainment of the ability to successfully design components and/or processes for advancement of agricultural, biological, or environmental systems.

Objective 2 - Metrics:

a) Acquisition of engineering employment (or employment in desired area) as a measure of employer confidence in our "product".
b) Salaries and promotions received since graduation to measure attainment of "steady advancement".
c) Key roles and leadership positions attained by graduates, which speak to both steady advancement and professional development.
d) Memberships in professional organizations, indicating access to professional development.

For each metric, standards and goals were determined. Standards represent the minimum acceptable, such that results below standard will require action (described in greater detail in Criterion 4). Goals represent the desired level for each metric.

Table 5. Standards and Goals for Objectives, Shown with Justifications.

Obj.	Tool	Standard	Goal	Justification
1	Performance on FE	Equal to the average national score over the review period.	10% higher than the average national score over the review period.	Our students should be able to perform as well as or above the national average.
1	Performance on the PE	70% of the BAE graduates responding who take the PE pass	95% of the BAE graduates responding who take the PE pass	At least half of the engineering alumni from our program should be prepared for the PE.
2	Acquisition of engineering employment in the desired area	70% of BAE graduates responding employed in satisfactory employment within 6 months of graduation	95% of BAE graduates responding employed in satisfactory employment within 6 months of graduation	Measures employer confidence in our "product" and the value of our program to students.
2	Salary and promotions since graduations for those employed	50% of BAE graduates responding had salary increases in the past 5 years	95% of BAE graduates responding had salary increases in the past 5 years	Measures attainment of steady advancement.
2	Key roles and leadership positions attained	10% of our graduates responding have supervisory roles	25% of our graduates responding have supervisory roles	Quantifies both steady advancement and professional development.
2	Memberships in professional organizations	50% of our graduates responding are members of at least one professional society	75% of our graduates responding are members of at least one professional society	Indicates access to professional development.

F. Achievement of Program Educational Objectives

An Alumni Survey was used to collect some of the data for assessment of the Program Educational Objectives. A copy of the Alumni Survey is included in Appendix E. The survey was emailed to alumni who had graduated in the last 10 years, not including the most recent year. For the most recent survey, alumni from 1998-1999 through 2007-2008 were sent a login and password for the Alumni Survey website. Email requests were sent to all of the alumni for whom we were able to obtain valid email addresses (106 of the 134 graduates for the specified years). Of the 106 requests, 67 alumni completed the survey. All of the assessments used for Objective 2 were based on these 67 responses. The results are shown in Figure 4Figure 7. For all five metrics our results were above standard, shown in Table 6, such that no further action was required. Our BAE Advisory Council also provided valuable feedback on the achievement of our educational objectives (included in Appendix E)

The Alumni Survey queried BAE alumni on their own perception of their preparedness for life and work, in terms of technical engineering knowledge, communication, and general non-technical knowledge (social factors, manufacturability, ethics, etc.). Figure 4 presents the average ratings for the 3 survey questions, with a rating of 0 meaning less than prepared and a 5 meaning well prepared. The goal for this metric is an average of 4 and the standard is an average of 3. The BAE program is meeting standard or goal for all years and for the average. There does seem to be a slight increase in the ratings over time, which is hopefully an indication that we are improving our program.

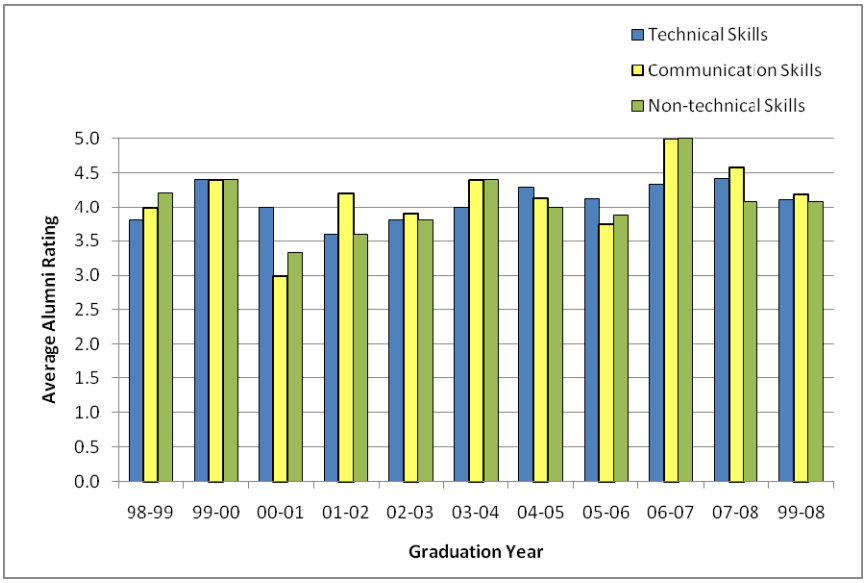

Figure 4. Average Ratings from the Alumni Survey Divided by Graduation Year.

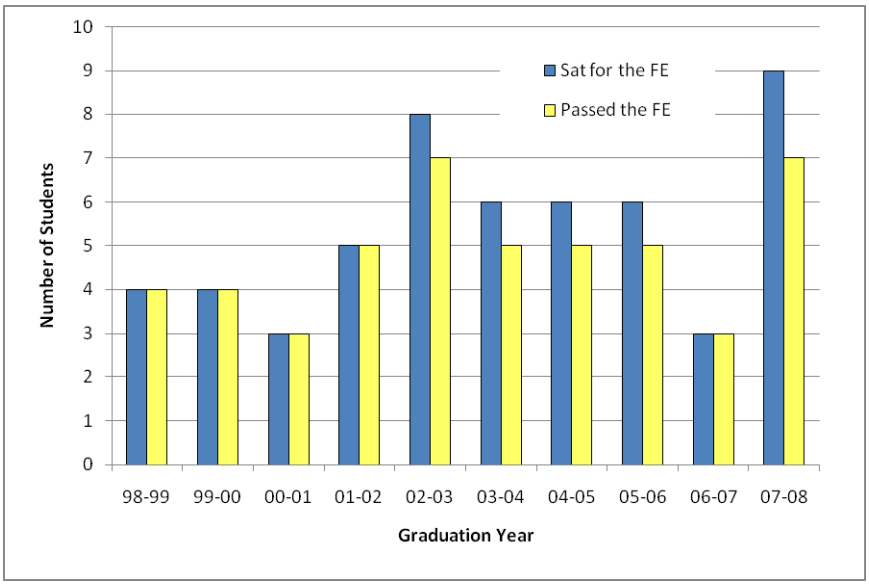

Figure 5. BAE Students Taking and Passing FE Exam since 1998.

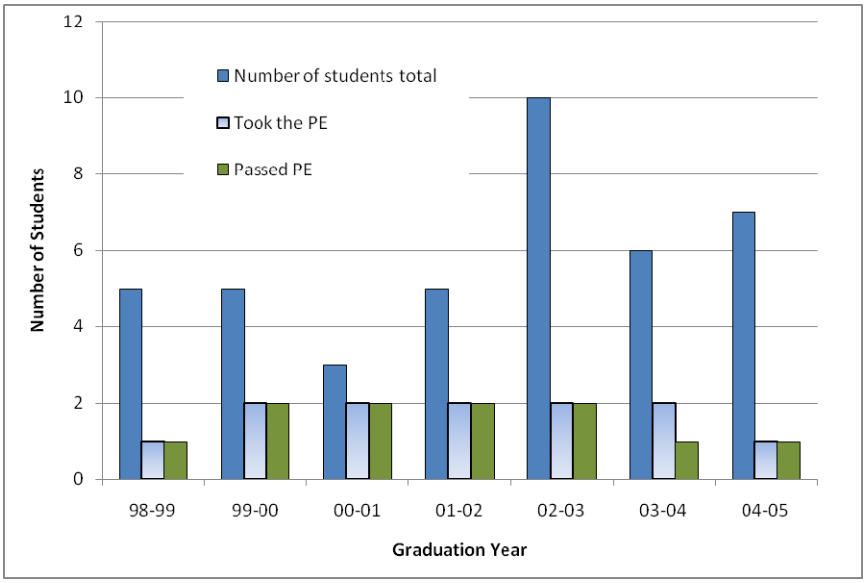

Figure 6. Percentage of BAE graduates, since 1998, who are Professional Engineers (PE). The latest five years of data are omitted due to the amount of time it takes to get a PE.

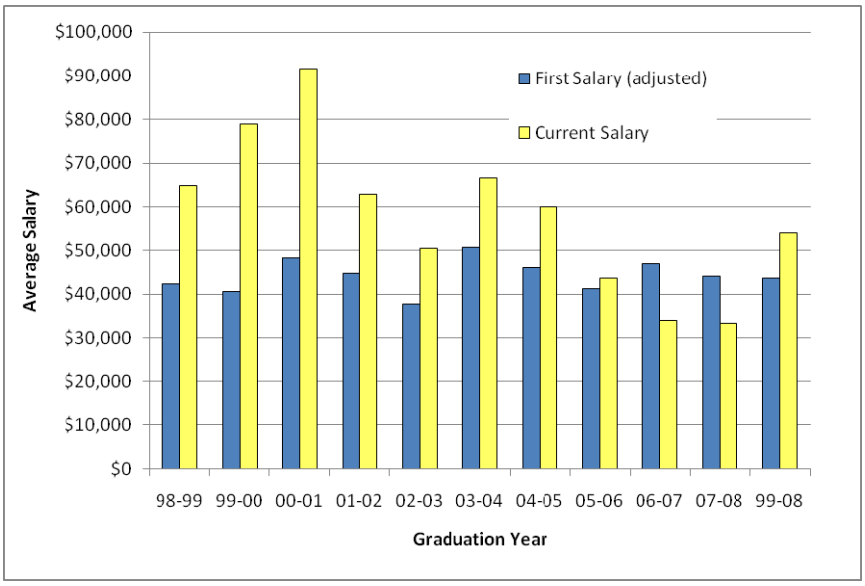

Figure 7. Average Starting (adjusted to 2009 dollars) and Current Salaries.

Table 6. Achievement of Objectives (the data are contained in Appendix F).
The percentages are all based on the 67 surveys returned.

Objective	Tool	Why?	Result	Action?
1	Performance on FE	Measuring preparedness	48/54 passed (89%, where 54 took the PE)	No
1	Performance on the PE	Measures engineering competence	Of the 12 that took the exam, 11 passed (92%)	No
2	Acquisition of engineering employment in the desired area	Measures employer confidence in our "product"	65/67 within 6 months of graduation (97%)	No
2	Salary and promotions since graduations for those employed	Measures attainment of steady advancement	Average increase in pay from starting position (adjusted) was 29% (only 49 responded) with 78% having increases	No
2	Key roles and leadership positions attained	Quantifies both steady advancement and professional development	43% of the individuals have supervisor roles (only 47 responded)	No
2	Memberships in professional organizations	Indicates access to professional development	58/67 members of at least one (86%)	No

CRITERION 3. PROGRAM OUTCOMES

A. Process for Establishing and Revising Program Outcomes

Program Educational Outcomes were initially developed during a faculty retreat in 2003. The outcomes were developed in conjunction with a redefinition of Program Educational Objectives, also in 2003. The Program Outcomes were selected to align with the missions of the BAE Department, College of Engineering, College of Agriculture, and the University of Kentucky. In addition, special attention was paid to ensure that our outcomes were closely aligned with the outcomes required by ABET (a-k). Each outcome is also directly related back to one of the two Objectives. Every year, at the UGCC meeting at the end of spring semester, the program outcomes are revisited to determine whether the department, the colleges, the university, the supporting industries, agencies, or government have changed such that the outcomes need to be revised. We then bring these suggestions before the Advisory Council meeting in June to obtain their input, before the faculty make a final decision on implementing changes to our program at the August faculty meeting.

B. Program Outcomes

Table 7. Biosystems Engineering program Outcomes with Primary Metrics.

Outcome - Objective 1	ABET Outcome	Primary Metrics
Students should be able to:		
1. Apply knowledge of mathematics, science and engineering to solve problems.	a	a) BAE 427/447: Homework assignments applying mathematics, science, and engineering to a biosystems problem, scored separately. b) FE: score on the math section.gi
2. Use techniques, skills and modern engineering tools necessary for engineering practice.	k	a) BAE 402/403: Homework assignments applying techniques, skills and modern engineering tools, scored separately. b) FE: score on the computer section.
3. Design and conduct experiments, as well as to analyze and interpret data.	b	a) BAE 202 b) BAE 305 c) BAE 402/403 Homework assignment(s) focused on the design of experiments and interpretation of data.
4. Identify, formulate, and solve engineering problems.	e	a) BAE 427/447: Homework assignments which evaluate the ability of our students to identify, formulate, and solve engineering problems, scored separately. b) FE: composite score*
5. Design a system, component, or process to meet desired needs.	c	a) BAE 4X7: Homework assignment(s) focused on designing a system, component, or process germane to the discipline. Especially problems typical of the PE exam should be considered.
6. Solve BAE problems that are vague or poorly constrained.	c	a) BAE 402/403: Quarterly report grades, because senior design focuses on vague or poorly constrained problems.
7. Utilize research and technical literature to interpret key issues or concepts.	i	a) BAE 4X7: Homework assignments that require students to consult published design standards and/or use technical literature (journal articles) to arrive at a final solution, scored separately.

* Composite score based on the engineering science sections, including engineering mechanics, strength of materials, material properties, fluid mechanics, thermodynamics, application of engineering mechanics, engineering of materials, fluids, and heat transfer.

Table 7. Biosystems Engineering program Outcomes with Primary Metrics (continued).

Outcome - Objective 2	ABET Outcome	Primary Metrics
8. Effectively communicate interpersonally, formally, and technically whether oral or written.	g	a) BAE 400 b) BAE 402/403 c) Student Competitions
9. Recognize the need for, and have an ability to engage in life-long learning.	i	a) BAE 400: A survey focused on future plans and career planning.
10. Work within a team approach to complete projects with many facets.	d	a) BAE 402/403: Performance in design teams, assessed by professional/faculty advisors and peers.
11. Work in a multi-disciplinary environment.	d	a) BAE 400: Homework assignments focused on researching and describing non-engineering roles such as accountants, environmentalists, community leaders, and safety specialists, scored separately.
12. Understand professional and ethical responsibility.	f	a) BAE 402/403: Homework assignment, scored separately. b) FE: score on the ethics section
13. Appreciate contemporary issues arising from industrially-relevant design questions.	j	a) BAE 403: Students are asked to write a paragraph after viewing each of the senior design presentations and describe a contemporary issue which the project addresses.
14. Understand the impact of engineering solutions in a global and social context.	h	a) BAE 417/437: Homework assignment focused on the evaluation of the students' perspective of global and social issues around engineering solutions.
15. Recognize the importance of and be engaged in the process of becoming a Registered Professional Engineer.	f	a) BAE 102 b) BAE 400 Homework assignment focused on the significance of becoming a Registered Professional Engineer.
16. Appreciate the advantages of being active in student clubs and professional organizations.	f	a) Exit interviews: All students are surveyed at the completion of their undergraduate program to track their participation in any clubs and professional organizations. b) BAE 102: Students are required to attend BAE Student Branch meetings during, and the instructor reports the actual attendance. c) BAE 403: Students are required to join ASABE on a national level during BAE 403, and the instructor reports the actual number of students that join.

Published on-line at http://www.bae.uky.edu/Instruction/ABET/outcomes.htm

C. Relationship of Program Outcomes to Program Educational Objectives

Outcomes 1-7 support attainment of Objective 1 and Outcomes 8-16 support attainment of Objective 2. Outcomes supporting Objective 1 are assessed by student mastery of basic technical skills necessary for engineering practice; these outcomes are easier to quantify numerically. Outcomes supporting Objective 2 measure attributes that are believed to be correlated with lifelong career success, and are more subjective in relation to the assessment techniques.

D. Relationship of Courses in the Curriculum to the Program Outcomes

Table 8 shows the linkages between individual courses in the BAE curriculum and the Program Outcomes. The twelve required BAE courses are listed, and the outcomes evaluated in each course are tracked. Faculty responsible for each course are responsible for administering the assessment(s) and summarizing the data.

Table 8. Courses where Outcomes are Assessed.

	Outcomes															
Classes	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
BAE 102															X	X
BAE 103																
BAE 201																
BAE 202			X													
BAE 305			X													
BAE 400								X	X		X	X			X	
BAE 402		X	X			X		X		X						
BAE 403		X	X			X		X		X			X			X
BAE 417				X	X		X							X		
BAE 427	X			X	X		X									
BAE 437				X	X		X							X		
BAE 447	X			X	X		X									

E. Documentation

Our 16 outcomes are listed the next section (F) along with the assessment process (tool), results of our 2008-2009 yearly evaluation, and summaries of actions resulting from previous yearly evaluations. The 2008-2009 yearly evaluation will serve as an example of the evaluation done every year. Details about the evaluations prior to 2008-2009 can be found in the Department's ABET documentation. Materials available for the ABET review team at the Fall 2010 visit will include homework assignments, class exercises and examination questions, survey results, and other materials needed to support the outcomes assessment described in the following pages.

F. Achievement of Program Outcomes

Assessments are compared to goals and standards that have been established for homework assignments scored separately, as indicated in Table 7. Unless noted otherwise, the standard metric is 70% of the assessment tool "correct", and the metric goal is 80%, which is the equivalent to the minimum score needed to obtain a "B" grade. For the FE examination assessment, a normalized score (FE_N = BAE score/national average) greater than 1.0 is used as the standard and a normalized score greater than 1.1 is set for the goal.

Table 9. Outcome Assessment Results for the 2008-2009 Yearly Assessment.

Out-come	Tool	Result from 2008-2009	UGCC Action Required?
1.	a) BAE 427/447 b) FE math score	a) BAE 427 - 88% BAE 447 - 87% b) FE_N(math) = 1.0	No
2.	a) BAE 402/403 b) FE_N computers	a) n/a * b) FE_N(computers) = 1.0	No
3.	a) BAE 202 b) BAE 305 c) BAE 402/403	a) 92% b) 95.6% c) 90%	No
4.	a) BAE 427/447 b) FE engineering sciences	a) B AE 427 - 88% BAE 447 - 87% b) For 2008-2009, FE_N = 1.0 For 2005-2009, FE_N = 0.9	Yes, see Table 10.
5.	a) BAE 4X7	a) BAE 417 - 61% BAE 427 - 87.6% BAE 437 - 84% BAE 447 - 90%	Yes, see Table 10
6.	a) BAE 402/403	a) 80%	No
7.	a) BAE 4X7	a) BAE 417 - 94.7% BAE 427 - 82% BAE 437 - 97% BAE 447 - 70%	No
8.	a) BAE 400 b) BAE 402/403 c) Student Comp.	a) 86.7% b) oral 94%;written 83% c) n/a**	No
9.	a) BAE 400	a) 94.4%	No
10.	a) BAE 402/403	a) >90%	No
11.	a) BAE 400	a) 88.9%	No
12.	a) BAE 400 b) FE ethics score	a) 90.6% b) FE_N(ethics) = 1.0	No
13.	a) BAE 403	a) 85% ***	No
14.	a) BAE 417 b) BAE 437	a) 75% b) 96%	No
15.	a) BAE 102 b) BAE 400	a) 90% b) 91.7%	No
16.	a) Exit interviews b) BAE 102 c) BAE 403	a) average 64% are members b) n/a* c) n/a*	Yes, see Table 10.

* New metric, no data for this year. ** There were no applicable competitions for this year.
*** New metric, data from 2009-2010.

There were three outcomes that required further action: 4, 5, and 16. Details about the specific actions taken by the UGCC and the results of these actions are in Table 10, in the Criterion 4 discussion. In addition, there are examples of other improvements made in individual classes instigated by the instructors (as opposed to the UGCC) in Table 11.

CRITERION 4. CONTINUOUS IMPROVEMENT

A. Information Used for Program Improvement

Figure 8 provides an overview of the process used for continuous improvement of our program. Two feedback loops join linking the assessments of the Program Educational Objectives with the assessments of the Outcomes. The interlocking circles meet at the Evaluation, Recommendation, and Decisions step. The faculty, in consultation with the Advisory Council, reviews the assessment results and determines the area of improvement which should be our highest priority for the coming academic year.

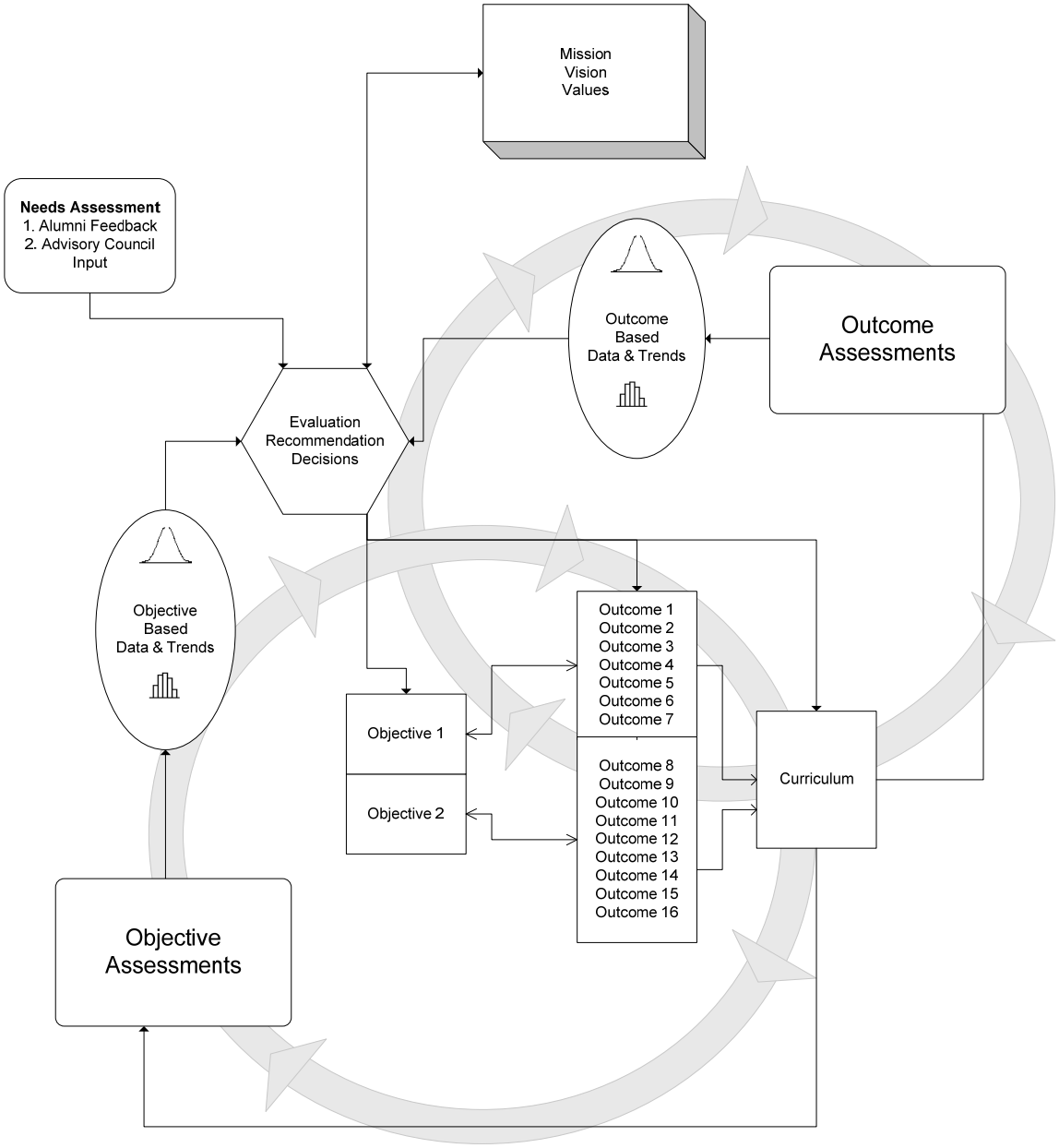

Figure 8. Continuous Improvement Process Model for the BAE Program.

B. Actions to Improve the Program

Over the review period several actions have been made to improve the program. These are discussed in Tables 10 and 11. Table 10 focuses on the actions taken as a direct result of the assessment and review by the UGCC that have been approved by the faculty and the Advisory Council. Table 11 focuses on the actions done by individual instructors as a direct result of performing the required assessment.

Table 10. Actions to Improve Program Instigated by the UGCC.

Area	Tool	Result	Action	Result
Outcome Metrics	Yearly assessments	The assessment tools needed to be revised, as well as the standards and goals.	Revised the outcome assessment metrics, goals, and standards.	Revisions approved by the faculty in April 2007, August 2008, August 2009, and December 2009.
Outcome 4	FE engineering sciences	Similar to national average for 2008-2009, below national average for 2004-2009.	Reinforce thermodynamics and applications of engineering mechanics in BAE 447 and BAE 417, respectively. These topics were the two lowest scoring sections on the FE in the engineering sciences.	In progress.
Outcome 5	BAE 417	Students scored 61% on the assessment.	Fall 2009, the students were given more time to complete the assignment.	In Fall 2009, the average score was 82%. No further action required.
Outcome 16	Exit interviews	On average 64% of students are members of student organizations (standard of 70%).	Fall 2009, further emphasized the importance of being a member of a professional organization by requiring BAE 102 students to attend 5 BAE Student Branch meetings during the Fall semester and by requiring BAE 403 students to join ASABE nationally. The standard was revised to 50%.	Students from BAE 102 were more likely to continue in the BAE student branch in the spring following BAE 102. Need to gather more data about students completing BAE 403. The average for professional society membership over the review period is 60%. No further action required.

Program Criteria	ABET criteria: dual vs. single-named program	Faculty voted to change to Biosystems Engineering for our program	Approved by COE in Spring 2008, approved by university in Fall 2009.	Effective Fall 2009. No further action required.

Table 11. Actions to Improve Program Instigated by the Instructors as a Result of Outcome Assessment.

Area	**Tool**	**Result**	**Action**	**Result**
Outcome 2	BAE 102 Excel assessment	47% of the students proficient at initial assessment; 75% of the students proficient at end of semester.	In Fall 2009, introduced more structured study of Excel by working on the computers during class	Proficiency went from 75% to 93% at the end of the semester
Outcome 4	Senior exit interviews	Students routinely said ME 340 was not helpful b/c of emphasis on mechanical systems.	In Fall 2008, changed curriculum to allow BAE 502 *or* ME 340; BAE 502 is Modeling of Biological Systems	Updated in the Bulletin Fall 2010
Outcome 8	BAE 400	Students' slides for presentations were poorly constructed.	In Fall 2008, added lecture specifically on proper construction of technical slides.	Slide preparations have improved.
Outcome 8	BAE 402/403	Technical writing in design reports was below standard.	In Fall 2008, Multiple rewrites implemented, with instructor checking against prior review comments to make sure appropriate changes were made	Writing has improved, Figure 12.
Outcome 8	BAE 402/403	Additional milestones	In Fall 2009, additional milestone assignments, such as economics, statistics, decision matrices, sustainability, social and political factors, environmental.	The students were able to consider design facets beyond their own individual project.

C. Yearly Continuous Improvement Procedure

The following describes the procedure for yearly Program Objective and Outcome assessments. This procedure will be followed every year, unless it is the year prior to an ABET review, for those years efforts will all be geared towards preparing for the ABET review.

Assessment Responsibilities

The Director of Undergraduate Studies (DUS) and the Chair of the Undergrad Curriculum Committee, with support from the Administrative Assistant to the DUS (referred to subsequently as the DUS*), have responsibility for collecting, analyzing, archiving and presenting all data used to assess achievement of Program Objectives and Outcomes**.** The DUS* will provide to the BAE Undergraduate Curriculum Committee a summary of metrics (assessed against data from current students) meeting and failing goals/standards, in June of each academic year. Additionally, the DUS* will provide a summary of metrics (assessed against data from the alumni survey) in June of the year preceding the 6-year ABET review. The committee will review the DUS* summary of metrics each year in July, and draft recommendations for possible revision of the program objectives and/or methods of assessment (including goals and standards) for presentation to the full faculty. The committee may, at its discretion, consider metrics not achieving goals. The committee must consider and act on metrics not meeting standards. In the event that a metric standard is not met, possible actions include:

a. Recommend a change in our procedures.
b. Adopt a new metric, goal and standard.
c. Revise the standard.

Revision of Objectives or Metrics

Metrics may be revised by a majority vote of full-time, tenure-track faculty of the Biosystems and Agricultural Engineering Department (BAE Faculty) at any meeting where a quorum of faculty is present.

Standards and/or goals may be revised by a majority vote of full-time, tenure-track faculty of the Biosystems and Agricultural Engineering Department (BAE Faculty) at any meeting where a quorum of the faculty is present.

Constituent Review

The final recommendations for objective revisions will be presented to the BAE Advisory Council consultation purposes. Comments and guidance from the BAE Advisory Council will be considered in the next review cycle.

Action and Documentation

In July, the BAE faculty will review the draft recommendations for revised program objectives and/or methods of assessment, and will vote on any recommended revisions in early August. Changes will be documented in the ABET documentation, in the next ABET Self-Study, and on the web as appropriate. The purpose of the ABET documentation will be to show the process over the course of the six year review period and to document the department's "closing the loop" each cycle, which naturally feeds into the next cycle and continues the process.

CRITERION 5. CURRICULUM

A. Program Curriculum

Students are prepared for a professional career and further study in the discipline by obtaining a firm grounding in math and the sciences, and a thorough set of engineering science courses. This allows our students to be successful on the FE exam, and to have the background needed to understand new science as it develops over the course of their careers. The engineering science courses are followed with a series of design courses that train the student in a breadth of biological engineering topics so that they can be successful in advancing biological systems, including agricultural and environmental systems. The final year of the program focuses on professionalism, combining the design skills they have learned with the realities of the world in which we live. In this way, our curriculum is consistent with our Program Educational Objectives, addressing both the technical and professional education of our students. Our curriculum is consistent with the Program Educational Outcomes because we have thoughtfully incorporated the outcomes into our courses so that we are teaching the necessary material for students to achieve the outcomes, and also because we are assessing the outcomes at appropriate junctures in the curriculum (for example see Table 9).

The Biosystems Engineering curriculum meets the requirements set forth in ABET CRITERIA FOR ACCREDITING ENGINEERING PROGRAMS, 2009-2010, Criterion 5.

Table 12 presents a listing of the basic curriculum of the BAE Bachelor of Science program, by semester. Required courses in calculus, chemistry, physics and biology total 44 semester credit hours and therefore exceed the 32 credit hours required under Criterion 5. Similarly, the program curriculum requires a total of 51 semester credit hours of engineering science and design courses (this would be a minimum, since technical electives typical also contain engineering topics and are not included in this number), also exceeding the 48 credit hours required by Criterion 5. The balance of program curriculum requirements are writing and oral communication (8 credit hours), university social studies, humanities and cross-cultural requirements (15 credit hours) and one free supportive elective (3 credit hours).

Table 12. (ABET Table 5-1) BAE Curriculum

Biosystems Engineering

Year, Semester	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Sciences	Engineering Topics*	General Education	Other
Yr 1, Fall	BAE 102 Intro to Biosystems Eng.		1		
	CHE 105 Gen College Chemistry I	3			
	ENG 104 Writing I			4	
	MA 113 Calculus I	4			
	CE 106 Computer Graphics		3		
Yr 1, Spr	BAE 103 Energy in Biological Systems	1	1		
	CHE 107 Gen College Chemistry II	3			
	BIO 150 Principles of Biology I	3			
	MA 114 Calculus II	4			
	PHY 231 Gen University Physics	4			
	PHY 241 Gen University Physics Lab	1			
Yr 2, Fall	BAE 201 Econ. Anal. for Biosystems	1	1		
	BIO 152 Principles of Biology II	3			
	EM 221 Statics		3		
	MA 213 Calculus III	4			
	PHY 232 Gen University Physics	4			
	PHY 242 Gen University Physics Lab	1			
Yr 2, Spr	BAE 202 Prob and Stats for Biosystems	2	1		
	CS 221 First Course in CS for Engrs.		3		
	ENG/University Studies			3	
	EM 302 Mechanics of Deform. Solids		3		
	MA 214 Calculus IV	3			
	ME 220 Engineering Thermodynamics		3		
Yr 3, Fall	ME 330 Fluid Mechanics I		3		
	EE 305 Electrical Circuits		3		
	EM 313 Dynamics		3		
	Biological Science Elective	3			
	Core Elective		3✓		

* ✓ indicates the course has a significant design component

(continued on next page)

Table 12. (ABET Table 5-1) BAE Curriculum(continued)

Biosystems Engineering

Year, Semester	Course (Department, Number, Title)	Category (Credit Hours)			
		Math & Basic Science	Engineering Topics*	General Education	Other
Yr 3, Spr	COM 199 Presentational Com. Skills			1	
	ME 325 Heat Transfer		3		
	BAE 305 DC Circuits and Microelect.		3		
	Core Elective		3✓		
	Technical Elective				
	University Studies			3	
Yr 4, Fall	BAE 400 Senior Seminar		1		
	BAE 402 BAE Design I		2✓		
	Core Elective		3✓		
	Supportive Elective				3
	University Studies			3	
	BAE 502 Modeling of Biological Syst		3		
Yr 4, Spr	BAE 403 BAE Design II		2✓		
	Technical Elective				
	Technical Elective				
	Technical Elective				
	University Studies			3	
	University Studies			3	
TOTALS-ABET BASIC-LEVEL REQUIREMENTS		44	54	20	3
OVERALL TOTAL FOR DEGREE	130				
PERCENT OF TOTAL		34%	49%	15%	2%
Totals must satisfy one set	Minimum semester credit hours	32 hrs	48 hrs		
	Minimum percentage	25%	37.5%		

* ✓ indicates the course has a significant design component

Note that instructional material and student work verifying course compliance with ABET criteria for the categories indicated above will be available during the campus visit.

The BAE program requires students to complete a two-course capstone design sequence, for a total of 4 credit hours (2 credit hours each semester). One of three credit hours of oral communication required by the university is satisfied by this sequence. Students receive instruction in preparing and delivering technical oral presentations and are required to present four formal presentations of their design work (proposal, preliminary design, progress and final design). Students are assigned to 3- or 4-person teams and select problems submitted by professional advisors. The student teams research the problems and propose design solutions, specifying measurable design requirements. Design solutions are developed and presented for evaluation. After responding to recommendations of the professional advisors and the instructor, design prototypes are fabricated or constructed. The student teams design and conduct experiments whereby the prototypes are tested to assess the attainment of design requirements. Student teams prepare a final design report, as well as design drawings and specifications.

The capstone design sequence consists of 1 hour per week of lecture and 2 hours per week of team collaboration. Instruction is presented in team roles and teamwork, technical oral presentations, technical writing, design modeling, design analysis, estimating design costs, selection of design materials, design reliability, statistical hypothesis testing, engineering ethics, environmental protection, design safety, multidisciplinary design teams, and other topics. Students evaluate themselves and their peers' relative contributions to the design effort. The professional advisors meet with the design teams throughout the two-semester period to offer suggestions and advice. Finally, the advisors are asked to complete a survey whereby they evaluate their student team with regard to various educational outcomes as reported in Criterion 4.

Table 13 quantifies the time devoted to each outcome in each course, as computed by the instructor. The percentage are allowed to overlap, such that the total percentage for a course will be over 100%.The general distribution of attention and time given to each outcome is observable. Outcomes 1-7 map back to Educational Objective 1, and Outcomes 8-16 map back to Educational Objective 2. Roughly, two-thirds of our core classes are devoted to aspects that are more technical in nature and the remaining one-third are devoted to more professional aspects of biosystems engineering. The percent time allocated to each outcome has been reviewed by faculty and by the BAE Advisory Council, and has been deemed appropriate for our objectives.

Table 13. Percentage of Course Dedicated to each Outcome.
Percentages are allowed to overlap, such that the total percentage for a course will be over 100%.

Outcome	**102**	**103**	**201**	**202**	**305**	**400**	**402**	**403**	**417**	**427**	**437**	**447**	**Total**
1 (math/science)		20	40	20	10				10	10	15	5	**130**
2 (computers/tools)	20	25	20	33	10	5	15	15	10	10		10	**173**
3 (stats)				75	40		10	20	10				**155**
4 (engineering prob.)	50	90	40	50	30				60	55	55	60	**490**
5 (design)					10		70	70	25	30	30	25	**260**
6 (vague)		15		10	5		20		10	5	15	5	**85**
7 (literature)							15		15	15	10	10	**65**
8 (communication)				20	5	70	20	20	10	10		5	**160**
9 (life-long)					5	5				5		5	**20**
10 (team)	15				25		20	20				10	**90**
11 (multi-discip.)			5			5	5	5					**20**
12 (ethics)	10		5			10	5	5			5		**40**
13 (contemporary)	30		5					5		5			**45**
14 (global)						5	5			5	5	5	**25**
15 (PE)	5		5			5	5			5			**25**
16 (membership)	5		5					5					**15**
Total	**135**	**150**	**125**	**208**	**140**	**105**	**190**	**165**	**150**	**155**	**135**	**140**	

The biosystems engineering program does not require any cooperative education experiences. BAE does encourage students to participate in cooperative education. Cooperative education is not typically used to fulfill curriculum requirements, but could be used to fulfill the supportive elective.

The documentation available on-site for the reviewer includes: 1) binders for all required classes taught in BAE (electives available upon request), and 2) the BAE ABET documentation folders. The class binder will contain the syllabus, ABET assessment instruments and results, and examples of student work. The BAE ABET documentation folders contain information about the yearly assessments, minutes and agendas for the UGCC, and other documentation that is required for completing the self-study every six years.

B. Prerequisite Flow Chart

The prerequisite flow chart is shown in Figure 9.

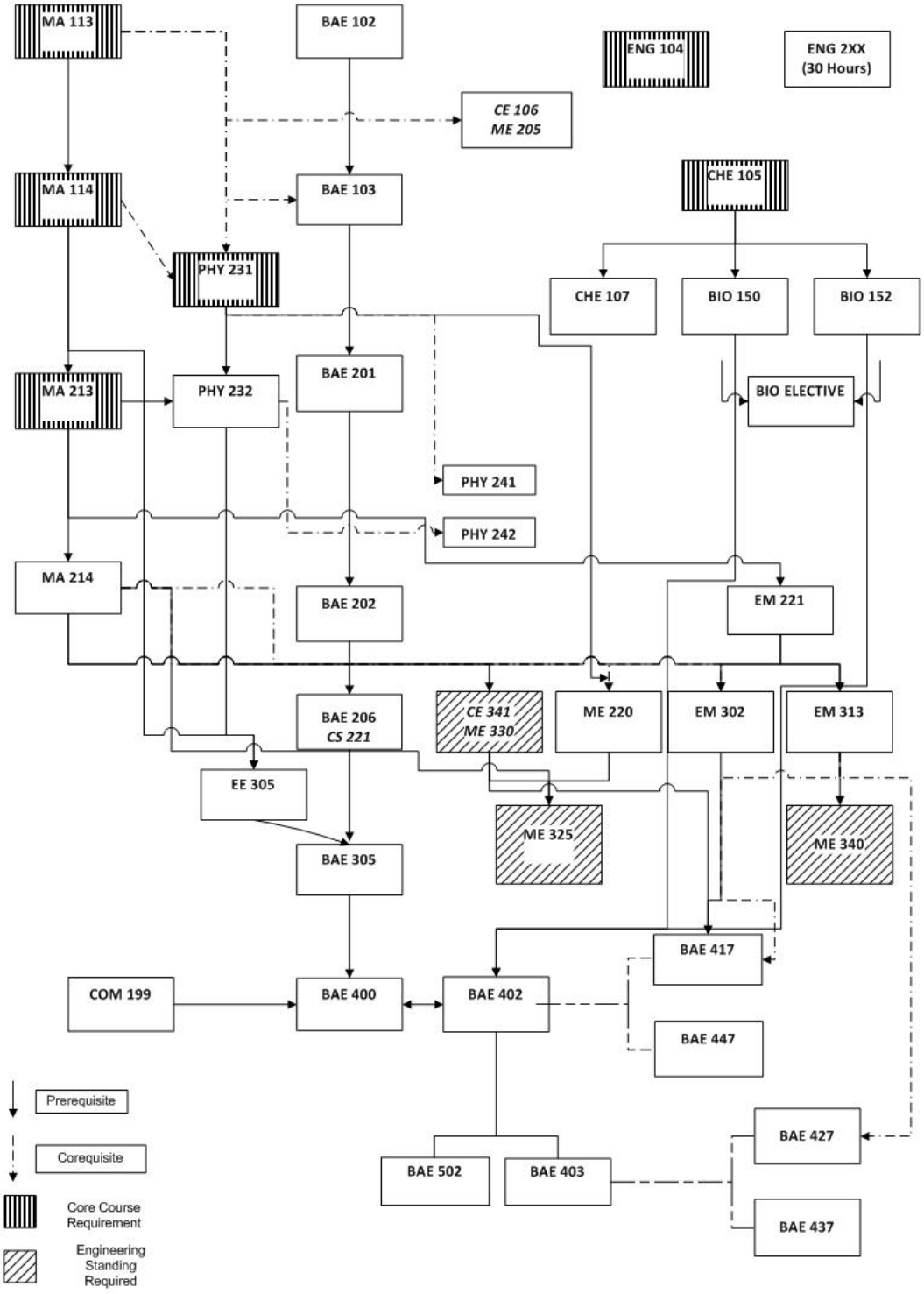

Figure 9. Biosystems Engineering Prerequisite Mapping

C. Course Syllabi

Course syllabi are provided in Appendix A. Table 14 summarized both required and elective courses with details about the number of sections, number of students, and time devoted to lecture and lab.

Table 14. (ABET Table 5-2) Course and Section Size Summary

Biosystems Engineering

Course No.	Title	No. of Sections	Avg. No. Students	Lecture %	Lab %
BAE 102	Introduction to Biosystems Engineering	1	20	100	
BAE 103	Energy in Biological Systems	1	21	100	
BAE 201	Economic Analysis of Biosystems	1	22	100	
BAE 202	Probability and Statistics for Biosystems	1	18	66	33
BAE 305	DC Circuits and Microelectronics	1	14	66	33
BAE 400	Senior Seminar	1	11	100	
BAE 402/403	Biosystems and Agric. Eng. Design I/II	1	12/12	100	
BAE 417	Design of Machine Systems	1	6	66	33
BAE 427	Structures and Environment Engineering	1	5	100	
BAE 437	Land and Water Resources Engineering	1	7	100	
BAE 447	Bioprocess Engineering Fundamentals	1	13	100	
BAE 502	Modeling of Biological Systems	1	15	66	33
Technical Electives for Specialization					
BAE 513	Soil Dynamics in Tillage and Traction	1	6	66	33
BAE 515	Fluid Power Systems	1	5	66	33
BAE 536	Fluvial Hydraulics	1	14	100	
BAE 537	Irrigation and Drainage Engineering	1	5	100	
BAE 545	Engineering Hydraulics	1	10	100	
BAE 549	Food and Bioprocess Engineering	1	7	100	
BAE 556	Solid and Hazardous Waste Management	1	-	100	
BAE 580	Heating, Ventilating and Air Conditioning	1	3	100	
BAE 581	Physics of Plant and Animal Environment	1	-	100	
BAE 435G	Waste Management for Biosystems	1	9	66	33
BAE 438G	Fundamentals of Groundwater Hydrology	1	7	100	

CRITERION 6. FACULTY

A. Leadership Responsibilities

The Biosystems Engineering degree program resides in the Department of Biosystems and Agricultural Engineering (BAE) and is administered by the Chair of BAE. However, important decisions about the program require consultation with the faculty of the Department.

The Chair of BAE delegates significant daily responsibilities for the program to the BAE Director of Undergraduate Studies (DUS) and the Student Affairs Administrator. The DUS meets with potential students, advises incoming transfer students, monitors the progress of students, and works with faculty on the curriculum. The Undergraduate Curriculum and Course Committee is appointed annually by the Chair and is charged with continual review of the curriculum and for making recommendations for changes to the faculty. All major changes to the curriculum are reviewed and approved by the faculty.

B. Authority and Responsibility of Faculty

The Department has an Administrative Coordinator, whose duties are to coordinate the fiscal and personnel matters of the department and direct activities of three administrative assistants and an accounts clerk. The administrative coordinator has signature authority and is responsible for payroll, monitoring purchases and providing accounting for extramural grants and Departmental state and federal accounts. The primary duty of one administrative assistant is to assist in the administration and documentation associated with the Department's Graduate and Undergraduate degree programs. The Department also has technical and professional support personnel who assist the faculty in the execution of laboratory exercises and the fabrication of research apparatus and senior design project prototypes. Dr. Sue Nokes is the Director of Undergraduate Studies and serves as the leader of the Continuous Quality Improvement efforts and ex officio member of the Undergraduate Curriculum and Course committee (Dr. Czarena Crofcheck, Chair; members: Drs. Edwards, Payne, Stombaugh, Wells, and Nokes (ex-officio)). This committee is responsible for an annual Outcomes Assessment review and brings forward, to the full faculty, suggestions for improvement of curriculum and various current issues related to the program.

C. Faculty

The BAE faculty consists of nineteen individuals working at the Lexington Campus, including Assistant Dean (COA) Dr. Stephen Workman, and two Associate Extension Professors at the Princeton facility. The faculty are listed in Table 15 with corresponding classes taught. All BAE faculty have Ph.D. degrees, granted from eleven different universities. Table 16 lists faculty with education and activity details as of September 2009.

Table 15. (ABET Table 6-1) Faculty Workload Summary

Faculty Member	FT PT	Classes Taught (Course No./Credit Hour) Fall Semester 2009	Total Activity Distribution		
			Teaching	Research	Other*
Agouridis, Carmen	FT			100%	
Colliver, Donald	FT		30%	70%	
Crofcheck, Czarena	FT	BAE 402/2	75%	25%	
Edwards, Dwayne	FT	BAE 536/3	30%	50%	20%
Fehr, Robert	FT			10%	90%
McNeill, Samuel	FT			20%	80%
Montross, Michael	FT	BAE 201/2	42%	58%	
		BAE 447/3			
Nokes, Sue	FT	BAE 102/1	47%	33%	20%
		BAE 599/3			
Overhults, Douglas	FT			15%	85%
Payne, Fred	FT	BAE 400/1	40%	45%	15%
		BAE 549/3			
Purschwitz, Mark	FT			50%	50%
Shearer, Scott	FT			55%	45%
Stombaugh, Timothy	FT		38%	31%	31%
Taraba, Joseph	FT	BAE 435G/3	10%	34%	56%
Warner, Richard	FT			30%	70%
Wells, Larry	FT	BAE 417/3	60%	40%	
		BAE 517/3			
Wilhoit, John	FT		30%	10%	60%
Workman, Stephen	FT			10%	90%

*Other includes time devoted to administration and/or extension.

Table 15. (ABET Table 6-1) Faculty Workload Summary (continued)

Faculty Member	FT PT	Classes Taught (Course No./Credit Hour) Spring Semester 2010	Total Activity Distribution		
			Teaching	Research	Other*
Agouridis, Carmen	FT	BAE 532/3	30%	70%	
Colliver, Donald	FT	BAE 580/3	25%	65%	10%
Crofcheck, Czarena	FT	BAE 202/3	78%	22%	
		BAE 403/2			
Edwards, Dwayne	FT	BAE 437/3	30%	50%	20%
Fehr, Robert	FT			10%	90%
McNeill, Samuel	FT			20%	80%
Montross, Michael	FT	BAE 427/3	35%	65%	
Nokes, Sue	FT	BAE 502/1	67%	13%	20%
		BAE 599/3			
Overhults, Douglas	FT			15%	85%
Payne, Fred	FT			70%	30%
Purschwitz, Mark	PT		30%	20%	50%
Shearer, Scott	FT	BAE 513/3	45%	15%	40%
Stombaugh, Timothy	FT	BAE 305/3	38%	31%	31%
Taraba, Joseph	FT			30%	70%
Warner, Richard	FT			30%	70%
Wells, Larry	FT	BAE 103/2	30%	70%	
Wilhoit, John	FT		30%	8%	62%
Workman, Stephen	FT			10%	90%

*Other includes time devoted to administration and/or extension.

Table 16. (ABET Table 6-2) Faculty Analysis

Biosystems Engineering

	Name*	Rank	Type of Appointment	FT or PT	Highest Degree and Field	Institution from which Highest Degree Earned & Year	Years of Experience			State in which registered	Level of Activity (high, med, low, none)		
							Govt./ Industry	Total Faculty	This Institution		Professional Society	Research	Consulting/ Summer Work
1	Agouridis, Carmen	Asst	TT	FT	PhD BAE	University of Kentucky, 2004	0	4	6	KY	low	high	low
2	Colliver, Donald	Prof	T	FT	PhD AE	Purdue University, 1979	1	31	31	KY	high	med	med
3	Crofcheck, Czarena	Assoc	T	FT	PhD BAE	University of Kentucky, 2001	-	9	9	KY	med	high	none
4	Edwards, Dwayne	Prof	T	FT	PhD AE	Oklahoma State University, 1988	-	22	16	AK	low	high	med
5	Fehr, Robert	Prof	T	FT	PhD AE	Iowa State University, 1976	-	34	34	KY	low	med	none
6	McNeill, Samuel	Prof	T	FT	PhD AE	University of Tennessee, 1996	-	14	32	KY	med	med	none
7	Montross, Michael	Assoc	T	FT	PhD BAE	Purdue University, 1999	1	11	11	KY	med	high	none
8	Nokes, Sue	Prof	T	FT	PhD BAE	North Carolina State University, 1990	2	14	14	OH	med	high	none
9	Overhults, Douglas	Assoc	T	FT	PhD BE	University of Nebraska, 1982	-	28	34	KY	med	low	none
10	Payne, Fred	Prof	T	FT	PhD AE	University of Kentucky, 1980	5	30	25	-	med	med	none
11	Purschwitz, Mark	Prof	T	FT	PhD AE	Purdue University, 1989	14	15	2	-	high	med	low
12	Shearer, Scott	Prof	T	FT	PhD AE	Ohio State University, 1986	-	24	24	KY	med	high	none
13	Stombaugh, Timothy	Assoc	T	FT	PhD AE	University of Illinois, 1998	-	10	10	KY	med	high	none
14	Taraba, Joseph	Prof	T	FT	PhD	Ohio State University, 1978	-	34	34	-	med	med	none

					ChemE								
15	Warner, Richard	Prof	T	FT	PhD Envir Sys Eng	Clemson University, 1981	1	29	31	-	none	high	high
16	Wells, Larry	Prof	T	FT	PhD BAE	North Carolina State University, 1975	-	35	35	KY	med	high	none
17	Wilhoit, John	Assoc	TT	FT	PhD AE	Virginia Polytechnic Institute & State University, 1989	0	14	10	VA	low	med	low
18	Workman, Stephen	Prof	T	FT	PhD BAE	North Carolina State University, 1990	6	14	14	KY	med	med	none
* In addition, Emeritus Professors include: George Duncan, Joe Ross, John Walker, Blaine Parker, Gerry White, Linus Walton													

D. Faculty Competencies

Of the nineteen regular or Extension faculty on campus (September 2009), excluding the Chair and Assistant Dean, one holds the rank of Research Assistant Professor, six are Associate Professors and ten are Professors. Six members of the faculty have received the top teaching award in both the College of Agriculture and College of Engineering and three have received the University Provost teaching award for non-tenured faculty and a USDA Southeast Region Teaching Award. Four members of the faculty have received the Young Teacher award from the American Society of Agricultural and Biological Engineers. The strong tradition of excellence in teaching by BAE faculty is recognized by both Colleges of Engineering and Agriculture administration, the student body, and alumni of the program. A formal faculty mentoring and review process has been implemented for all untenured faculty members. All faculty members are encouraged to attend teaching development workshops regularly offered on campus.

Fourteen faculty hold the P.E. license. Licensure is considered important by the faculty and a Kentucky statute requires licensure to teach engineering design at the undergraduate level.

E. Faculty Size

Of the eighteen BAE faculty, nine BAE faculty have formal teaching assignments, while eight have a formal Extension appointment. Four Extension faculty have a teaching assignment as well, typically teach one course per year, primarily either upper division undergraduate or graduate courses. The average faculty teaching assignment was 24.3% in 2009-2010 for the sixteen Lexington-based faculty, which equates to approximately two courses per year (see Table 15). The remaining two faculty are based in Princeton. Faculty teaching workload is fairly evenly distributed among teaching faculty; however the teaching efforts listed in Table 15 also include effort for student advising, administration, and teaching graduate courses. Instructors teaching new courses, and courses with significant laboratory time, are weighted more heavily in the teaching distribution of effort, as recognition of the importance of these activities. This is especially important given the lack of teaching assistant lines.

The undergraduate program has a fairly stable population of 60-70 students. The program is attractive to students for a number of reasons, including: the only Biological and similarly named accredited program in Kentucky, a broad-based curriculum focused on fundamentals of engineering, a unique pre-biomedical and pre-veterinary program, and active recruitment that articulates the positive benefits of smaller class sizes and greater faculty:student interactions.

A key element in our retention strategy has been to revise our curriculum (Table 12) to ensure that most students are involved in a BAE course every semester of their first two critical years. Table 15 lists those courses taught in 2009-2010. This curriculum has been implemented since the 1998 accreditation visit and was done as a means of addressing the relatively remote location of the department compared to the venue for most engineering courses. Thus, incoming freshman enroll in BAE 102 in the fall semester, BAE 103 in spring semester, and BAE 201 and BAE 202 in the sophomore year. Students are encouraged to form cohorts. The requirement for students to enroll in a

class in the C.E. Barnhart Building each semester of the first two years provides opportunity for faculty to build relationships with these cohorts, encourage participation in student branch and other activities, and become acquainted with the students. We judge this approach to be critical to retention and to an enhanced undergraduate engineering experience.

Students in the BAE Student Branch organization are encouraged to join one of three professional societies, namely ASABE, ASHRAE, or IBE. Regular biweekly meetings of the student branch are held during the academic year, with officers elected to represent the Engineering Student Council and the Agriculture Student Council. Faculty involvement with student branch activities includes facilitation of meetings and topics, assistance with fund-raising, and organization of annual regional trips (typically the Southeast Student Rally and North Central Rally). In 2005, the North Central Rally was held at UK and, in 2006 the Southeast Rally was held at UK. Each year a different faculty member is the primary advisor; for continuity, the faculty advisor from the prior year and the expected advisor for the next year are also involved.

Students have also been actively involved in the annual ASABE ¼-scale tractor design competition. This competition draws membership from the full array of BAE undergraduates (fifteen students traveled to Peoria, IL in 2009), not only those with a machinery systems focus. The team members are involved in all aspects of the project, including securing the majority of direct expenses. Several faculty (Drs. Shearer, Wells, Montross, and Stombaugh) and additional engineers on staff assist the students.

F. Faculty Resumes

Faculty resumes are included in Appendix B.

G. Faculty Development

Professional development of faculty members can include involvement in professional conferences and workshops (research, teaching, or administrative), professional societies, and participation in professional development activities associated with the university, Colleges of Agricultural and Engineering, or the Department.

Involvement in professional conferences and workshops (research, teaching, or administrative).

The faculty members in BAE are active in research and/or extension. Through research/extension, these faculty members regularly interact with colleagues nationally and internationally, and keep current in their fields. Table 17 includes example professional conferences or other professional development travel for each faculty member.

Table 17 Professional Development of the BAE Faculty.

BAE Faculty	Professional Societies	Conferences or other Professional Development
Agouridis	ASABE; Am. Soc. of Mining & Reclamation; Appalachian Regional Reforestation Initiative; Am. Soc. of Civil Engineers; Alpha Epsilon	2010 – EPA Regional Meeting, Atlanta, GA. 2009 – Geomorphic Reclamation Conference at Southern Illinois University; Joint Meeting of GCAGS and NRCS. 2008 – SME Annual Meeting; SEDCAD 4 Workshop. 2005 – Master of Public Policy. Martin School of Public Policy and Administration, University of Kentucky, (55% complete).
Colliver	ASHRAE, American Solar Energy Society (ASES); Omicron Delta Kappa, Alpha Epsilon, Alpha Zeta, Gamma Sigma Delta	2010 – Design of High Performance K-12 School Facilities, Atlanta, GA; ASHRAE Conference, Orlando, FL; Development of Sustainability Design Workshop, Phoenix, AZ; American Institute of Architecture Annual Conference, Miami, FL. 2009 – Net Zero Energy Buildings Conference, San Francisco, CA.
Crofcheck	ASABE; Institute of Biological Engineering (IBE), Alpha Epsilon, Gamma Sigma Delta	2010 – ASABE Annual Conference, Pittsburgh, PA; Institute of Biological Engineers Meeting, Boston, MA. 2009 – ASABE Annual Conference, Reno, NV. Attended various teaching improvement workshops sponsored by the UK College of Agriculture, Lexington, KY.
Edwards	ASABE, Am. Soc. for Engr. Ed., Am. Water Resources Association, Tau Beta Pi	2006 – ASABE Annual Conference.
Fehr	ASABE, Tau Beta Pi, Alpha Epsilon, Phi Kappa Phi	2010 – RESNET Building Performance Conference, Raleigh, NC; International Builders' Show, Las Vegas, NV. 2009 – DOE Building Codes Conference.
McNeill	ASABE	2010 – KY Soybean Promotion Board, Argentina. 2009 – ASABE Annual Conference, Reno, NV; North Central Regional Grain Storage Meeting, Kansas City, MO.
Montross	ASABE	2010 – ASABE Annual Conference, Pittsburgh, PA; NC-213 Multi-State Regional Project, Kansas City, MO. 2008 – U.S. Grain Council meetings in Vietnam/Philippines.
Nokes	ASABE, American	2010 – ASABE Annual Conference, Pittsburgh, PA.

	Society for Engineering Education	2009 – ASABE Finance Committee Meeting, St. Joseph, MI; Sun Grant Conference, Washington D.C. 2008 - ABET Summit, Louisville, KY; UK College of Agriculture Workshop on Teaching and Advising.
Overhults	ASABE, Council for Agr Sci Tech (CAST), AKES, National Frame Building Association	2010 – ASABE Annual Conference, Pittsburgh, PA; Poultry Project Meetings, Lexington, KY; National Frame Building EXPO, Nashville, TN. 2009 – ASABE Annual Conference, Reno, NV; Training on fan testing procedures and BESS Lab, Urbana. IL.
Payne	ASABE, Institute of Food Technologists (IFT), The International Society for Optical Engineering (SPIE)	2010 – ASABE Annual Conference, Pittsburgh, PA; ASABE Foundation Board of Trustees Meeting, St. Joseph, MI; Industry Summit Meeting by Walker Transport, Madison, WI. 2009 – ASABE Annual Conference, Reno, NV.
Purschwitz	ASABE, National Institute for Farm Safety (NIFS), Tau Beta Pi, Gamma Sigma Delta	2010 – NCERA-197 Multi-State Project Meeting, USDA-NIFA, Washington, D.C.; KY ASABE Student Branch Mid-West Region Rally, Champaign, IL; NIOSH Conf., Cooperstown, NY. 2009 – NIOSH Conference, Cincinnati, OH; Western KY Research and Educational Center Field Day; ASABE Annual Conference, Reno, NV.
Shearer	ASABE	2010 – Agricultural and Biological Engineers Department Heads and Multi-State SAC-05 and NCAC-16, Washington, D.C. 2009 – 67th International Conference on Agricultural Engineering Land, Germany; Solar Decathlon, Washington, D.C.; NCERA 180 Meeting, Portsmouth, VA; ASABE Annual Conference, Reno, NV; National Agricultural and Biological Engineers Department Head Retreat. 2008 – International Workshop on AMANKT (SCAU), Guangzhou, China.
Stombaugh	ASABE, Gamma Sigma Delta, Alpha Epsilon	2010 – ASABE Annual Conference, Pittsburgh, PA; International Conference on Precision Agric., Denver, CO. 2009 – ASABE Annual Conference, Reno, NV; Seventh European Conference on Precision Agriculture, Wageningen, Netherlands; Agricultural Equipment Technology Conference, Louisville, KY.
Taraba	ASABE, Gamma Sigma Delta, Sigma Xi, Amer. Institute of Chemical Engineers, Am.	2010 – S-1025 Joint Annual Meeting – Controlling Air Pollutant Emissions from Animal Agriculture Facilities, Sacramento, CA; Environmental Compliance Training Greenhouse Gas Workshop, Frankfort, KY; Cattlemen Association Meetings,

	Chem. Soc., Am. Association for the Advancement of Science	Madisonville, KY. 2009 – Manure Storage Workshop and Field Day, Circleville, OH.
Warner	ASABE, Soil Conservation Society of America (SCSA)	2010 – EPA Regional Meeting, Atlanta, GA. 2009 – Geomorphic Reclamation and Natural Stream Design Coal Mines Conference, Bristol, VA; Alabama Coal Association Meeting.
Wells	ASABE, American Society of Mining and Reclamation	2009 – ASABE Annual Conference, Reno, NV. 2008 – ASABE Annual Conference, Providence, RI.
Wilhoit	ASABE	2010 – Southern Sustainable Agriculture Working Group (SSAWG) Conference, Chattanooga, TN. 2009 – 44th Tobacco Workers' Conference, Lexington, KY; ASABE Annual Conference, Reno, NV.
Workman	ASABE	2009 – ASABE Annual Conference, Reno, NV. 2008 – ASABE Annual Conference, Providence, RI. 2007 – LEAD-21 Leadership for the 21st Century.

Financial support for these activities comes from grants and contracts, departmental funds, and sometimes College of Agriculture funds. Because of the successful research activity of most department faculty, most professional travel is supported by research grants associated with the individual faculty members. The Department dedicates funds for professional development, and in FY2009, this totaled $13,027. Decisions regarding use of departmental resources are made by the Chair. Departmental support is available for conferences or workshops for faculty without other sources of support, or for conferences specifically benefitting the department (examples: ABET, ECEDHA, etc. or conferences on key topics on instructional strategies in areas of departmental need).

In addition to the above sources of support, the College of Engineering and the Office of the Vice President for Research have limited funds for faculty for travel to professional development conferences.

Involvement in professional societies

Faculty of the BAE Department are active in professional societies, as shown in Table 17.

Participation in professional development activities associated with the university or department.

The University offers professional development activities through the Teaching and Academic Support Center (TASC). TASC provides a wide variety of educational support services, including: seminars, workshops and individual consultation to improve instructional skills; audio-visual and classroom support services; web-based resource materials; and instructional technology support. In addition, faculty in BAE are eligible to take advantage of teaching improvement workshops sponsored by the College of Agriculture.

CRITERION 7. FACILITIES

A. Departmental Space

The Department of Biosystems and Agricultural Engineering has been housed in the Charles E. Barnhart Building since 1990. This is located in the College of Agriculture complex south of central campus. The department has available 4,576 m^2 (49,252 ft^2) space in offices, classrooms and laboratories. It is approximately a twenty minute walk to the Engineering College buildings. The Barnhart Building four-story office tower is shared with the Department of Agricultural Economics (top two floors). Each floor has a gross area of 604 m^2 (6,500 ft^2) and contains central rooms and 21 perimeter offices. The University maintains one classroom on the second floor; the Department maintains a computer laboratory on the first floor, and an Engineering Design Laboratory (Room 236) on the second floor that is used heavily for instruction.

Attached to the Barnhart office tower is the department's laboratory facilities, featuring 3,373 m^2 (36,306 ft^2) of laboratories. This space includes a long (>100m) central hallway with laboratories for electronics, mechanical fabrication, wet chemistry, material properties analysis and fermentation technologies on one side and large high-bay laboratories for controlled environment systems, grain handling, machinery systems, food engineering, biomechanics and bioprocess engineering on the other. Two large arms off this central corridor provide additional labs housing controlled temperature-humidity units, fabrication areas for student and research projects, and a series of bays for soil and machinery interaction testing, surface and sub-surface hydrology, and waste management. One laboratory (153) is dedicated to electronics and instrumentation instruction.

These facilities provide adequate quality space for undergraduate and graduate instruction needs. Current infrastructure challenges related to several years of budget shortfall include the need for a new roof, and implementation of wireless internet connectivity.

The Department also maintains the Agricultural Machinery Research Laboratory and HVAC Training Facility, a 17,000 ft^2 steel structure located near the football stadium. Four full-time staff are employed and housed in this facility, providing key engineering, fabrication and machining support for the wide variety of teaching projects, particularly the capstone design course. Typically, four to twelve undergraduate students are employed on various projects in this facility. Since the last review, the space between these two buildings was enclosed increasing the square footage of the facility by 2600 ft^2.

B. Resources and Support

1. The student computer lab includes eighteen personal computers, networked printers, and restricted access for BAE students, staff and faculty. The computers in this lab have been updated twice since 2004, the most recent being in 2008. There are several specialized programs installed on these computers for our students' use, including Microsoft Office, Visio, Ansys, ArcInfo, EndNote 2x, Microsoft Expression Web 2, Microsoft Visual Basic 2008 Enterprise, SAS, Sigmaplot, AutoCAD, and ProE.

The engineering design room includes internet access, computer-based projection and audio-visual equipment. A computer identical to the ones in the student computer laboratory is installed in that room as well to be used for teaching.

Shared network space is available for use by classes to share files and programs. Faculty also have web authoring access for use with their class as desired.

2. The BAE computer committee continually oversees the computing resources in the department. This committee has established a policy of replacing the computers in the student laboratory every 2-3 years as funds permit. The replaced computers are first committed to the electronics teaching laboratory to be used for data acquisition and microcontroller development. Computers not needed in that facility are then moved to other teaching/research labs as needed.

Other specialized laboratory facilities are maintained by the respective faculty members. Various pieces of state-of-the-art equipment that are purchased for research projects are also utilized for teaching. This equipment is updated as new research projects are initiated.

3. The department has one full time staff member committed fully to oversight and maintenance of the computing and network resources. This person is accountable to the computer committee. There is also a full time staff member committed to support of electronics and instrumentation. Though this person supports research activities as well, a significant portion of their time is committed to the support of instruction in instrumentation, and in that capacity, they also support the computing resources for teaching.

4. The department supports three full time staff managers to oversee the mechanical fabrication, wet chemistry, and general laboratory areas, respectively. In addition, several other full-time staff, some supported by the department, and some supported on soft money, assist in the maintenance and use of laboratory facilities.

C. Major Instructional and Laboratory Equipment

In Appendix C, include a list of major instructional and laboratory equipment.

CRITERION 8. SUPPORT

A. Program Budget Process and Sources of Financial Support

Faculty are on twelve-month appointments in the College of Agriculture. Students are formally enrolled in the College of Engineering, and have close ties with College of Agriculture services, faculty and staff. Students compete for scholarships in both Colleges.

B. Sources of Financial Support

Annual budgets for the BAE Department include approximately $3.5M of state funding (including personnel benefits) distributed among teaching, research and cooperative extension accounts. Most faculty and staff lines are funded from two or more accounts. For FY 11, the department is facing a $35K recurring cut that is being handled through elimination of a vacant staff position. A hiring freeze is currently in effect.

The annual budget is developed in conjunction with the Dean of the College of Agriculture. The teaching budget for FY 10 was $513,493 and has remained relatively stable since the previous accreditation visit. The departmental accounting system does not readily lend itself to determining actual expenditures for teaching-related activities (e.g. copier use, telephones, etc.). The financial expenditures listed in Table I-5 include all funds in the state teaching account and a pro-rated portion from state research and extension accounts. A $122,500 USDA Higher Education Challenge grant was awarded in 2006 as a subcontract from Iowa State University. This is a collaborative project with Iowa State University and University of Idaho to develop biobased courses for internet delivery. The Principal Investigator is Dr. Sue Nokes and Co-Investigators are Drs. Czarena Crofcheck and Larry Wells. A $239,965 extramural grant was awarded in 2009 from the U.S. Department of Education for an undergraduate exchange program with Brazilian institutions. Dr. Timothy Stombaugh is the Principal Investigator and Dr. Stephen Workman is Co-Investigator. Funds for the ¼-scale design team include donations of about $19,200 in 2010.

C. Adequacy of Budget

Institutional support is adequate for maintenance of our undergraduate program. State budget shortfalls have created some administrative challenges in the last two fiscal years, but the teaching program has been relatively unscathed in the process.

D. Support of Faculty Professional Development

Faculty professional development is regularly supported and encouraged. An annual professional meeting (ASABE, IBE, ASHRAE) is attended by most faculty. Recent budget shortfalls have required that faculty secure funding from alternate sources; however, partial expense reimbursement is still a goal. Approximately $1300 per eligible faculty and $880 per eligible graduate student will be spent for the ASABE and ASHRAE meetings in 2010. Faculty also attend many regional, national and international meetings and find support from a variety of sources including their grants, the sponsoring agency, and the Associate Dean for Research in the College of Agriculture's program for refund of some grant indirect costs.

E. Support of Facilities and Equipment

The department does not have an explicit plan in place for regular replacement of obsolete equipment, partially because it is not possible to carry forward budgeted state funds past a fiscal year. Hence, the decision to maintain a departmental computer laboratory without specific recurrent upgrade support requires some flexibility and creativity on the part of the faculty, but an in-house computer laboratory is seen as a strong benefit for our student programs. We have been able to maintain high quality systems since creation of the laboratory in 1990. Having a full-time system administrator on-hand has meant that the department has been less affected by recent computer viruses and related problems than most other units on campus. The UK College of Agriculture support for this position has been critical.

F. Adequacy of Support Personnel and Institutional Services

Other staff lines are budgeted across research, extension and teaching accounts. Several professional staff are pursuing graduate degrees part-time. The staff contributes greatly to the ambiance of collegiality and support for our undergraduate students. Part-time employment for students provides opportunity for interaction between staff and students, and faculty view staff support for students as critically important. A great deal of flexibility is afforded by most supervisors for staff to assist in student projects, social functions and related events.

Table 18. (ABET Table 8.1) Support Expenditures.

Biosystems & Agricultural Engineering

Fiscal Year	2008 (prior to previous year)	2009 (previous year)	2010 (current year)	2011 (year of visit)
Expenditure Category				
Operations (not including staff)	71,906	52,287	41,438	45,205
Travel	12,040	12,183	4,744	5,175
Equipment				
Institutional Funds	1,855	11,061	-	-
Grants and Gifts	-	-	-	-
Graduate Teaching Assistants	-	-	-	-
Part-time Assistance (other than teaching)	-	-	-	-

CRITERION 9. PROGRAM CRITERIA

The program criteria for "Biological and similarly named engineering programs" states:

> "Programs must demonstrate that graduates have proficiency in mathematics through differential equations, a thorough grounding in chemistry and biology, and a working knowledge of advanced biological sciences consistent with the program educational objectives. Competence must be demonstrated in the application of engineering to biological systems."

Our program requires mathematics through differential equations. The students demonstrate their mathematics proficiency in our upper division design classes. The thorough grounding in chemistry and biology occurs during the year of chemistry, and the year and a half of biology our students are required to take. The working knowledge of advanced biological sciences, consistent with the program educational objectives, is demonstrated in our core design courses. Students are required to have completed their biology before attempting these courses, and the different courses require different biological knowledge bases depending on the systems the course is teaching the students to design. For example, BAE 447 requires the knowledge of biological material properties, BAE 427 requires knowledge of mammal physiology, and BAE 437 requires knowledge of soil physics and microbiology within biosystems engineering. The students demonstrate competence in the application of engineering to biological systems through the capstone design experience.

APPENDIX A - COURSE SYLLABI

BAE 102: Introduction to Biosystems Engineering
Biosystems and Agricultural Engineering
University of Kentucky
Fall 2009

Course (Catalog) Description: An introduction to the engineering of food and fiber production and processing systems. Professionalism and the engineering approach will be emphasized. 1 credit hour. Prerequisites: None. *This course is required.*
Class Schedule: Lecture: MW 3:00-4:50 pm; CE Barnhart Building, Room 227

Textbook: Engineering your future: Brief student's guide. An introduction to engineering. 2009-2010 edition. William Oakes, Les Leone and Craig Gunn. Great Lakes Press.

Learning Outcomes: At the end of this class, a successful student will:

- Seek assistance from other students, staff, and faculty and be familiar with the facilities in the department of Biosystems and Agricultural Engineering.
- List and describe the technical options available to BAE majors, and give examples of how technical course selection differs by option.
- Use the engineering computing facilities and software packages (i.e., search electronic databases; analyze engineering data; prepare and transmit engineering reports and documents electronically).
- Accurately describe potential careers of a biosystems engineer.
- Work cooperatively on a team.
- Write a resume and cover letter, and strategically plan activities to develop desired resume.
- Understand the FE and PE exam format and content.
- Know, understand, and correctly apply the engineering approach to problem solving.

Topics:

Professionalism Topic	Textbook Topic	Reading (to be read before class)
Chair's welcome/treasure hunt	Syllabus/topic outline	
Clubs	Problem solving and the engineering approach	Chapter 1 & 2
Resumes	Gathering info	Chapter 3
Transitions	Defining the problem	Chapter 4
Teamwork	Creativity	Chapter 5

Working the career fair	Solutions 1	Chapter 6 through p. 130
Midterm		Chapter 1-5
Curriculum/advising	Solutions 2/decisions	Chapter 6 (p. 130 through end) and Chapter 7 through p. 158
Professional engineers	Decisions	Chapter 7 p. 158 through end
Design report expectations	Implement	Chapter 8
Excel	Evaluate	Chapter 9
Excel	Troubleshoot	Chapter 10
PowerPoint	Assemble	Chapter 11
No class		Thanksgiving
Design presentations		
Design presentations	Review	
Final exam	1:00 pm	

Contribution of course to meeting the program criteria: The course is intended to be taken by a first-semester freshman, or a first-semester transfer student. In addition to the information on university life, problem solving, engineering in general and biosystems engineering in particular, technical material is presented on using the advanced features of Microsoft Word and Microsoft Excel. Homework assignments and small assigned projects reinforce these skills. In this way, this course provides the students with an opportunity to get up to speed with word processing and spreadsheet applications. Students will revisit problem solving in BAE 103 and extensively use Excel in BAE 201.

Relationship of Course to Program Outcomes:

BAE 102

Outcome	Outcome Description
2	Graduates should demonstrate an ability to use techniques, skills and modern engineering tools necessary for engineering practice.
10	Graduates should be able to work within a team approach to complete projects that include multiple facets.
12	Graduates should have an understanding of professional and ethical responsibility.
15	Graduates should know the importance of and be engaged in the process of becoming a Registered Professional Engineer.
16	Graduates should have been active in student clubs and professional organizations.

Prepared by: Sue Nokes, May, 2010

BAE 103: Energy in Biological Systems
Biosystems and Agricultural Engineering
University of Kentucky
Spring 2010

Course (Catalog) Description: This course introduces the concepts of energy transport in biological systems, including the study of thermodynamics, heat transfer, psychrometrics and fluid flow. 2 credit hours. Prerequisites: BAE 102, MA 113 (concurrent). *This course is required.*
Class Schedule: Lecture: 2—50 minute sessions per week

Textbooks (suggested):

- *Physics for Scientists and Engineers*, vol. 1, 5th edition by R.A. Serway and R.J. Beichner Thomson Learning, Inc.
- *Thermodynamics, an Engineering Approach*, 4th edition by Y.A. Cengel and M.A. Boles McGraw-Hill, New York

Course Learning Outcomes:

- To apply the engineering problem solving approach to perform energy balances on biological systems.
- To apply the fundamental laws of thermodynamics to solving problems relating to energy transfer and transformations within biological systems.
- To use the psychrometric chart to solve problems relating to air-water vapor mixtures.
- To apply the Gibb's Energy concept to estimate the chemical potential to build proteins and power muscle contraction.
- To use direct and indirect bomb calorimetry to estimate the energy content of biological materials.
- To estimate the power and energy requirements for controlling plant and animal environments.

Topics Covered:

- Unit and dimensional analysis
- Problem solving
- Defining systems (biological, chemical, thermal, mechanical, electrical)
- Laws of thermodynamics
- Work, energy, power
- Conservation of energy (internal combustion engine)
- Conversion of energy (photosynthesis)
- Conversion efficiency (Carnot cycle)
- State change (heat capacity, heat of fusion, heat of vaporization)
- Fluid flow in biosystems (mass balance, Bernoulli's equation, pressure loss)
- Psychrometrics (heating, cooling, humidification, dehumidification, drying, latent and sensible heat balance)

- Elementary heat transfer in biosystems (conduction, convection, insulation)
- Heating (energy sources and conversion)
- Refrigeration (air conditioning, heat pumps)
- Thermodynamics of microorganisms
- Gibb's energy
- Calorimetry

Contribution of course to meeting the program criteria: The class contributes two credit hours to the engineering science components of the program.

Relationship to Program Outcomes:

BAE 103

Outcome	Outcome Description
1	Graduates must demonstrate their ability to apply knowledge of mathematics, science and engineering to solve problems.
2	Graduates should demonstrate an ability to use techniques, skills and modern engineering tools necessary for engineering practice.
4	Graduates must demonstrate an ability to identify, formulate, and solve engineering problems.
6	Graduates should gain experience in solving BAE problems that are vague or poorly constrained.

Prepared by: Larry G. Wells, Ph.D., P.E., Professor, April 2010

BAE 201: Economic Analysis of Biosystems
Biosystems and Agricultural Engineering
University of Kentucky
Fall 2009

Course (Catalog) Description: The financial and managerial aspects of biosystems in evaluating design alternatives. Typical topics included are: concepts of present and future value, techniques of managerial economics, and biosystem design analysis in the evaluation of alternatives. Retirement/replacement policies and risk analysis. 2 credit hours. Prerequisite: MA 113. *This course is required.*
Class Schedule: Lecture: MW 8:00 to 8:50 AM

Text: Park, C.S. 2007. *Contemporary Engineering Economics*. 4th ed. Prentice Hall. Upper Saddle River, New Jersey. ISBN 0-13-187628-7

Learning Outcomes:

- To develop an appreciation of the importance of economics and decision analysis processes in evaluating alternative engineering systems.
- To introduce many of the processes and procedures used in effective economic analysis.
- To gain skills in conducting economic analyses of typical engineering problems, including alternatives and risk assessments.

Topics: Nominal and effective interest rates, present worth analysis, annual equivalent analysis, rate of return, depreciation and taxes

Contribution of course to meeting the program criteria: The course is a required sophomore level course. Initial coverage of engineering economics is a course component. BAE 201 course objectives are to learn the principles of engineering economic analysis and apply these principles to the design, financial and managerial aspects of biosystems.

Relationship of Course to Program Outcomes: This course covers topics that are focused on outcomes 1, 2, and 4. In addition, some coverage of outcomes 11, 12, 13, 15, and 16 is accomplished.

BAE 201

Outcome	Outcome Description
1	Graduates must demonstrate their ability to apply knowledge of mathematics, science and engineering to solve problems.
2	Graduates should demonstrate an ability to use techniques, skills and modern engineering tools necessary for engineering practice.
4	Graduates must demonstrate an ability to identify, formulate, and solve engineering problems.
10	Graduates should be able to work within a team approach to complete projects that include multiple facets.
12	Graduates should have an understanding of professional and ethical responsibility.
13	Graduates should have a knowledge of contemporary issues.
15	Graduates should know the importance of and be engaged in the process of becoming a Registered Professional Engineer.
16	Graduates should have been active in student clubs and professional organizations.

Prepared by: Michael Montross, May 2010

BAE 202: Probability and Statistics for Biosystems
Biosystems and Agricultural Engineering
University of Kentucky
Spring 2009

Course (Catalog) Description: Introduction to biosystems engineering: engineering problem solving; computer applications and structured programming; probability; and statistics. Emphasis on application of these skills to biosystems applications. 3 credit hours. Prerequisites: MA 113 and sophomore standing. *This course is required.*
Class Schedule: Lecture: MW 1:00-1:50 in CE Barnhart Building, Room 236; Laboratory: F 1:00-2:50 in CE Barnhart Building, Room 136

Textbook: Miller & Freund's Probability and Statistics for Engineers, Richard Johnson, Prentice-Hall, Inc. NY, NY 7th Edition, 2004.

Learning Outcomes: At the end of this class, a successful student will have:

- an understanding of probability and statistics,
- the ability to apply fundamental knowledge to solve engineering problems,
- an appreciation for the breadth and scope of biosystems engineering, and
- the ability to use a computer to understand, describe, and solve problems.

Topics: descriptive statistics, histograms, probability, combinations, permutations, discrete probability distributions, binomial, Hypergeometric, uniform, normal, log-normal, sampling distribution, hypothesis testing, linear regression, and experimental design

Contribution of course to meeting the program criteria: The course is intended to be taken by a sophomore. In addition to the technical material presented, several written reports are assigned. In this way, this course also provides the students with an opportunity to hone their writing skills. The students will revisit experimental design and hypothesis testing in senior design.

Relationship of Course to Program Outcomes: This course includes content that directly relates to Outcomes 1, 2, 3, 6, and 8. Outcome 3 is specifically assessed in this course, which is that graduates should be able to design and conduct experiments, as well as to analyze and interpret data.

BAE 202

Outcome	Outcome Description
1	Graduates must demonstrate their ability to apply knowledge of mathematics, science and engineering to solve problems.
2	Graduates should demonstrate an ability to use techniques, skills and modern engineering tools necessary for engineering practice.
3	Graduates should be able design and conduct experiments, as well as to analyze and interpret data
6	Graduates should gain experience in solving BAE problems that are vague or poorly constrained.
8	Graduates should demonstrate effective interpersonal, formal, and technical communications skills whether oral or written.

Prepared by: Czarena Crofcheck, February 22, 2010

BAE 305: DC Circuits and Microelectronics
Biosystems and Agricultural Engineering
University of Kentucky
Spring 2010

Course (Catalog) Description: An introduction to the use of digital electronics and integrated circuits in solving biosystems engineering problems. Digital circuits, microprocessor concepts, computer interfacing, transducers, signal conditioning and control applications are discussed. 3 credit hours. Prerequisites: EE 305 or EE 306. *This course is required*.
Class Schedule: Lecture: two hours per week; Laboratory: two hours per week.

Text:

- Alciatore, D.G. and M. B. Histand. 2007. Introduction to Mechatronics and Measurement Systems, 3ed. McGraw Hill, New York, NY.
- Lecture Outlines: Provided by instructor

Learning Outcomes: Students successfully completing this course should be able to:

- Analyze and design basic analog signal conditioning circuitry.
- Construct and troubleshoot basic analog and digital circuits.
- Identify sources of electromagnetic interference and methods for elimination.
- Statistically scrutinize data obtained from instrumentation systems.
- Understand techniques and limitations of converting analog to digital signals.
- Use common computer interfacing protocols.
- Understand and use basic sensor technologies.

Topics:

Week	Lecture Topic	Reading	Laboratory
1/13	Introduction	1	1. Lab Orientation
1/18	**MLK** Electrical Components	2 3	2. Circuit Measurement
1/25	Circuit Analysis/Measurement Op Amps	 5	3. Op Amps
2/1	Op Amps Signal Conditioning		4. Signal Conditioning
2/8	Power Supplies Transistors, Relays, Switches	 10.1-10.3	5. Power Supplies
2/15	Electromagnetic Interference Filters	 4	6. Analog Controller
2/22	Filters		(Cont.)

	Midterm Exam		
3/1	Numbering Sys./Digital Logic A/D Conversion	6.1, 6.2 8	7. Filters
3/8	A/D Conversion A/D Conversion		8. Data Acquisition
3/15	**SPRING BREAK**		
3/22	Microcontrollers Data Communications	7	9. Microcontroller Development
3/29	Statistic data interpretation Statistics	Handout	10. Microcontroller Interfacing
4/5	Confidence Intervals Instrument Error/Selection		11. Digital Controller
4/12	Sensors Sensors	9	(Cont.)
4/19	Sensors Sensors		12. Sensors and Calibration
4/26	Actuators and Control Clean-up/Review	10,11	13. Surprise Lab
5/5	**Final exam 10:30 a.m.**		

Contribution of course to meeting the program criteria: This course is intended to give students practical experience in the design and use of analog and digital instrumentation systems to solve agricultural and biosystems problems. Guidelines used in the selection of commercial sensors and measurement systems as well as commonly overlooked limitations of instruments are discussed.

Relationship of Course to Program Outcomes:

BAE 305

Outcome	Outcome Description
3	Graduates should be able design and conduct experiments, as well as to analyze and interpret data.
9	Graduates should demonstrate recognition of the need for and an ability to engage in life-long learning.
10	Graduates should be able to work within a team approach to complete projects that include multiple facets.

Prepared by: Timothy S. Stombaugh, May 2010

BAE 400: Senior Seminar
Biosystems and Agricultural Engineering
University of Kentucky
Fall 2009

Course (Catalog) Description: A course for senior students in biosystems and agricultural engineering with emphasis on oral communications skills. Students will do literature searches on topics related to the biosystems and agricultural engineering profession and present oral and written reports. 1 credit hour. Prerequisites: COM 199 and senior standing in Biosystems and Agricultural Engineering. *This is a required course.*
Class Schedule: M 3:00 pm – 4:30 pm, CE Barnhart Building, Room 236

Reference: Bostom, Speaking in Public. (Text required for COM 199.)

Learning Outcomes:
Course Objectives: This course is designed to enhance and further develop the oral communication skills of students with particular emphasis on technical presentations. It is intended to build on the prerequisite, COM 199 - Presentational Communication Skills, and requires literature searches for presentation development. In addition, professional topics relating to engineering, ethics, professional registration, professional societies, goal setting, etiquette and personal commitment will be discussed and interspersed with topics on oral communication.

Topics:
- Oral communication (9 classes + 1 Toastmasters meeting)
- Engineering profession, life-long learning opportunities (1 class)
- Professional engineering registration and benefits (1 class)
- Professional resumes and class introduction (1 class)
- Personal development (etiquette, dress, interviewing, goals) (1 class)

Contribution of course to meeting the program criteria: The ability to communicate effectively is a necessary skill for engineering students in our society. This course provides the students with an incubator to grow and develop their oral communication skills in a friendly and hospitable environment. The friendly attitudes generated in class are conducive to rapid growth in communication skills. Professional maturity and personal confidence generated are a great boost for the starting engineer.

Relationship of Course to Program Outcomes

Relationship of course to program outcomes: The ability to communicate effectively is a necessary skill for engineering students in our society. This course provides the students with an incubator to grow and develop their oral communication skills in a friendly and hospitable environment. The friendly attitudes generated in class are conducive to rapid growth in communication skills. Professional maturity and personal confidence generated are a great boost for the starting engineer. Each student prepares and delivers five 5-minute speeches. The first is regarding their personal life, the second is a PowerPoint presentation on a major historical engineering or scientific accomplishment, the third is a speech to a non-technical audience, the fourth is structured around a "Contemporary Issue" in which the student is asked to present the viewpoint of a discipline other than engineering, and the fifth is a formal presentation in which students showcase their oral technical presentation skills to a panel of three external evaluators.

Outcome	Outcome Description
2	Graduates should demonstrate an ability to use techniques, skills and modern engineering tools necessary for engineering practice.
8	Graduates should demonstrate effective interpersonal, formal, and technical communications skills whether oral or written.
9	Graduates should have a recognition of the need for, and an ability to engage in life-long learning.
11	Graduates should demonstrate an appreciation for working in a multi-disciplinary environment.
12	Graduates should have an understanding of professional and ethical responsibility.
14	Graduates should have the broad education necessary to understand the impact of engineering solutions in a global and social context.
15	Graduates should know the importance of and be engaged in the process of becoming a Registered Professional Engineer.

BAE 400

Prepared by: Fred A. Payne, May 2010

BAE 402: Biosystems and Agricultural Engineering Design I
Biosystems and Agricultural Engineering
University of Kentucky
Fall 2009

Course (Catalog) Description: A design course for seniors in BAE requiring students to solve open-ended problems. Students will use previously learned engineering principles to produce actual designs which will be built and analyzed in BAE 403. 2 credit hours. Prerequisites: Engineering standing in BAE or consent of instructor. *This course is required.*
Class Schedule: Lecture T 3-3:50 pm, Laboratory: W 3-4:50 pm

Textbook: Engineering Design, 3rd Edition, Clive L. Dym & Patrick Little, John Wiley & Sons Inc., 2009.

Learning Outcomes: Upon successful completion of BAE 402, each student will be able to:

- Understand the various roles that constitute a design team and how team members interact for maximum productivity.
- Define an open-ended design problem and apply previously learned engineering principles in the formulation and development of a solution.
- Utilize and demonstrate effective oral and written communication in presenting a design proposal and a preliminary design report.
- Apply appropriate ethical principles, as well as ensure an appropriate and viable solution to an open-ended design problem.
- Apply sound manufacturing, economic and safety considerations in the development of a design solution.
- Utilize CAD software, spreadsheets, presentation software, etc. in the development and presentation of a design solution.

Topics: Engineering Design, The Design Process, Teamwork, Modeling and Prototyping, Economics, Statistical Analysis, Defining the Problem, Objectives & Constraints, Design Alternatives, Specifications & Drawings, Oral and Written Communication

Contribution of course to meeting the program criteria: BAE 402/403 includes team experiences, problem formulation, multiple presentations to a technical audience that includes engineers from appropriate industries, and prototype fabrication/construction, testing and analysis.

Relationship of Course to Program Outcomes: This course includes content that directly relates to Outcomes 1, 2, 3, 6, 8, and 16. Outcome 3, 6, 8, and 16 are specifically assessed in this course.

BAE 402

Outcome	Outcome Description
1	Graduates must demonstrate their ability to apply knowledge of mathematics, science and engineering to solve problems.
2	Graduates should demonstrate an ability to use techniques, skills and modern engineering tools necessary for engineering practice.
4	Graduates must demonstrate an ability to identify, formulate, and solve engineering problems.
5	Graduates must demonstrate an ability to design a system, component, or process to meet desired needs
6	Graduates should gain experience in solving BAE problems that are vague or poorly constrained.
7	Graduates should be exposed to research and technical literature and have the ability to interpret key issues or concepts.
8	Graduates should demonstrate effective interpersonal, formal, and technical communications skills whether oral or written.
10	Graduates should be able to work within a team approach to complete projects that include multiple facets.
12	Graduates should have an understanding of professional and ethical responsibility.
14	Graduates should have the broad education necessary to understand the impact of engineering solutions in a global and social context.

Prepared by: Czarena Crofcheck, February 22, 2010

BAE 403: Biosystems and Agricultural Engineering Design II
Biosystems and Agricultural Engineering
University of Kentucky
Spring 2010

Course (Catalog) Description: Student design teams evaluate and enhance design solutions, fabricate prototypes, execute performance tests, analyze results, and develop final design specifications. Oral and written reports are required. 2 credit hours. Prerequisites: BAE 402. *This course is required.*
Class Schedule: Lecture: M 3-3:50 pm, Laboratory: T 3-4:50 pm

Textbook: Engineering Design, 3rd Edition, Clive L. Dym & Patrick Little, John Wiley & Sons Inc., 2009.

Learning Outcomes: Upon successful completion of BAE 403, each student will be able to:

- Understand the various roles that constitute a design team and how team members interact for maximum productivity.
- Define an open-ended design problem and apply previously learned engineering principles in the formulation and development of a solution.
- Utilize and demonstrate effective oral and written communication in presenting a design proposal and a preliminary design report.
- Apply appropriate ethical principles, as well as ensure an appropriate and viable solution to an open-ended design problem.
- Apply sound manufacturing, economic and safety considerations in the development of a design solution.
- Utilize CAD software, spreadsheets, presentation software, etc. in the development and presentation of a design solution.

Topics: Engineering Design, The Design Process, Teamwork, Modeling and Prototyping, Economics, Statistical Analysis, Environmental and Social Factors, Ethics, Health & Safety, Multidisciplinary Issues, Oral and Written Communication

Contribution of course to meeting the program criteria: BAE 402/403 includes team experiences, problem formulation, multiple presentations to a technical audience that includes engineers from appropriate industries, and prototype fabrication/construction, testing and analysis.

Relationship of Course to Program Outcomes: This course includes content that directly relates to Outcomes 1, 2, 3, 6, 8, and 16. Outcome 3, 6, 8, and 16 are specifically assessed in this course.

BAE 403

Outcome	Outcome Description
1	Graduates must demonstrate their ability to apply knowledge of mathematics, science and engineering to solve problems.
2	Graduates should demonstrate an ability to use techniques, skills and modern engineering tools necessary for engineering practice.
4	Graduates must demonstrate an ability to identify, formulate, and solve engineering problems.
5	Graduates must demonstrate an ability to design a system, component, or process to meet desired needs
6	Graduates should gain experience in solving BAE problems that are vague or poorly constrained.
7	Graduates should be exposed to research and technical literature and have the ability to interpret key issues or concepts.
8	Graduates should demonstrate effective interpersonal, formal, and technical communications skills whether oral or written.
10	Graduates should be able to work within a team approach to complete projects that include multiple facets.
12	An understanding of professional and ethical responsibility
14	The broad education necessary to understand the impact of engineering solutions in a global and social context

Prepared by: Czarena Crofcheck, February 22, 2010

BAE 417: Design of Machine Systems
Biosystems and Agricultural Engineering
University of Kentucky
Fall 2009

Course (Catalog) Description: A study of the operational characteristics and design features associated with the production and processing equipment for food and fiber products and an introduction to conceptualization, analysis and design of these systems. 3 credit hours. Prerequisites: EM 313 (or concurrent), ME 330, engineering standing or consent of instructor. *This course is required*.
Class Schedule: Lecture: 2—90 minute sessions per week; Laboratory: 2 hours biweekly, six laboratories scheduled

Textbook: *Mechanical Engineering Design*, 8th edition by J.E. Shigley, C.R. Mischke and R.G. Budynas McGraw-Hill, New York

Course Learning Outcomes:

- To understand important machine design concepts, including free body diagrams, stress-strain relationships, combined stress analysis, failure theories, and kinematic analysis, so that students can apply these principles to the design of agricultural machinery.
- To be able to examine the functional requirements of selected agricultural machines and understand the role of the engineer in the design of this equipment.
- To be able to examine and analyze specific components of agricultural machinery.
- To gain experience and confidence in applying machine design concepts.
- To develop problem solving skills by using software (i.e. Excel, ProE, Matlab, etc.) to create, synthesize and optimize machine components and assemblies.
- To complete a comprehensive design problem whereby a mechanism is conceived and designed to perform specified functions under realistic constraints and prepare a report, which describes conceptualization, synthesis, analysis and evaluation of the resulting solution.

Topics:

- Machine design
- Material properties
- Alloys and casting materials
- Stress components and Mohr's circle
- Stress-strain relationships
- Stress concentration
- Spring rates and deflections
- Buckling and impact loading
- Failure from static loading
- Failure from variable loading
- Fatigue

- Shafts and shaft components
- Gear drives
- Belt drives
- Roller chain drives
- Bearings
- Mechanical springs
- Clutches and brakes
- Power transmission
- Hydraulic components and circuits

Contribution of course to meeting the program criteria: The class contributes three credit hours to the engineering design components of the program.

Relationship to Program Outcomes:

BAE 417

Outcome	Outcome Description
1	Graduates must demonstrate their ability to apply knowledge of mathematics, science and engineering to solve problems.
2	Graduates should demonstrate an ability to use techniques, skills and modern engineering tools necessary for engineering practice.
3	Graduates should be able design and conduct experiments, as well as to analyze and interpret data
4	Graduates must demonstrate an ability to identify, formulate, and solve engineering problems.
5	Graduates must demonstrate an ability to design a system, component, or process to meet desired needs
6	Graduates should gain experience in solving BAE problems that are vague or poorly constrained.
7	Graduates should be exposed to research and technical literature and have the ability to interpret key issues or concepts.
8	Graduates should demonstrate effective interpersonal, formal, and technical communications skills whether oral or written.
14	Graduates should have the broad education necessary to understand the impact of engineering solutions in a global and social context.

Prepared by: Larry G. Wells, Ph.D., P.E., Professor, May 2010

BAE 427: Structures and Environment Engineering
Biosystems and Agricultural Engineering
University of Kentucky
Spring 2010

Course Description: This course teaches load estimate for light timber and concrete structures and introduces the design of heating, cooling, and ventilation systems in these structures. 3 credit hours. Prerequisites: EM 302, prereq or concur: ME 325, or consent of instructor. *This course is required.*
Class Schedule: Lecture: MWF 10:00-10:50 am, CE Barnhart Building, Room 236

Required Text: Environment Control for Animals and Plants. 1990 Albright. ASAE Publications, MI.

Learning Outcomes: At the completion of the course, the student should be able to apply:

- Structural design in agriculture, with emphasis on load estimation, light timber and concrete, granular materials storage, and fasteners.
- Psychrometrics, physical environment for animals and plants, design of thermal environment systems, with emphasis on plant and animal interaction with the building thermal environment.
- Heating, ventilating, cooling and interior air distribution.

Topics:

- Psychometric chart
- Steady state energy and mass balances
- Ventilation rates
- Concrete floors and footings
- Post design
- Load analysis
- Fasteners

Contribution of course to meeting the program criteria: The course is one of the four design technical electives taken in the junior or senior year.

Relationship of Course to Program Outcomes: This course covers topics that are focused on outcomes 1, 2, 4, 5, and 8. The course also helps address outcomes 6, 7, 9, 13, 14, and 15.

BAE 427

Outcome	Outcome Description
1	Graduates must demonstrate their ability to apply knowledge of mathematics, science and engineering to solve problems.
2	Graduates should demonstrate an ability to use techniques, skills and modern engineering tools necessary for engineering practice.
3	Graduates should be able design and conduct experiments, as well as to analyze and interpret data
4	Graduates must demonstrate an ability to identify, formulate, and solve engineering problems.
5	Graduates must demonstrate an ability to design a system, component, or process to meet desired needs
6	Graduates should gain experience in solving BAE problems that are vague or poorly constrained.
7	Graduates should be exposed to research and technical literature and have the ability to interpret key issues or concepts.
8	Graduates should demonstrate effective interpersonal, formal, and technical communications skills whether oral or written.

Prepared by: Michael Montross, May 2010

BAE 437: Land and Water Resources Engineering
Biosystems and Agricultural Engineering
University of Kentucky
Spring 2010

Course (Catalog) Description: The hydrologic cycle is studied and design procedures are developed for flood control structures, water table management, wetlands, irrigation, and erosion control systems. 3 credit hours. Prerequisites: CE 341 or ME 330. *This course is required.*
Class Schedule: Lecture: MWF 9:00-9:50 am, CE Barnhart Building, Room 227

Text: Soil and Water Conservation Engineering by Fangmeier, D.F., W.E. Elliot, S.R. Workman, R.L. Huffman, and G.O. Schwab. 2006. Thomson-Delmar publishers.

Learning Outcomes: Upon successful completion of BAE 437, a student will have:

- Developed an understanding of the hydrologic cycle with an ability to use Internet resources and mathematical techniques to estimate key hydrologic parameters and variables.
- Developed the ability to analyze and or design hydrologic structures or structural components to control excess water.
- Developed an understanding of the methods to alleviate excess and deficit soil water conditions.

Topics:

	Topic	**Chapter**	**Notes**
Week 1	Introduction and Water Quality	1 and 2	Chapter 1, Chapter 2
Week 2	Precipitation	3	Chapter 3, Example problems
Week 3	Evapotranspiration	4	Chapter 4
Week 4	Runoff	5	Chapter 5
Week 5	Open Channel Hydraulics	6	Chapter 6
Week 6	Soil Erosion	7	Chapter 7
Week 7	Vegetated Waterways	8	Chapter 8
Week 8	Water and Sediment Control Structures	9	Chapter 9
Week 9	Channel Stabilization and Restoration	10	Chapter 10

Week 10	**Spring Break (March 15-19)**		
Week 11	Water Supply	11	Chapter 11
Week 12	Wetlands	12	Chapter 12
Week 13	Drainage Principles and Surface Drainage	13	Chapter 13
Week 14	Water Table Management	14	Chapter 14
Week 15	Irrigation Principles & Sprinkler Irrigation	17	Chapter 15 Chapter 17
Week 16	Microirrigation	18	Chapter 18
	Monday, May 3 at 8:00		

Contribution of course to meeting the program criteria: This course is one of the four design technical electives taken the junior or senior year.

Relationship of Course to Program Outcomes:

BAE 437

Outcome	Outcome Description
1	Graduates must demonstrate their ability to apply knowledge of mathematics, science and engineering to solve problems.
4	Graduates must demonstrate an ability to identify, formulate, and solve engineering problems.
5	Graduates must demonstrate an ability to design a system, component, or process to meet desired needs
6	Graduates should gain experience in solving BAE problems that are vague or poorly constrained.
7	Graduates should be exposed to research and technical literature and have the ability to interpret key issues or concepts.
12	Graduates should have an understanding of professional and ethical responsibility.
15	Graduates should know the importance of and be engaged in the process of becoming a Registered Professional Engineer.

Prepared by: Dwayne Edwards, May 2010

BAE 447: Bioprocess Engineering Fundamentals
Biosystems and Agricultural Engineering
University of Kentucky
Fall 2009

Course (Catalog) Description: Design principles and equipment selection for the most common processing operations are studied for the manufacturing and preservation of biological materials. Topics will include the design of fluid flow systems, transient heat transfer, heat exchangers, psychometrics, and refrigeration. 3 credit hours. Prerequisite: ME 325 and engineering standing. *This course is required.*
Class Schedule: Lecture: MWF 2:00-2:50 PM

Text: Henderson, S.M., R.L. Perry, and J.H. Young. 1997. Principles of Process Engineering. ASAE Press. ISBN 0-929355-85-7

Learning Outcomes: At the completion of the course, the student should be able to:

- Analyze and design fluid flow systems (pumps, fans, pipes, ducts) for Newtonian and non-Newtonian fluids.
- Design and analyze transient heat transfer processes for processing biological materials. Size and analyze heat exchangers.
- Find and correctly use physical property data for biological materials.
- Use psychometric relationships to analyze and design drying systems.

Topics:

- Pipe fluid flow
- Friction losses in piping networks
- Pump/fan laws
- Heat transfer
- Drying processes

Contribution of course to meeting the program criteria: The course is one of the four design technical electives taken in the junior or senior year.

Relationship of Course to Program Outcomes: This course covers topics that are focused on outcomes 5 and 7. In addition, some coverage of outcomes 1, 2, 4, 6, 8, 9, 10, and 14 is accomplished.

BAE 447

Outcome	Outcome Description
1	Graduates must demonstrate their ability to apply knowledge of mathematics, science and engineering to solve problems.
2	Graduates should demonstrate an ability to use techniques, skills and modern engineering tools necessary for engineering practice.
4	Graduates must demonstrate an ability to identify, formulate, and solve engineering problems.
5	Graduates must demonstrate an ability to design a system, component, or process to meet desired needs.
6	Graduates should gain experience in solving BAE problems that are vague or poorly constrained.
7	Graduates should be exposed to research and technical literature and have the ability to interpret key issues or concepts.
8	Graduates should demonstrate effective interpersonal, formal, and technical communications skills whether oral or written.
9	Graduates should have a recognition of the need for, and an ability to engage in life-long learning.
10	Graduates should be able to work within a team approach to complete projects that include multiple facets.
14	Graduates should have the broad education necessary to understand the impact of engineering solutions in a global and social context.

Prepared by: Michael Montross, May 2010

APPENDIX B - FACULTY RESUMÉS

CARMEN T. AGOURIDIS, Ph.D., P.E.
90% Research, 10% Teaching

Professional Preparation

University of Tennessee	Agricultural Engineering	B.S., 1998
University of Tennessee	Agricultural and Biosystems Engineering	M.S., 2000
University of Kentucky	Biosystems and Agricultural Engineering	Ph.D., 2004
University of Kentucky	Public Policy and Administration	M.P.P., 2005-present

Professional Licensure

Professional Engineer (P.E.), since 2007, Kentucky License No. 25431
Professional Engineer (P.E.), since 2009, West Virginia License No. 018003

Appointments and Experience

- Assistant Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, Lexington, KY, January 2010-present.
- Assistant Research Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, March 2006-December 2009.
- Engineer Associate IV/Research for Water Resources, Biosystems and Agricultural Engineering Department, University of Kentucky, August 2004-March 2006.

Principal Publications (last five years)

- Warner, R.C., C.T. Agouridis, P.B. Vingralek, and A.W. Fogle. 2010. Reclaimed Mineland Curve Number Response to Temporal Distribution of Rainfall. Journal of the American Water Resources Association (In Press – Early View).
- Agouridis, C.T. and L. Owens. 2009 (expected print publication 2010). Prescribed Grazing: Water Quality and Watershed Hydrology – Grazing Methods. USDA CEAP. (Invited)
- Agouridis, C.T. and L. Owens. 2009 (expected print publication 2010). Prescribed Grazing: Water Quality and Watershed Hydrology – Grazing Intensity. USDA CEAP. (Invited)
- Agouridis, C.T. 2009 (expected print publication 2010). Prescribed Grazing: Water Quality and Watershed Hydrology – Livestock Distribution. USDA CEAP. (Invited)
- Agouridis, C.T. 2009 (expected print publication 2010). Prescribed Grazing: Water Quality and Watershed Hydrology – Type and Class of Livestock. USDA CEAP. (Invited)
- Agouridis, C.T. 2009 (expected print publication 2010). Prescribed Grazing: Water Quality and Watershed Hydrology – Season and Deferment of Grazing. USDA CEAP. (Invited)
- Agouridis, C.T., D.R. Edwards, S.R. Workman, J.R. Bicudo, J.L. Taraba, and E.S. Vanzant. In Preparation. Influence of BMPs on Cattle Grazing Preferences. Transactions of the ASAE.
- Taylor, T.J., C.T. Agouridis, R.C. Warner, C.D. Barton, and P.N. Angel. 2009.

Hydrologic Characteristics of Loose Dumped Spoil in the Cumberland Plateau of Eastern Kentucky. Hydrological Processes 23(23): 3373-3381.

- Taylor, T.J., C.T. Agouridis, R.C. Warner, and C.D. Barton. 2009. Runoff Curve Numbers for Loose-dumped Spoil. International Journal of Mining, Reclamation and Environment 23(2): 103-120.
- Agouridis, C.T. 2007. Book Review of Water Quality Engineering in Natural Systems. Journal of the American Water Resources Association 43(2): 559-560.
- Agouridis, C.T., S.R. Workman, R.C. Warner, and G.D. Jennings. 2005. Livestock Grazing Management Impacts on Stream Water Quality: A Review. Journal of the American Water Resources Association 41(3): 591-606.
- Agouridis, C.T., D.R. Edwards, S.R. Workman, J.R. Bicudo, J.L. Taraba, and E.S. Vanzant. 2005. Streambank Erosion Associated with Grazing Practices in the Humid Region. Transactions of the ASAE 48(1): 181-190.

Honors and Awards

- United States Department of Interior's 2007 Cooperative Conservation Award to ARRI Core and Academic Teams (member of the Academic Team).
- American Society of Mining and Reclamation 2nd place poster award (graduate student) at the 2006 7th ICARD Annual Meeting, Hydrologic and Water Quality Characteristics of Loose-Dumped Mine Spoil.
- University of Kentucky Commonwealth Collaborative (two selected projects): Reforestation of Surface Mined Lands and Cane Run Watershed Assessment and Restoration.

Professional Societies

- American Society of Mining and Reclamation
- Appalachian Regional Reforestation Initiative
- American Society of Civil Engineers
- Alpha Epsilon Kentucky Omega Chapter
- American Society of Biological and Agricultural Engineers

Service

- Environment and Natural Resources Initiative, steering committee.
- Kentucky Department for Natural Resources, wetlands working group.
- University of Kentucky, Biosystems and Agricultural Engineering Department, chair of the alumni and development committee.
- 2009 Mid-Atlantic Stream Restoration Conference, member of conference steering committee.
- Developed tour posters for Appalachian Regional Reforestation Initiative Conference, Starfire Mined Land Reclamation Research Project, Prestonsburg, Kentucky, August 4-6, 2009.
- Natural Resource Initiative Planning Committee member, University of Kentucky, College of Agriculture, 2007-present.
- Tracy Farmer Center for the Environment, 2006-2008. Scientific Advisory Board member.
- 2007 Mid-Atlantic Stream Restoration Conference, Cumberland, MD, November 6-8, Member of Conference Steering Committee.

DONALD G. COLLIVER, Ph.D., P.E.
75% Research, 25% Teaching

Professional Preparation

University of Kentucky	Agricultural Engineering	B.S., 1974
University of Kentucky	Agricultural Engineering	M.S., 1977
Purdue University	Agricultural Engineering	Ph.D., 1979

Professional Licensure

Professional Engineer (P.E.), since 1981, Kentucky License #12228

Appointments and Experience

- Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, Lexington, Kentucky, June 2008 to present.
- Associate Professor; Biosystems and Agricultural Engineering Department, University of Kentucky, Lexington, Kentucky, June 1985 to June 2008.
- Visiting Specialist; Air Infiltration and Ventilation Centre, Annex V, International Energy Agency; Coventry, Great Britain, March 1994 to August 1994.
- Assistant Professor; Department of Agricultural Engineering, University of Kentucky, Lexington, Kentucky, June 1979 to June 1985.

Principal Publications (last five years)

- Colliver, D.G. 2007. Annual Variability of Energy Usage in a Small Office Building Due to Weather. CLIMA 2007 - 9th REHVA World Congress. Helsinki, Finland. Vol 5:355-363.
- Colliver, D.G. 2007. Sustainable and Energy Efficient Buildings Class Curriculum. CLIMA 2007 - 9th REHVA World Congress. Helsinki, Finland. Vol 4:287-293.
- Jarnagin, R.E, M.F. McBride, and D.G. Colliver. 2006. Advanced Energy Design Guide for Small Retail Buildings. ASHRAE Journal 48(9):26-31.
- Colliver, D.G. and R.E. Jarnagin. 2005. Achieving 30% Progress Toward a Net-Zero-Energy Small Office - Development of the Advanced Energy Design Guide for Small Office Buildings. Clima 2005 - 8th REHVA World Congress. Lausanne, Switzerland.
- Colliver, D.G. and R.E. Jarnagin. 2005. Development of the Advanced Energy Design Guide for Small Office Buildings. ASHRAE Journal 47(3):22-27.
- Colliver, D.G. and R.E. Jarnagin. 2005. Development of the Advanced Energy Design Guide for Small Office Buildings. Same as ASHRAE March ASHRAE Journal paper but posted on the Illuminating Engineering Society of North America (IESNA) Online site http://iesna.org/PDF/Store/AEDGArticle.pdf
- 2007. Advanced Energy Design Guide for K-12 School Buildings. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Atlanta, GA, October 2007.
- 2006. Advanced Energy Design Guide for Small Retail Buildings. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Atlanta. GA. ISBN/ISSN: 1-933742-06-2.

Consultations

- July 2004-present. Chairman. Advanced Energy Design Guide Steering Committee.
- 2006-Consultant. Setty Associates / U.S. General Services Administration.
- 2005-2006 – Consultant. Setty Associates/U.S. Department of State.

Honors and Awards

- Title Sponsor Representative to the US DOE 2007 Solar Decathlon - an international competition for students from 20 universities to design and construction houses on the National Capitol Mall (see www.solardecathlon.org). Each university raises approximately $600K to support their program. The UK team placed ninth out of the twenty teams.
- Received three national awards for the Advanced Energy Design Guide for Small Office Buildings
  - US Green Building Council 2005 Leadership Award for Research
  - Alliance to Save Energy 2005 Stars of Energy Efficiency Award Honorable Mention
  - Sustainable Buildings Industry Council's 2005 Best Sustainable Practice Award Honorable Mention for Educational Initiatives
- ASHRAE Best Journal Paper Award - 2000 (for "New Weather Data for Energy Calculations, ASHRAE Journal 41(3):31-38.")
- Recipient of 2003 *International Honorary Member* of the Society of Heating, Air-Conditioning & Sanitary Engineers of Japan (SHASE).

Scientific and Professional Societies

- American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), Fellow, Leadership in Policy and Regulatory Development: Applied Research and Strategic Management/Planning (1998-2007); President (2002-2003); Nominating Committee, Chairman (2004-2005), Vice Chair (2003-2004), Member (2006-8); ASHRAE Foundation (2006-2009); Society Vice President - Chair Technology Council; Society Vice President - Chair Education Council; Formed the ASHRAE Learning Institute (ALI); Founder and Chairman of the Advanced Energy Design Guide (AEDG); Steering Committee and Member of AEDG writing committees.

Service

- US Department of Energy (DOE) and US Environmental Protection Agency (EPA). Authored Agreement of Understanding for Base and Measurement Units for Building Energy Reduction Targets. Spring 2007.
- Member of the National Retail Alliance.
  - Led a development team for the US DOE National Residential Builder's Challenge.
  - Chaired the Scale Working Group, which determined the base and measurement unit of how energy usage was to be evaluated.
  - Member of the Technical Working Group, which developed the residential energy rating scale which is analogous to the mpg rating for automobiles.
- Provided vision for KY Rural Energy Consortium.
  - Wrote initial white paper describing purpose of a statewide research and deployment consortium and identified seven missions.
- Chaired National Engineers Week. Co-Chair of 2003 National Engineers Week (co-chair with Vance Coffman, Chairman and COE, Lockheed Martin) and member of National Engineers Week Steering Committee 2002-present. Trustee National Engineers Week Foundation 2003-2005.

CZARENA CROFCHECK, Ph.D., P.E.
49% Research, 51% Teaching

Professional Preparation

Michigan State University	Chemical Engineering	B.S., 1994
University of Kentucky	Chemical Engineering	M.S., 1997
University of Kentucky	Biosystems & Agricultural Engineering	Ph.D., 2001

Professional Licensure

Professional Engineer (P.E.), since 2004, Kentucky License # 24390

Appointments and Experience

- Associate Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, July 2007 to present.
- Assistant Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, April 2001-June 2007.

Principal Publications (last five years)

- Duguid, K.B., M.D. Montross, C.W. Radtke, C.L. Crofcheck, L.M. Wendt, and S.A. Shearer, 2009. Effect of Anatomical Fractionation on the Enzymatic Hydrolysis of Acid and Alkaline Pretreated Corn Stover, Bioresource Technology, 100(21):5189-5195.
- Fisk, C.A., T. Morgan, Y. Ji, M. Crocker, C. Crofcheck, and S.A. Lewis. 2009. Bio-oil Upgrading Over Platinum Catalysts Using In Situ Generated Hydrogen, Applied Catalysis A: General, 358(2):150-156.
- Coleman, N.P., C.L. Crofcheck, S.E. Nokes, and B. Knutson. 2009. Effects of Growth Media pH and Reaction Water Activity on the Conversion of Acetophenone to [S]-phenylethanol by Saccharomyces cerevisiae Immobilized on Celite 635® and in Calcium Alginate, Transactions ASABE, 52(2):656-671.
- Shea, A.P., C.L. Crofcheck, F.A. Payne, and Y.L. Xiong. 2009. Foam Fractionation of α-Lactalbumin and β-Lactoglobulin from a Whey Solution. Asia-Pacific Journal of Chemical Engineering, 4(2):191-203.
- Swamy, J.N., C. Crofcheck, and M.P. Mengüç. 2009. Time Dependent Scattering Properties of Slow Decaying Liquid Foams, Colloids and Surfaces A: Physicochemical and Engineering Aspects, 338(1-3):80-86.
- Hawes, E.A., J.T. Hastings, C. Crofcheck, and M.P. Mengüç. 2008. Spatially selective melting and evaporation of nanosized gold particles. Optics Letters, 33(12):1383-1385.
- Shumaker, J.L., C. Crofcheck, S.A. Tackett, E. Santillan-Jimenez, T. Morgan, Y. Ji, M. Crocker, and T.J. Toops. 2008. Biodiesel synthesis using calcined layered double hydroxide catalysts. Applied Catalysis B: Environmental, 82(1-2):120-130.
- Shumaker, J.L., C. Crofcheck, S.A. Tackett, E. Santillan-Jimenez, and M. Crocker. 2007. Biodiesel production from soybean oil using calcined Li–Al layered double hydroxide catalysts. Catalysis Letters, 115(1-2):56-61.

- Singh, A., C. Crofcheck, G. Brion. 2007. Characterization of Dairy Milk House Wastewater in Kentucky. Applied Engineering in Agriculture, 23(2):165-170.
- Duguid, K.B., M.D. Montross, C.W. Radtke, C.L. Crofcheck, S.A. Shearer, and R.L. Hoskinson. 2007. Screening for sugar and ethanol processing characteristics from anatomical fractions of wheat stover. Biomass and Bioenergy, 31(8):585-592.
- Hawes, E.A., J.T. Hastings, C. Crofcheck, and M.P. Mengüç. 2007. Spectrally selective heating of nanosized particles by surface plasmon resonance and an atomic force microscopy tip. J. Quant. Spectro. Radiative Transfer, 104, 199-207.
- Swamy, J.N., C. Crofcheck, and M.P. Mengüç. 2007. A Monte Carlo Ray Tracing study of Polarized Light Propagation in Liquid Foams. J. Quant. Spectro. Radiative Transfer, 104, 277-287.
- Aslan, M.M., C. Crofcheck, D. Tao, and M.P. Mengüç. 2006. Evaluation of Micro-bubble Size and Gas Hold-up in Two-Phase Gas Liquid Columns via Scattered Light Measurements. J. Quant. Spectro. Radiative Transfer. 101, 527-539.
- Crofcheck, C., and M.D. Montross. 2006. Evaluation of Fourier Transform Infrared Measurements of Glucose and Xylose in Biomass Hydrolyzate. Applied Engineering in Agriculture, 22(3):415-420.

Honors and Awards

- ASABE AW Farrall Young Educator Award, 2009.
- ASABE Honorable Mention Paper Award, 2007.
- College of Agriculture Student Council Early Career Outstanding Teaching Award, 2007.
- ASABE Honorable Mention Paper Award, 2006.
- Henry Mason Lutes Award for Outstanding Engineering Education, 2006.
- Provost's Award for Outstanding Teaching Award, 2006.
- Gamma Sigma Delta Master Teacher Award, 2006.
- Outstanding Biosystems and Agricultural Engineering Teacher, 2006.
- Wethington Research Award, 2004, 2005, 2006, 2007, 2008, 2009. University of Kentucky award for generating salary savings from external funding.

Professional Societies

- American Society of Agricultural and Biological Engineers (ASABE), member since 1998.
- Institute of Biological Engineering (IBE), member since 2000.

Service

- Departmental: Student Recruitment Committee 2001-2005, chair 2004-2006, Undergraduate Teaching and Curriculum Committee 2002-2006, chair 2006-2009.
- College: Graduate Student Awards Committee, Gamma Sigma Delta, 2005, C.E. Barnhart.
- University: Instructional Computing Subcommittee, 2004-2010.

DWAYNE R. EDWARDS, Ph.D., P.E.
60% Research, 20% Teaching, 20% Administration

Professional Preparation

University of Arkansas	Agricultural Engineering	B.S., 1984
University of Arkansas	Agricultural Engineering	M.S., 1986
Oklahoma State University	Agricultural Engineering	Ph.D., 1988

Professional Licensure

Professional Engineer (P.E.), since 1992, Arkansas License #7998

Appointments and Experience

- Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, Lexington, KY, 2000-present.
- Associate Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, Lexington, KY, 1994-2000.
- Associate Professor, Biological and Agricultural Engineering, Department, University of Arkansas, Fayetteville, AR, 1993-1994.
- Assistant Professor, Biological and Agricultural Engineering Department, University of Arkansas, Fayetteville, AR, 1988-1993.

Professional Societies

- American Society of Agricultural and Biological Engineers
- American Society of Engineering Education
- American Water Resources Association
- Arkansas Society of Professional Engineers
- National Society of Professional Engineers
- Alpha Epsilon (Honor society of Agricultural Engineering)
- Gamma Sigma Delta (Honor society of Agriculture graduate students)
- Phi Kappa Phi (Honor society for graduate students)
- Tau Beta Pi (Honor society for Engineering)

Service

- Director of Graduate Studies, Biosystems and Agricultural Engineering Department, University of Kentucky, 2003-present.
- University of Kentucky, Kentucky Water Resources Institute Oversight Committee, 1997-present.
- Publications Council, ASAE, 2002-present. Vice Chair, 2002-2004. Chair, 2004-present.
- Regional Research Project S-273, 1996-present.

Awards

- ASAE New Holland Young Researcher Award, 2000.
- Honorable Mention, ASAE Paper Competition, 1999.
- Environmental Excellence Award, U.S. Environmental Protection Agency, 1995.

- Environmental Excellence Award, U.S. Environmental Protection Agency, 1993.
- Outstanding Researcher, Biological and Agricultural Engineering Department, University
  of Arkansas, 1992.
- Outstanding Researcher, Biological and Agricultural Engineering Department.
  - University of Arkansas, 1991.
- Honorable Mention, ASAE Paper Competition, 1988.
- USDA National Needs Fellowship, Oklahoma State University, 1986-1988.

Papers Presented at Professional Meetings

- Barnett, J.R., R.C. Warner, and D.R. Edwards. 2004. The effectiveness of a combination weep berm – grass filter control system for reducing fecal coliforms and nutrients from surface runoff. ASAE Paper No. 04-2181, ASAE International Meeting, Ottawa, Ontario, Canada, August 1-4.
- Agouridis, C.T., D.R. Edwards, S.R. Workman, J.R. Bicudo, J.L. Taraba, E.S. Vanzant, and R.S. Gates. 2004. Effects of cattle grazing and BMPs on stream water quality. Paper No. 042131, ASAE International Meeting, , Ottawa, Ontario, Canada, August 1-4.
- Agouridis, C.T., D.R. Edwards, S.R. Workman, J.R. Bicudo, J.L. Taraba, E.S. Vanzant, and R.S. Gates. 2004. Influence of BMPs on cattle position preference. Paper No. 042182, ASAE International Meeting, Ottawa, Ontario, Canada, August 1-4.
- Agouridis, C.T., D.R. Edwards, S.R. Workman, J.R. Bicudo, J.L. Taraba, E.S. Vanzant, and R.S. Gates. 2004. Streambank erosion associated with grazing practices in central Kentucky. Paper No. 042227, ASAE International Meeting, Ottawa, Ontario, Canada, August 1-4.

ROBERT L. FEHR, Ph.D., P.E.
90% Extension, 10% Research

Professional Preparation

North Dakota State University	Agricultural Engineering	B.S., 1971
North Dakota State University	Agricultural Engineering	M.S., 1972
Iowa State University	Agricultural Engineering	Ph.D., 1976

Professional Licensure

Professional Engineer (P.E.), since 1980, Kentucky License #11961

Appointments and Experience

- Extension Professor, Biosystems and Agricultural Engineering, University of Kentucky, 1984 to present.
- Computing Section Manager, Agricultural Communications Services, University of Kentucky, 1995-2004.
- Technology Coordinator, Agricultural Communications Services, University of Kentucky, 1991-2004.
- Director, Agricultural Data Center, University of Kentucky, 1983-1991.
- Associate Extension Professor, Biosystems and Agricultural Engineering, University of Kentucky, 1980-1983.
- Assistant Extension Professor, Biosystems and Agricultural Engineering, University of Kentucky, 1976-1980, Structures and Environment areas.

Manuscripts

- Fehr, R.L., Editor. 2009. Guide to Building Energy Efficient Homes in Kentucky & Climate Zone 4, 203 pp.

Presented Papers (last five years)

- Colliver, D., J. Bush, A. Davis, M. Montross, R. Fehr, R. Gates, G. Hallich, and S. Nokes. 2008. Kentucky resources to meet energy needs of the 25x'25 Initiative. White Paper, University of Kentucky, College of Agriculture, Research Manuscript Number 08-05-038.
- Fehr, Robert L. 2007. Designing for Energy Efficiency, National Frame Builders Association, Builders Expo, Indianapolis, IN, February 28, 2007.
- Fehr, Robert L. 2007. Designing HVAC Systems for the Tax Credit, HVAC Contractors Training, Lexington, KY, February 15, 2007.
- Fehr, Robert L. 2006. Mold and Vapor Barriers, National Frame Builders Association, Builders Expo, Nashville, TN.
- Fehr, Robert L. 2006. Improving Energy Efficiency on Your Farm, Kentucky Fruit and Vegetable Growers Conference and Trade Show, Lexington, KY.
- Fehr, Robert L. 2005. Collaboration versus Conferencing - Where We Are and How We Got Here, ASABE 2005 Annual Meeting, Tampa, FL.

Training Modules Developed For DOE Deployment Grant

Controlling InfiltrationDuel Fuel Heating System Overview
Energy Efficient Homes OverviewEnergy Issues and Building Solutions
Goldie Envelope and the Three BarriersHeat Loss and Gain Calculations
Home Systems CertificationsInsulating the Envelope

Kentucky and 2006 IRC Energy CodeMath for HERS Raters
Psychrometric Basics The House as a System
Reducing Energy Use for Heating and CoolingThermal Bypass
Understanding ENERGY billsWindows and Doors
ENERGY STAR® Homes OverviewEnergy Efficient Green Homes
Alternative Methods of Meeting the 2006 IRCAir Leakage Measurement & Terms
Ceiling Insulation R Reduction
2006 International Energy Conservation Code for Climate Zone 4
Home Builder Association of Kentucky Green Building Project Overview

Web Sites

- Web calculators for residential energy
  - ― Fuel Price Comparison
  - ― Upgrade a Natural Gas Furnace and/or Air Conditioner
  - ― Replace a Natural Gas Furnace with a Air Source Heat Pump
  - ― Replace a Natural Gas Furnace with a Geothermal Heat Pump
  - ― Upgrade an Air Source Heat Pump
  - ― Replace an Air Source Heat Pump with a Geothermal Heat Pump
- Enhanced Building Energy Efficiency Technology Deployment Grant Final Products
  - ― Public Site and Secure Site of Publications Distribution
- Created College Energy Web Site, February 2006
- Energy and Radon Publications Web Site, October 2004

Honors and Awards

- Honor Societies: Tau Beta Pi; Alpha Epsilon; Phi Kappa Phi; Gamma Sigma Delta; Epsilon Sigma Phi.
- 2007 and 2006 ― Wethington Award for Research.

Professional Societies

- American Society of Agricultural and Biological Engineers, member since 1976.

Service

- 2010 and 2009 Midwest Regional ENERGY STAR® Conference - Planning Committee – Building Science Track Chair.
- Lexington Habitat for Humanity - Construction Committee (2004-2008).
- University of Kentucky Sustainability Task Force, 2004-2007; Operations sub-committee.
- Kentucky Home Energy Efficiency Task Force, Environment and Public Protection Cabinet.
- Bluegrass Community and Technical College, Energy Management Program Advisory Committee.
- Home Builders Association of Kentucky.
  - ― Green Building Program Steering Committee.
  - ― Green Build Program Web Site Planning Committee.
- Home Builders Association of Lexington.
  - ― Green Build Council.

SAMUEL G. MCNEILL, Ph.D., P.E.
80% Extension, 20% Research

Professional Preparation

University of Kentucky	Agricultural Engineering	B.S.,1974
University of Kentucky	Agricultural Engineering	M.S.,1979
University of Tennessee	Agricultural Engineering	Ph.D., 1996

Professional Licensure

Professional Engineer (P.E.), since 2000, Kentucky License # 21820

Appointments and Experience

- Associate Extension Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, January 2004-present.
- Assistant Extension Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, January 1998-December 2003.
- Extension Agricultural Engineer, Agricultural Engineering Department, University of Kentucky, January 1979-December 1997.

Principal Publications (last five years)

- McNeill, S.G., D.G. Overhults, and M.D. Montross. 2009. Harvesting, drying and storing wheat *in:* A comprehensive guide to wheat management in Kentucky. University of Kentucky Cooperative Extension Service Bulletin ID-125.
- McNeill, S.G., S.A. Thompson, M.D. Montross, I.J. Ross, and T.C. Bridges. 2008. Packing factors of feed products in storage structures. Applied Engineering in Agriculture. 24(5):625-630.
- Stombaugh, T., S. Shearer, J. Wilhoit, and S. McNeill. 2008. Proper ballast and tire inflation. University of Kentucky Cooperative Extension Service Bulletin AEN-93.
- Stombaugh, T., S. Shearer, J. Wilhoit, and S. McNeill. 2008. Saving fuel in the field. University of Kentucky Cooperative Extension Service Bulletin AEN-94.
- McNeill, S.G., G.S. Halich, and K.H. Burdine. 2008. Mechanical drying versus air drying for corn. UK Cooperative Extension Service Economic and Policy Update. Vol. 8, No. 9.
- Prewitt, R.M., M.D. Montross, S.A. Shearer, T.S. Stombaugh, S.F. Higgins, S.G. McNeill, and S. Sokhansanj. 2007. Corn stover availability and collection efficiency, using typical hay equipment. Transactions of the ASABE 50(3):705-711.
- McNeill, S. 2006. Storing flood damaged soybeans and corn. UK Cooperative Extension Service Corn and Soybean Science Newsletter. Vol. 6, No. 3.
- Bridges, T.C., M.D. Montross, and S.G. McNeill. 2005. Estimation of costs associated with aeration of wheat in the mid-South region of the United States. Applied Engineering in Agriculture. 21(1):115-124.

- McNeill, S.G., M.D. Montross, and S.A. Shearer. 2005. Spatial variation of protein, oil and starch in yellow corn. Applied Engineering for Agriculture. 21(4):619-625.
- Montross, M.D. and S.G. McNeill. 2005. Permeability of corn, soybeans, soft red and white wheat as affected by bulk density. Applied Engineering in Agriculture. 21(3):479-484.
- Molenda, M., M.D. Montross, J. Horabik, and S.G. McNeill. 2005. Airflow resistance of seeds at different bulk densities using Ergun's equation. Transactions of the ASAE. 48(3): 1137-1145.
- McNeill, S.G. 2005. Control seed costs to manage profit margin. Corn and Soybean Newsletter Vol. 5, Iss. 1. UK Plant and Soil Science Department.

Honors and Awards

- Service Award (30 years). UK Cooperative Extension Service. 2009.
- American Society of Agronomy. 2009. Publications Award: A comprehensive guide to wheat management in Kentucky. UK Cooperative Extension Service Bulletin ID-125.
- Wethington Award. University of Kentucky. 2006.
- Outstanding Program Award as member of UKCA Wheat Science Group. KASEP. 2006.
- American Society of Agricultural Engineers. 2003. Blue Ribbon Award for Extension Methods (Educational Aids-PowerPoint/slide presentation). Buschermohle, M.J., and S.G. McNeill. S.L.A.M.—An integrated approach to maintain stored grain quality.
- American Society of Agricultural Engineers. 2002. Blue Ribbon Award for Extension Methods (Educational Aids-Publications). Bicudo, J.R., S.G. McNeill, J. Anderson, L.W. Turner, and W.R. Burris. 2001. Cattle handling facilities—planning, components and layouts. UK Cooperative Extension Service. ID-141.

Professional Societies

- American Society of Agricultural and Biological Engineers (ASABE), member since 1979.
- Kentucky Association of State Extension Professionals (KASEP), member since 1979.

Service (last five years)

- University: Faculty Senate, 2006-2009.
- College: Precision Resource Management Systems Committee, 2010; Sustainable Ag and Food Systems Committee, 2008-2009; Wheat Science Committee, 2004-2009; Corn and Soybean Science Committee, 2005-2009; Field Day Committee, 2007-2009.
- Departmental: Extension Publications ad-hoc Committee 2010; Extension Committee 2004-2009; Student Recruitment Committee, 2004-2009.
- Kentucky Association of State Extension Specialists (KASEP), Board Member (7/04 – 6/05); Representative to Western Region Planning and Issues Committee (7/04 – 6/06).
- Research and Education Center: Faculty-Staff Advisory Committee (2005-2006 term); UKCA 2005 Field Day Committee – Past Chair; Exhibit Committee – Chair 2006.

MICHAEL D. MONTROSS, Ph.D., P.E.

68.3% Research, 26.7% Teaching, 5% Extension

Professional Preparation

Michigan State University	Agricultural Engineering	B.S., 1994
Michigan State University	Agricultural Engineering	M.S., 1995
Purdue University	Agricultural Engineering	Ph.D., 1999

Professional Licensure

Professional Engineer (P.E.), since 2003, Kentucky License #23403

Appointments and Experience

- Associate Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, July 2005 to present.
- Assistant Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, November 1999-June 2005.

Principal Publications (last five years)

- Duguid, K.B., M.D. Montross, C.W. Radtke, C.L. Crofcheck, L.M. Wendt, and S.A. Shearer. 2009. Effect of anatomical fractionation on the enzymatic hydrolysis of acid and alkaline pretreated corn stover. Biores. Tech. 100(21):5189-5195.
- Debolt, S., J. Elliott Campbell, R. Smith, M. Montross, and J. Stork. 2009. Life cycle assessment of native plants and marginal lands for bioenergy agriculture in Kentucky as a model for south-eastern USA. Global Change Biology Bioenergy. 1(4):308-316.
- Stork, J., M. Montross, R. Smith, L. Schwer, W. Chen, M. Reynolds, T. Phillips, T. Coolong, and S. Debolt. 2009. Regional examination shows potential for native feedstock options for cellulosic biofuel production. Global Change Biology Bioenergy. 1(3):230-239.
- Molenda, M., M.D. Montross, S.A. Thompson, and J. Horabik. 2009. Asymmetry of model bin wall loads and lateral pressure induced from two- and three-dimensional obstructions attached to the wall. Trans. ASABE. 52(1):225-233.
- Łukaszuk, L., M. Molenda, J. Horabik, and M.D. Montross. 2009. Variability of pressure drops in grain generated by kernel shape and bedding method. Journal of Stored Products Research. 45(1):112-118.
- Fan, Z., K. Wagschal, W. Chen, M.D. Montross, C.C. Lee, and L. Yuan. 2009. Multimeric hemicellulases facilitate biomass conversion. Applied and Environmental Microbiology. 75(6):1754-1757.
- McNeill, S.G., M.D. Montross, S.A. Thompson, I.J. Ross, and T.C. Bridges. 2008. Packing factors of feed products in storage structures. Appl. Eng. in Agric. 24(5):625-630.
- Łukaszuk, L., M. Molenda, J. Horabik, B. Szot, and M.D. Montross. 2008. Airflow resistance of wheat bedding as influenced by the filling method. Res. Agr. Eng. (ISSN 1212-9151). 54(2):50-57.

- Molenda, M., M.D. Montross, and J. Horabik. 2007. Non-axial stress state in a model silo generated by eccentric filling and internal inserts. Part. & Part. Syst. Charact. 24(4-5):291-295.
- Duguid, K.B., M.D. Montross, C.W. Radtke, C.L. Crofcheck, S.A. Shearer, and R.L. Hoskinson. 2007. Screening for sugar and ethanol processing characteristics from anatomical fractions of wheat stover. Biomass and Bioenergy. 31(8):585-592.
- Prewitt, R.M., M.D. Montross, S.G. McNeill, T.S. Stombaugh, S.A. Shearer, S.F. Higgins, and S. Sokhansanj. 2007. Corn stover availability and collection efficiency using typical hay equipment. Trans. ASAE. 50(3):705-711.
- Molenda, M., M.D. Montross, and J. Horabik. 2007. Performance of earth pressure cell as grain pressure transducer in a model silo. Int. Agrophysics. 21(1):73-79.
- Molenda, M., M.D. Montross, S.A. Thompson, and J. Horabik. 2006. Vertical loads from wheat on obstructions located on the floor of a model bin. Trans. ASAE. 49(6):1855-1865.
- Montross, M.D., G.A. Duncan, and R.S. Gates. 2006. Development and testing of a low-cost condensation detection system. Appl. Eng. Agric. 22(4):603-608.
- Crofcheck, C.L. and M.D. Montross. 2006. Evaluation of Fourier Transform Infrared Spectroscopy measurements of glucose and xylose in biomass hydrolyzate. Appl. Eng. In Agric. 22(3):415-420.
- McNeill, S.G., M.D. Montross, and S.A. Shearer. 2005. Spatial variation of protein and oil in yellow corn. Appl. Eng. in Agric. 21(4):619-625.
- Molenda, M., M.D. Montross, J. Horabik, and S.G. McNeill. 2005. Airflow resistance of seeds at different bulk densities using Ergun's equation. Trans. ASAE. 48(3):1137-1145.

Honors and Awards

- Outstanding Teacher in Biosystems and Agricultural Engineering 2008, 2009.
- Loys Mather Teaching Award 2007.

Scientific and Professional Societies

- American Society of Agricultural and Biological Engineers, member since 1994.

Institutional and Professional Service

- Graduate committee (2000 to present).
- Computer committee (2000 to present).
- NC-213, (2000 to present), objective co-chair (02/03 to present), secretary (02/04 - 02/05), chair (02/06 - 02/07).
- ASAE, FPE-702 Grain and Feed Processing and Storage (1998 to present), program chair (07/04 - 07/06), chair (07/06 - 07/07).
- ASAE, SE-202 Bulk Solids Storage Systems (2001 to present), Vice-Committee chair (2003), program chair (2006).
- ASAE, PM-23/7/2 Forage and Biomass Engineering (2004 to present).
- ASAE, FPE-709 Biomass Energy and Industrial Products (2006 to present).

SUE E. NOKES, Ph.D., P.E.
41.67% Research, 38.33% Teaching, 20% Administration

Professional Preparation

The Ohio State University	Agricultural Engineering	B.S., June 1982
The Ohio State University	Agricultural Engineering	M.S., December 1983
North Carolina State University	Biological and Agricultural Engineering, Biomathematics (minor)	Ph.D., May 1990

Professional Licensure

Professional Engineer (P.E.), since 1995, State of Ohio

Appointments and Experience

- Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, July 2007-present.
- Associate Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, July 2001-June 2007.
- Assistant Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, July 1995-June 2001.
- Research Scientist, Department of Agricultural Engineering, The Ohio State University, July 1990-June 1995.

Principal Publications (last five years)

- Coleman, N., C. Crofcheck, S. Nokes, and B. Knutson. 2009. Effects of Growth Media pH and Reaction Water Activity on the Conversion of Acetophenone to (S)-1-phenylethanol by *Saccharomyces cerevisiae* Immobilized on Celite 635® and Calcium Alginate. Trans of ASABE. 52(2):665-671.
- Timmons, M.D., B.L. Knutson, S.E. Nokes, H.J. Strobel, and B.C. Lynn. 2009. Analysis of composition and structure of Clostridium thermocellum membranes from wild-type and ethanol-adapted strains. Applied Microbiology and Biotechnology. Vol. 82(5):929-939.
- Chinn, M.S., S.E. Nokes, and H.J. Strobel. 2008. Influence of Process Conditions on End Product Formation from Clostridium thermocellum 27405 in Solid Substrate Cultivation on Avicel. Bioresource Technology. Vol. 99(7) May 2008:2664-2671.
- Zhuang, J., M.A. Marchant, S.E. Nokes, and H.J. Strobel. 2007. Economic analysis of cellulase production methods for bioethanol. Applied Engineering in Agriculture. 23(5):679-687.
- Chinn, M.S., S.E. Nokes, and H.J. Strobel. 2007. Influence of Process Conditions on End Product Formation from Clostridium thermocellum 27405 in Solid Substrate Cultivation on Paper Pulp Sludge. Bioresource Technology. Volume 98(2007):2184-2193.
- Chinn, M.S., S.E. Nokes, and H.J. Strobel. 2006. Screening of Thermophilic Anaerobic Bacteria for Solid Substrate Cultivation on Lignocellulosic Substrates. Biotechnology Progress. 22(1):53-59.
- Bothun, G.D., B.L. Knutson, H.J. Strobel, and S.E. Nokes. 2006. Liposome fluidization and melting point depression by compressed and liquid n-alkanes. Colloids and Surfaces, A: Physiochemical and Engineering Aspects. 279(1-3):50-57.

- Bothun, G.D., B.L. Knutson, J.A. Berberich, H.J. Strobel, and S.E. Nokes. 2005. Molecular and phase toxicity of compressed and supercritical fluids in biphasic continuous cultures of *Clostridium thermocellum*. Biotechnology and Bioengineering. 89(1):32-41.
- Bothun, G.D., B.L. Knutson, H.J. Strobel, and S.E. Nokes. 2005. Liposome fluidization and melting point depression by pressurized CO_2 determined by fluorescence anisotropy. Langmuir. 21(2):530-536.

Honors and Awards

- Wethington Award (Award for obtaining extramural funding), 2006, 2007, 2008, 2009.
- Recognized at half-time at the UK men's basketball game for receiving the Excellence in Teaching Award, January 28, 2004.
- USDA-NASULGC Excellence in Teaching Award, Southern Region. November 2003.
- Superior ASAE Paper Award. 2002. (2.5% of the papers published in 2002 were selected as Superior.)

Professional Societies

- American Society of Agricultural and Biological Engineers (ASABE)
- American Society for Engineering Education (ASEE)

Service

- UK BAE Department:
  - Director of Undergraduate Studies, June 2007-present.
  - Curriculum Committee, 2008-present.
  - Fundamentals of Engineering Exam Review Session for BAE undergraduates, April 2006.
- UK College of Engineering:
  - Academic Area Advisory Committee for the Physical and Engineering Sciences; 2009-2011.
  - SWE Scholarship selection committee, Spring 2009.
  - Dean's Advisory Committee, 2007-2009.
- UK College of Agriculture:
  - Faculty Senate, Fall 2009-May 2012.
  - Review Committee for Agricultural Biotechnology Program, 2008.
  - Search Committee, Horticulture 2007.
  - Honors Committee, 2005-2006.
  - Agricultural Biotechnology Coordination Committee, 2005-2007
- ASABE Finance Committee, July 2009-June 2014.
- ASABE Publications Council Liaison, July 2009-June 2014.
- ASABE PAK committee for Professional Engineering Exam Summer 2008-Summer 2009.
- University of Kentucky, Serve on the Turner Leadership Academy advisory board, Fall 2008-present.
- University of Kentucky, Participated in Pre-Vet day organizational meetings and on-campus visit, Search Committee for Ornamental Greenhouse Mechanization position, Department of Horticulture, Fall 2007-Spring 2008.

DOUGLAS G. OVERHULTS, Ph.D., P.E.
85% Extension, 15% Research

Professional Preparation

University of Kentucky	Agricultural Engineering	B.S., 1970
University of Kentucky	Agricultural Engineering	M.S.,1975
University of Nebraska	Bio-environmental Engineering	Ph.D.,1982

Professional Licensure

Professional Engineer (P.E.), License #10370 State of Kentucky

Appointments and Experience

- Associate Extension Professor, Biosystems & Agricultural Engineering Department, University of Kentucky, July 1988-present.
- Assistant Extension Professor, Agricultural Engineering Department, University of Kentucky, April 1982-June 1988.
- Instructor & Research Assistant, Agricultural Engineering Department, University of Nebraska, June 1978-April 1982.
- Extension Specialist, Agricultural Engineering Department, University of Kentucky, November 1972-May 1978.

Principal Publications (last five years)

- Xin, H, H. Li, R.T. Burns, R.S. Gates, D.G. Overhults, and J. Earnest, Jr. 2009. Use of CO_2 concentration difference or CO_2 balance to assess ventilation rate of broiler houses. Transactions of the ASABE 52(4):1353-1361.
- Li, H., R.T. Burns, H. Xin, R.S. Gates, S.Trabue, D.G. Overhults, L. Moody, and J. Earnest. 2008. Hydrogen Sulfide and Nonmethane Hydrocarbon Emissions from Broiler Houses in the Southeastern United States. Presented at the ASABE Annual International Meeting, Paper no.084417, Providence, Rhode Island, June 29-July 2, 2008.
- R. Burns , H. Li, L. Moody, H. Xin, R. Gates , D. Overhults , and J. Earnest, Jr. 2008. Quantification of particulate emissions from broiler houses in the southeastern United States. Proceedings of the Eighth International Livestock Environment Symposium, Iguassu Falls, Brazil, 9/08.
- Overhults, D.G., R.S. Gates, A. Pescatore, and M. Miller. 2008. Energy assessments for broiler houses. Presented at the ASABE Annual International Meeting, Paper no. 080027, Providence, Rhode Island, June 29-July 2, 2008.
- Amaral, M.F.P., R.S. Gates, D.G. Overhults, I.F.F. Tinôco, H. Li, R.T. Burns, H. Xin, and J.W. Earnest, Jr. 2008. Analysis of different methods to compute ammonia concentration and emission rate. Proceedings of the Eighth International Livestock Environment Symposium, Iguassu Falls, Brazil, 9/08.
- Amaral, Maira F.P., R.S. Gates, D.G. Overhults, I.FF Tinôco, E.G. Wilkerson, H. Li., R.T. Burns, H. Xin, and J.W. Earnest, Jr. 2007. Comparison between two systems for ammonia emission monitoring in broiler houses. International Symposium on Air Quality and Waste Management for Agriculture Conference Proceedings, 16-19 September 2007, (Broomfield, Colorado, USA) Editor, L. Moody, St. Joseph

Michigan: ASABE Pub #701P0907cd.

- Burns, R.T., H. Xin, R.S. Gates, H. Li, L.B. Moody, D.G. Overhults, J. Earnest, and S. Hoff. 2007. Continuous Monitoring Method for Ammonia Emissions from Poultry Broiler Houses in the United States. Proceedings of the International Conference on Ammonia in Agriculture. Ede, The Netherlands, March 19-21, 2007.

Consulting

- Consultant to Lewis-King, Attorneys at Law, Nashville, TN. Litigation involving dairy cattle facilities, Defendant. 1999-2000.
- Court appointed expert for a special judge in litigation regarding the construction of broiler production houses. 1997.

Honors and Awards

- Wethington Award-University of Kentucky, 2006, 2007, 2008.
- KASEP Outstanding Program Award. 2005. Presented to the Master Cattleman team for the Master Cattleman program.
- ASAE Blue Ribbon Awards for Educational Aids (6).
- American Society of Agronomy "Certificates of Excellence (2)," Extension publication.
- Outstanding Service Award. 1997. Kentucky Pork Producers Association.

Professional Societies

- American Society of Agricultural and Biological Engineers (ASABE)
- Council for Agricultural Science & Technology (CAST)
- Kentucky Association of State Extension Professionals (AKES)
- National Frame Building Association

Service

- Departmental: Extension Planning Committee, Awards Committee.
- University of Kentucky, College of Agriculture, Environment & Natural Resource Issues (ENRI) Core Group, (2001-2006).
- Professional: KY/TN Chapter, National Frame Builders Association - Board of Directors, Chair Education Committee; Past Chairman of ASAE SE-302 Environment of Animal Structures Committee, Past Chair ASAE SE-02 Structures & Environment Division Steering Committee, Member ASAE SE-404 (Swine Housing) and SE-405 (Poultry Housing) Committees.
- ASABE committee: M-151, Henry Giese Award Jury (1997-2001; 2005-2010); Structures & Environment Division (1994-1996, 2004-2005).

FRED A. PAYNE, Ph.D.
61.67% Research, 13.33% Teaching, 25% Extension

Professional Preparation

University of Kentucky	Agricultural Engineering	B.S., 1970
University of Kentucky	Agricultural Engineering	M.S., 1972
University of Kentucky	Agricultural Engineering	Ph.D., 1980

Appointments and Experience

Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, 1993-present.
Associate Professor, Agricultural Engineering Department, University of Kentucky, 1985-1993.
Associate Professor, Agricultural Engineering Department, Clemson University, 1984-1985.
Assistant Professor, Agricultural Engineering Department, Clemson University, 1980-1984.
Research Specialist, Agricultural Engineering Department, University of Kentucky, 1977-1980.
Project Engineer, Research Food Engineer, General Mills, 1972-1977.

Principal Publications (last five years)

- Payne, F.A. and M. Castillo. 2007. Light backscatter sensor applications in milk coagulation. In: Encyclopedia of Agricultural, Food, and Biological Engineering. Heldman, D., Ed. Taylor & Francis Group, Boca Raton. ISBN: 0-8247-4266-4.
- Hicks, C.L., J.M. Stencel, H. Song, and F.A. Payne. 2007. Acoustical emissions generated by E-coli bacteria. Poultry Science 86:426-427. Suppl. 1.
- Fagan, C.C., M. Castillo, C.P. O'Donnell, D.J. O'Callaghan, and F.A. Payne. 2008. On-line prediction of cheese making indices using backscatter of near infrared light. International Dairy Journal. 18:120-128.
- Everard, C.D., D.J. O'Callaghan, M.J. Mateo, C.P. O'Donnell, M. Castillo, and F. Payne. 2008. Effects of cutting intensity and stirring speed on syneresis and curd losses during cheese manufacture. Journal of Dairy Science, 91:2575-2582.
- Fagan, C.C., C.-J. Du, C.P. O'Donnell, M. Castillo, C.D. Everard, D.J. O'Callaghan, and F.A. Payne. 2008. Application Of Image Texture Analysis For Online Determination Of Curd Moisture And Whey Solids In A Laboratory Scale Stirred Cheese Vat. Journal of Food.
- Mateo, M.J., D.J. O'Callaghan, C.D. Everard, C.C. Fagan, C.P. O'Donnell, M. Castillo, and F.A. Payne. Influence of curd cutting programme and stirring speed on the prediction of syneresis indices in cheese-making using a light scatter NIR sensor. LWT – F.
- Mateo, M.J., D.J. O'Callaghan, C.D. Everard, C.C. Fagan, C.P. O'Donnell, M. Castillo, and F.A. Payne. Modeling the Effect of Milk Fat Concentration and Gel Firmness on Syneresis during Cheeses-making. International Dairy Journal.
- Talens, C., D.J. O'Callaghan, C.D. Everard, C.C. Fagan, C.P. O'Donnell, M. Castillo, and F.A. Payne. Evaluation of an improved tracer method to monitor cheese curd syneresis at varying milk fat levels in a cheese vat. Milchwissenschaft.
- Everard, C.D., D.J. O'Callaghan, M.J. Mateo, C.P. O'Donnell, M. Castillo, and F.A. Payne. The use of colour parameters derived from an online fibre-optic sensor to monitor curd syneresis during cheesemaking. Journal of Food Engineering.

- Alvarez, D., M. Castillo, F.A. Payne, and Y.L. Xiong. 2009. A novel fiber optic sensor to monitor beef meat emulsion stability using visible light scattering. Meat Science. 81:456-466.

Recent Patents (selected from 7 patents and 4 patent applications)

- F.A. Payne and C.L. Hicks. 1992. U.S. Patent 5,172,193. Method of predicting cut-time of milk coagulum in cheese-making process.
- U.S. Patent Application S. N. 12/015,181. Security Monitoring System for a Bulk Foodstuff Transport Container, filed March 19, 2008 (10 co-inventors including F. A. Payne).
- U.S. Patent Application S.N. 1211 09,650. Online, Continuous Sensor and Method for Curd Moisture Content Control in Cheese Making, Patent Application filed April 25, 2008. Manuel Castillo, Colette C. Fagan, Colm P. O'Donnell, Donal O'Callaghan, and Frederick A. Payne.
- U.S. Patent Application S. N. 12/015,181. Method for Assessing Biological Test Specimen, Stencel, John M., Haiping Song, Clair L. Hicks, and F.A. Payne.

Honors and Awards

- Named Fellow of ASABE, July 2006.
- Received Distinguished Food Engineering Award IAFIS Foundation/FPEI, July 2005.
- Elected to the ASABE Board of Directors 1994-1996.
- Received six ASABE paper awards that are given to the top 2.5% of papers.

Professional Societies

- American Society of Agricultural and Biological Engineers, member 1977-present.
  - member of ASABE finance committee, 2000-present.
  - member of ASABE Foundation Board of Trustees, 2004-present.
  - member of ASABE FPE-703 Food Processing.
- Institute of Food Technologists (IFT), Professional member, 1972-present.
- SPIE ─ The International Society for Optical Engineering. member 1998-present.
- University of Kentucky Intellectual Property Committee, 2003-2006.
- University of Kentucky Research Conflict of Interest Committee, 2007-2013.

Service

- Managed a professional research group of three Kentucky Universities (2006 – present) in the successful development of a Milk Transport Security System funded by DHS through NIHS ($1.5 million, 3 yrs, 2006-2008; $1.2 million 2008-2009).
- 2007 - Co-Formed *TranSecurity Systems, Inc.* (www.transecuritysystems.com) in March 2007 to commercialize the security, traceability and data management system developed under a grant from the Department of Homeland Security for securing milk between the farm and processor. Currently President.

MARK A. PURSCHWITZ, Ph.D.
50% Extension, 40% Research, 10% Teaching

Professional Preparation

Purdue University	Agricultural Engineering	B.S., 1977
Purdue University	Agricultural Engineering	M.S., 1981
Purdue University	Agricultural Engineering	Ph.D., 1989

Appointments and Experience

- Extension Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, August 2008-present.
- Associate Extension Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, January 2008-August 2008.
- Research Engineer, Agricultural Safety, National Farm Medicine Center, Marshfield Clinic Research Foundation, Marshfield, WI, 2003-2007.
- Adjunct Associate Professor, Department of Biological Systems Engineering, University of Wisconsin-Madison, 2003-2007.
- Associate Professor, (75% Extension, 25% Research) and Extension Agricultural Safety and Health Specialist, Department of Biological Systems Engineering, University of Wisconsin-Madison, 1997-2003.
- Assistant Professor, (75% Extension, 25% Research) and Extension Agricultural Safety and Health Specialist, Department of Agricultural Engineering, University of Wisconsin-Madison, 1993-1997.
- Director, University of Wisconsin-Madison/Extension Center for Agricultural Safety and Health, 1994-2003.
- Assistant Professor, (100% Extension) and Extension Safety Specialist, Department of Agricultural & Biological Engineering, Clemson University, Clemson, SC, 1990-1993.

Principal Publications (last five years)

- Purschwitz, M.A., B.C. Pierce, and K.W. Seebold. 2009. Protect Yourself and Your Workers from Dusts and Molds on Cured Tobacco. Cooperative Extension Service, University of Kentucky College of Agriculture, Agricultural Distribution Center. Four pages.
- Tonelli, S.M., K.J. Donham, K. Leedom-Larson, W. Sanderson, and M. Purschwitz. 2009. Retrofitting Tractors with Rollover Protective Structures: Perspective of Equipment Dealers. Journal of Agricultural Safety and Health 15(4):365-375.
- Purschwitz, M.A., T.M. Ellis, L.L. Benetti, and R.L. Berg. Personal Circumstances, Concerns, and Needs of Women on Wisconsin Dairy Farms. 2008. Special Report. National Farm Medicine Center, Marshfield Clinic, Marshfield, WI.
- Sorensen, J.A., J.J. May, K. Paap, M.A. Purschwitz, and M. Emmelin. 2008. Encouraging Farmers to Retrofit Tractors: A Quantitative Analysis of Risk Perceptions Among a Group of High-Risk Farmers in New York. Journal of Agricultural Safety and Health 14(1):105-117.

- Lee, B.C., J.D. Westaby, P.H. Chyou, and M.A. Purschwitz. 2007. Agricultural Employers' Hiring and Safety Practices for Adolescent Workers. Journal of Agricultural Safety and Health 13(1):25-32.
- Purschwitz, M.A. and T. M. Ellis. 2007. Wisconsin Farm-Related Fatalities 1996-2005. National Farm Medicine Center, Marshfield Clinic, Marshfield, WI.
- Purschwitz, M.A. 2006. Personal Protective Equipment and Safety Engineering of Machinery. Book chapter. In *Handbook of Agricultural Medicine,* [Ed. J.E. Lessinger] Springer Science and Business Media, New York, NY. pp. 53-69.
- Purschwitz, M.A. and M. Miller. 2005. Series of 19 hazard tip sheets for Safety Training for Employers and Supervisors of Adolescent Farmworkers project. National Farm Medicine Center, Marshfield, WI.

Professional Societies

- American Society of Agricultural and Biological Engineers (ASABE), member since 1979.
- National Institute for Farm Safety (NIFS), member since 1986, (past president).

Service

- University of Kentucky, College of Agriculture, NCERA-197, North Central Education/Extension and Research Activity Committee on Agricultural Safety and Health Research and Extension (including subcommittee for High Speed Tractors). secretary, 2008-present.
- University of Kentucky, College of Public Health, Feasibility Project Program review committee, Southeast Center for Agricultural Health and Injury Prevention, chair, 2008-present.
- University of Kentucky, Department of Biosystems and Agricultural Engineering, Solar Decathlon Team, Safety Advisor, 2008-2009.
- American Society of Agricultural and Biological Engineers, ESH-03/1 External Standards Development Subcommittee (v. chair, 2006; chair, 2007-2008).
- University of Kentucky, College of Agriculture Planning Committee, School of Human Environmental Sciences, "University of Kentucky Conference on Physical Activity and the Built Environment," 2008.
- University of Kentucky, College of Agriculture Safety Advisor to UK Occupational Health and Safety and Health Department on an agricultural machinery issue, 2008.
- Kentucky Farm Bureau, Member, State Safety and Rural Health Advisory Committee, 2008-present.
- University of Kentucky, Department of Biosystems and Agricultural Engineering Co-lecturer in AEN 463G, Agricultural Safety and Health, 2008.
- National Institute for Farm Safety, Research and Development Committee (chair), 2006-2007.
- American Society of Agricultural and Biological Engineers, ESH-01 (Ergonomics, Safety, and Health Division Executive Committee), 2006-present.

SCOTT A. SHEARER, Ph.D., P.E.
40% Research, 25% Extension, 20% Administration, 15% Teaching

Professional Preparation

The Ohio State University	Agricultural Engineering	B.S., 1981
The Ohio State University	Agricultural Engineering	M.S., 1983
The Ohio State University	Agricultural Engineering	Ph.D., 1986

Professional Licensure

Professional Engineer (P.E.), since 1994, Kentucky License #18094

Appointments and Experience

- Professor and Chair, Department of Biosystems and Agricultural Engineering, University of Kentucky, August 2007-present.
- Professor, Department of Biosystems and Agricultural Engineering, University of Kentucky, July 2002-August 2007.
- Associate Professor, Department of Biosystems and Agricultural Engineering, University of Kentucky, July 1993-June 2002.
- Assistant Professor, Department of Agricultural Engineering, University of Kentucky, July 1986-June 1993.

Principal Publications (last five years)

- Luck, J.D., S.K. Pitla, S.A. Shearer, T.G. Mueller, C.R. Dillon, J.P. Fulton, and S.F. Higgins. 2010. Potential for pesticide and nutrient savings via map-based automatic boom section control of spray nozzles. Computers and Electronics in Agriculture. 70(1):19-26.
- Fulton, J.P., C.J. Sobolik, S.A. Shearer, S.F. Higgins, and T.F. Burks. 2009. Grain yield monitor accuracy for simulated varying field slopes. Applied Engineering in Agriculture. 25(1):15-21.
- Pitla, S.K., L.G. Wells, and S.A. Shearer. 2009. Integration of an extended octagonal ring transducer and soil coulterometer for indentifying soil compaction. Applied Engineering in Agriculture. 25(5):647-652.
- Duguid, K.B., M.D. Montross, C.W. Radtke, C.L. Crofcheck, L.M. Wendt, and S.A. Shearer. 2009. Effect of anatomical fractionation on the enzymatic hydrolysis of acid and alkaline retreated corn stover. Bioresource Technology. 100(21):5189-5195.
- Fulton, J.P., C.J. Sobolik, S.A. Shearer, S.F. Higgins, and T.F. Burks. 2009. Grain yield monitor flow sensor accuracy for simulated varying field slopes. Applied Engineering in Agriculture. 25(1):15-21.
- Darr, M.J., T.S. Stombaugh, S.A. Shearer, and R.S. Gates. 2007. A new course to teach microcontrollers and embedded networking to biosystems and agricultural engineers. International Journal of Engineering Education. 23(4):716-722.
- Higgins, S.F., M.S. Coyne, S.A. Shearer, and J.P. Fulton. 2006. Evaluating a rapid on-farm nutrient determination model for use in implementing nutrient management plans. Water Air and Soil Pollution. 171(1-4):333-358.
- Darr, M.J., T.S. Stombaugh, and S.A. Shearer. 2005. Controller Area Network Based Distributed Control for Autonomous Vehicles. Transactions of the ASAE. Vol. 48(2):479-490.

- Fulton, J.P., S.A. Shearer, S.F. Higgins, M.J. Darr, and T.S. Stombaugh. 2005. Rate response assessment from various granular VRT applicators. Transactions of the ASAE. 48(6):2095-2103.
- Fulton, J.P., S.A. Shearer, S.F. Higgins, D.W. Hancock, and T.S. Stombaugh. 2005. Distribution pattern variability of granular VRT applicators. Transactions of the ASAE. 48(6):2053-2064.
- Higgins, S.F., M.S. Coyne, and S.A. Shearer. 2005. Determining nitrogen fractions in swine slurry. Bioresource Technology. 96, 1081-1088.
- Thomasson, J.A, S.A. Shearer, and R.K. Byler. 2005. Image-Processing Solution to Cotton Color Measurement Problems: Part I, Instrument design and Construction. Transactions of the ASAE. Vol. 48(2):421-438.
- Thomasson, J.A, S.A. Shearer, and R.K. Byler. 2005. Image-Processing Solution to Cotton Color Measurement Problems: Part II, Instrument Testing and Evaluation. Transactions of the ASAE. Vol. 48(2):439-454.
- Burks, T.F., S.A. Shearer, J.R. Heath, and K.D. Donohue. 2005. Evaluation of neural-network classifiers for weed species discrimination. Biosystems Engineering. 91(3):293-304.

Patents

- Holmes, R.G. and S.A. Shearer. Seed planter, planter assembly and method of picking up and discharging single seeds. U.S. Patent No. 4,533,066. August 6, 1985.

Honors and Awards

- Joe T. Davis Outstanding Advisor Award. University of Kentucky, College of Agriculture Student Council, 2008.
- Outstanding Teacher Award in Biosystems and Agricultural Engineering. University of Kentucky, College of Engineering, 2003-2004, 2006-2007.
- Henry Mason Lutes Award for Undergraduate Engineering Education. University of Kentucky, College of Engineering, 2003-2004.

Professional Societies

- American Society of Agricultural and Biological Engineers (ASABE), member since 1986.

Service

- Biosystems Engineering Program Advisory Council, University of Tennessee, 2006-present.
- Jessamine Career and Technical Center Pre-Engineering Advisory Committee, Jessamine County Schools, Nicholasville, KY, 2006-present.
- ASABE, M-113 Engineering Concept of the Year Award Committee, 2005-present.
- Editorial Board for "Computers and Electronic in Agriculture." Elsevier Science B.V., Amsterdam, The Netherlands. 2003-present.
- University of Kentucky, Promotion and Tenure Committee, College of Agriculture, 2005-2006, Chair 2006-2007.
- University of Kentucky, Dean's Advisory Council, College of Engineering, 2004-2007.
- Faculty Advisor to the 1999 through 2010 ASABE 1/4 Scale Tractor Design Teams.

TIMOTHY S. STOMBAUGH, Ph.D., P.E.
35% Extension, 34% Teaching, 31% Research

Professional Preparation

The Pennsylvania State University	Agricultural Engineering	B.S., 1989
The Pennsylvania State University	Agricultural and Biological Engineering	M.S., 1991
University of Illinois at Urbana-Champaign	Agricultural Engineering	Ph.D., 1998

Professional Licensure

Professional Engineer (P.E.), since 2003, Kentucky License #23424

Appointments and Experience

- Associate Extension Professor, Biosystems and Agricultural Engineering, University of Kentucky, Lexington, KY, 2006-present.
- Assistant Extension Professor, Biosystems and Agricultural Engineering, University of Kentucky, Lexington, KY, 2000-2006.
- Assistant Professor, Food, Agricultural and Biological Engineering, The Ohio State University, Columbus, OH, 1998-2000.
- Visiting Instructor, Agricultural Engineering, University of Illinois at Urbana-Champaign, Urbana, IL, 1991-1998.
- Research Assistant, Agricultural and Biological Engineering, The Pennsylvania State University, University Park, PA, 1989-1991.

Principal Publications (last five years)

- Zandonadi, R.S., T.S. Stombaugh, S.A. Shearer, D.M. Queiroz, and M.P. Sama. 2010. Laboratory performance of a mass flow sensor for dry edible bean harvesters. Accepted for publication in Applied Engineering in Agriculture.
- Zandonadi, R.S., T.S. Stombaugh, D.M. Queiroz, and S.A. Shearer. 2009. Mass flow sensor for combines with bucket conveyors. In Proc. of the Seventh European Conference on Precision Agriculture, pp. 373-380. Wageningen, Netherlands. July 5-8.
- Stombaugh, T.S., R.S. Zandonadi, and C.R. Dillon. 2009. Assessing the Potential of Automatic Section Control. In Proc. of the European Federation for Information Technology in Agriculture, pp. 759-766. Wageningen, Netherlands. July 5-8.
- Shockley, J.C., R. Dillon, and T.S. Stombaugh. 2009. Auto-steer navigation profitability and its influence on management practices: a whole farm analysis. In Proc. of the Seventh European Conference on Precision Agriculture, pp. 751-775. Wageningen, Netherlands. July 5-8.
- Stombaugh, T.S., B.K. Koostra, C.R. Dillon, T.G. Mueller, and A.C. Pike. 2007. Implications of topography on field coverage when using GPS-based guidance. In Proc. of the Sixth European Conference on Precision Agriculture, pp. 465-471. Skiathos, Greece. June 3-6.
- Dillon, C.R., T.S. Stombaugh, B. Kayrouz, J. Salim, and B.K. Koostra. 2007. An educational workshop on the use of precision agriculture as a risk management tool. In Proc. of the Sixth European Conference on Precision Agriculture, pp. 861-867. Skiathos, Greece. June 3-6.

- Fulton, J., S. Shearer, S. Higgins, T. McDonald, C.R. Dillon, and T. Stombaugh. 2007. Variable-Rate fertilizer application Assessment Using an As-Applied Methodology. Proceedings of the 6th European Conference on Precision Agriculture. J. Stafford, ed. Skiathos, Greece. June 3-6, 2007. 681-687.
- Darr, M.J., T.S. Stombaugh, S.A. Shearer, and R.S. Gates. 2007. A new course to teach microcontrollers and embedded networking to biosystems and agricultural engineers. International Journal of Engineering Education 23(4).
- Prewitt, R.M., M.D. Montross, S.G. McNeill, T.S. Stombaugh, S.A. Shearer, S.F. Higgins, and S. Sokhansanj. 2007. Corn stover availability and collection efficiency using typical hay equipment. Trans. ASAE. 50(3):705-711.
- Gandonou, J.M., C.R. Dillon, S.A. Shearer, and T.S. Stombaugh. 2006. Precision agriculture equipment ownership versus custom hire: a break-even land area analysis. Journal of the American Society of Farm Managers and Rural Appraisers, 69(1):106-116.

Extension Publications

- Stombaugh, T.S., 2009. GPS changes: how to be prepared. University of Kentucky Cooperative Extension Service, AEN-95.
- Stombaugh, T.S., S.A. Shearer, J. Wilhoit, and S. McNeill. 2009. Saving fuel in the field. University of Kentucky Cooperative Extension Service, AEN-94.
- Stombaugh, T.S., S.A. Shearer, J. Wilhoit, and S. McNeill. 2008. Proper ballast and tire inflation. University of Kentucky Cooperative Extension Service, Pending CoA Review.
- Adamchuk, V.I., T.S. Stombaugh, and R.R. Price. 2008. GNSS-based auto-guidance in agriculture. Site-Specific Management Guidelines, SSMG-46. International Plant Nutrition Institute in cooperation by the Foundation for Agronomic Research.

Honors and Awards

- ASAE Blue Ribbon Award for Educational Aids, 2009.
- College of Agriculture Outstanding Teacher Award, 2008.
- ASABE Nolan Mitchell Young Extension Worker Award, 2006.
- 2 ASAE Blue Ribbon Award for Educational Aids.

Professional Societies

- American Society of Agricultural and Biological Engineers, member since 1990.
- Gamma Sigma Delta and Alpha Epsilon.

Service

- Convener, ISO TC23/SC19/WG7 - committee to develop standards for GNSS-based equipment.
- Associate editor, ASABE Power and Machinery Division, 2007-present.
- Associate editor, ASAE Information and Electrical Technology division, 2005-2009.
- Past Chair, ASABE PM-54 Precision Agriculture Committee, 2006-2008.
- Program Chair, ASAE PM-54 Precision Agriculture Committee, 2004-2006.
- NCERA-180 Regional committee on precision agriculture.
  - Hosted annual meeting in Lexington, Jan. 6-8, 2009; chair, 2009; secretary, 2008.

JOSEPH L. TARABA, Ph.D.
70% Extension, 30% Research

Professional Preparation

The Ohio State University	Chemical Engineering	B.Ch.E., 1968
The Ohio State University	Chemical Engineering	M.S.,1971
The Ohio State University	Chemical Engineering	Ph.D.,1978

Appointments and Experience

- Extension Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, 1995-present.
- Associate Extension Professor and Extension Specialist, Agricultural Engineering Department, University of Kentucky, 1982-1995.
- Assistant Extension Professor and Extension Specialist, Agricultural Engineering Department, University of Kentucky, 1976-1982.
- Graduate Teaching Associate. Department of Chemical Engineering, The Ohio State University, Columbus, Ohio, 1972-1974.
- Research Associate, Max Planck Institute fur Stromungsforschung, Gottingen, Germany, Summer 1971.

Principal Publications (last five years)

- Lovanh, N., J. Loughrin, P. Silva, R. Gates, J. Taraba, and G. Day. 2010. Effect of feeding schedule on fractionated particulate matter distribution in rooster house. ASABE Meeting Presentation. Paper No: 10xxxx. June 20-23, Pittsburgh PA. St. Joseph, Mich.: ASABE.
- Dutra de Melo, L., G.B. Day V, J.L. Taraba, and G. Del Nero Maia. 2010. Assessment of a Moisture Application System for Compost Biofilters. ASABE Meeting Presentation. Paper No: 1009176. June 20-23, Pittsburgh PA., St. Joseph, Mich.: ASABE.
- Reed, T.M., J.T. McFarland, A.E. Fryar, S.M. Rimmer, A.W. Fogle, and J.L. Taraba. 2010. Sediment discharges during storm flow from proximal urban and rural karst springs, central Kentucky, USA. Journal of Hydrology, 383: 280–290.
- Bewley, J.M., J.L. Taraba, M. Schutz, and J. Zulovich. 2010. Guidelines for managing compost bedded pack barns. The Dairy Practices Council, Newtown, PA. January (in press).
- Del Nero Maia, G., G.B. Day V, R.S. Gates, J.L.Taraba, and N. Lovanh. 2009. Ammonia Removal and Nitrous Oxide Production in Gas-Phase Biofilters. Presented at the Simpósio Internacional sobre Gerenciamento de Residuos de Animais – SIGERA. (1st International Symposium on Animal Waste Management). March 12-13. Florianópolis – SC, Brazil.
- Bewley, J.M. and J.L. Taraba. 2009. Understanding Bedding Materials for Compost Bedded Pack Barns. Kentucky Dairy Notes. College of Agriculture, Cooperative Extension Publication. University of Kentucky, March.
- Bewley, J.M. and J.L. Taraba. 2009. Compost-Bedded Pack Barns in Kentucky. University of Kentucky, College of Agriculture, Cooperative Extension Service Publication ID-178.
- Taraba, J.L. 2009. Environmental Stewardship –Master Cattleman Program Module: 4-hour PowerPoint Presentation. Extension Instructional Video. University of Kentucky, College of Agriculture.
- Del Nero Maia, G., R.S. Gates, G.B. Day V., G.T. Sales, A. Singh, and J.L. Taraba. 2008. Contaminant gas generation as product of degraded ammonia during biofiltration. Paper No. 084630. ASABE Intl Mtg, 30 June – 3 July. St. Joseph, MI. ASABE.

- Del Nero Maia, G., R.S. Gates, G.B. Day V., M.D. Montross, and J.L. Taraba. 2008. Comparison of water sorption isotherms applied to compost biofilters of different particle sizes. Paper No. 084642. ASABE Intl Mtg, 30 June – 3 July. St. Joseph, MI. ASABE.
- Maia, G.D.N., R.S. Gates, E.G. Wilkerson, S.F. Higgins, A. Singh, and J.L. Taraba. 2006. Characterization of headspace gases in ventilated and impermeable swine manure tanks and their abatement using biofiltration. Paper No. 064027. ASABE Annual International Meeting.
- Taraba, J.L., J.S. Dinger, and A.W. Fogle. 2006. Monitoring impacts of animal research center on surface and groundwater quality. Water Quality Research & Education Program: Progress Report. SB 271-Phase V. College of Agriculture, University of Kentucky.
- Coffey, R.D., D.G. Overhults, A.J. Pescatore, J.L. Taraba, D.M. Amaral-Phillips, G.R. Parker, and W.L. Crist. 2005. Animal feeding operations air quality compliance agreement and national monitoring study. Fact Sheet. College of Agriculture, Cooperative Extension, University of Kentucky.
- Agouridis, C.T., D.R. Edwards, S.R. Workman, J.R. Bicudo, B.K. Koostra, E.S. Vanzant, and J.L. Taraba. 2005. Streambank erosion associated with grazing practices in the humid region. Transactions of the ASAE, 48(1):181-190.

Honors and Awards

- Outstanding Extension Program. 2005. Master Cattleman. Kentucky Association of Extension Professionals, January.
- State Team Award for Excellence. 1999. Sustainable Dairy Systems Training Project. Epsilon Sigma Phi - National Honorary Extension Fraternity, February.

Professional Societies

- Associate Member, American Society of Agricultural and Biological Engineers, 1977 to present.
  - Member, Technical Committee SE 412, Agricultural Sanitation and Waste Management, 1977 to present and Member Kentucky Section ASABE, 1977 to present.
- Associate Member, American Institute of Chemical Engineers, 1969 to present.
  - Member, Louisville Section AIChE, 1977 to present.
- Member, American Chemical Society, 1971 to present.
- Member, American Association for the Advancement of Science, 1977 to present.
- Member, Association Kentucky Extension Specialists, 1980 to present.

Service

- Technical Advisor, Natural Resources Advisory Committee, Kentucky Farm Bureau, 1991-2010.
- Certified On-farm Odor/Environmental Assistance Program Assessor. 1999-2007.
- University of Kentucky, College of Agriculture
  - Facility and Land Management Committee for Animal Research Center. 2001-2006.
  - Nutrient Management subcommittee for Animal Research Center. 2001-2006.
  - Natural Resource Conservation and Management Steering Committee Member. 2004-2006.
- University of Kentucky, Biosystems and Agricultural Engineering Department
  - Extension Committee, 1990-2010.
  - Graduate Student and Research Committee, 2006-2010.
  - Research Committee, 1981-1983, 1984-1994, 2002-2004.

RICHARD C. WARNER, Ph.D.
70% Extension, 30% Research

Professional Preparation

University of Illinois-Chicago	Water and Air Resources Engineering	B.S., 1970
Clemson University	Water Resources Engineering	M.S., 1972
Clemson University	Environmental Systems Engineering	Ph.D., 1981

Appointments and Experience

- Extension Professor, Biosystems and Agricultural Engineering Department, University of Kentucky. July 2002-present.
- Associate Extension Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, July 1986-June 2002.
- Assistant Extension Professor, Agricultural Engineering Department, University of Kentucky, May 1981-July 1986.
- Extension Specialist, Agricultural Engineering Department, University of Kentucky, October 1980-May 1981.

Principal Publications (last five years)

- Taylor, T.J., C.T. Agouridis, R.C. Warner, and C.D. Barton. 2009. Runoff Curve Numbers for Loose-dumped Spoil in Eastern Kentucky. International Journal of Mining, Reclamation and Environment 23(2):103-120.
- Angel, P.N., C.D. Barton, R.C. Warner, C.T. Agouridis, T. Taylor, and S.L. Hall. 2008. Tree Growth, Natural Regeneration and Hydrologic Characteristics of Three Loose-Graded Surface Mine Spoils in Kentucky. In: Proceedings of 2008 National Meeting of the American Society of Mining and Reclamation, Richmond, VA, New Opportunities to Apply Our Science. June 14-19, 2008. R.I. Barnhisel (Ed.) Published by ASMR, 3134 Montavesta Rd., Lexington, KY 40502.
- S. T. Torrealba and R.C. Warner. 2008. Quantitative Performance Screening Method for Flocculants Based on Particle Size Distribution Data. 21st Century Watershed Technology: Improving Water Quality and Environment, Proceedings of the 29 March - 3 April 2008 Conference, Concepcion, Chile.
- Graves, D.H., C.D. Barton, R.J. Sweigard, R.C. Warner, C.T. Agouridis, and T. Cushing. 2008. Post-Mining Reforestation Demonstration Project. Final Report for USDA-Forest Service, Award Number: 05-DG-11083150.
- Agouridis, C.T., R.C. Warner, and C.D. Barton. 2008. University of Kentucky Mined Land Reclamation: Inventory of Expertise and Assets. Three-page informative document for Center for Applied Energy Research.
- Agouridis, C.T., R.C. Warner, and C.D. Barton. 2008. Design of a Headwater Stream System for a Head-of-Hollow Fill. One-page informative document for UK Board of Trustees.
- Graves, D.H., C.D. Barton, C.T. Agouridis, R.J. Sweigard, and R.C. Warner. 2008. Reforestation of Coal-Mined Lands. Two-page informative document.
- Sturm, T.W., R.C. Warner, S.F. Torrealba, and F. Hamade. 2007. Demonstration of a Performance-Based System of Storm Water and Erosion Controls on Small Residential/Commercial Sites in the Georgia Piedmont. U.S. EPA Region 4. Oct. 31, 2007. 26pp.

- Warner, R.C., T, Dowdy, L. Ormsbee, J. Volpe, and S. Hampson. 2007. Development and Design of Cost-Effective, Real-Time Implementable Sediment and Contaminant Release Controls. Kentucky Research Consortium for Energy and the Environment. 160pp.
- R.C. Warner, T.W. Strum and S.F. Torrealba. 2007. Seep Berm Design Manual. U.S. Environmental Protection Agency, Atlanta, GA. November 2007. 20pp.

Consultations

- Residential Irrigation Demonstration, Fayette Co., KY. December 15, 2006.
- Irrigation/fertilization design to enhance growth of trees on mined lands for biomass production. January 6, 2007.
- Assessment of sediment impact on homeowner's stream due to up-gradient construction. Oldham Co., KY. April-May 2007.
- In-situ stream flow controls to reduce CO_2 release from drained peat lands in Indonesia. March 13, 2007.
- SEDCAD Design Considerations of Infrequent Storm Events for the Protection of Large Dams. U.S. Mine Safety and Health Administration. March 20, 2007.
- Critical Assessment and Alternative Options for World Bank TSS Mining Regulations. Denver, CO. May 28-29, 2008.
- Residential Micro-Irrigation for Landscapes – Installation Procedures. Site Visits. August 2008.

Honors and Awards

- United States Department of Interior's 2007 Cooperative Conservation Award to ARRI Core and Academic Teams (member of the Academic Team).
- Wethington Awards, 2005, 2006 and 2007.
- American Society of Mining and Reclamation 2nd place poster award at the 2006 7th ICARD Annual Meeting, Hydrologic and Water Quality Characteristics of Loose-Dumped Mine Spoil.
- University of Kentucky Commonwealth Collaborative selected project, Reforestation of Surface Mined Lands, 2006.

Professional Societies

- American Society of Agricultural and Biological Engineering (ASABE), member since 1981.
- American Society of Agricultural Engineering, Kentucky Section, 1981-present.
- Soil Conservation Society of America (SCSA), 1978-1980, 1991.

Service

- University of Kentucky, College Advisory Committee on Appointment. Promotion and Tenure. 2007 and 2008.
- University of Kentucky, BAE Promotion and Tenure Chair 2007-2008.
- ASABE Evaluator for Blue Ribbon Awards – Manuals and Workbooks. June 2007.
- Solid Waste Collection and Waste Reduction Tiger Team: UK.
- University of Kentucky, BAE, Promotion and Tenure Chair, 2004-2006.
- University of Kentucky, Alumni Development Committee: BAE 2005-2006.
- University of Kentucky, Extension Planning Committee: BAE 2005-2006.

LARRY G. WELLS, Ph.D., P.E.
69.3% Research, 30.7% Teaching

Professional Preparation

University of Kentucky	Agricultural Engineering	B.S., 1969
University of Kentucky	Agricultural Engineering	M.S., 1971
North Carolina State University	Biological and Agricultural Engineering	Ph.D., 1975

Professional Licensure

Professional Engineer (P.E.), since 1979, Kentucky License #11206

Appointments and Experience

- Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, July 1986 to present.
- Associate Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, July 1980 - July 1986.
- Assistant Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, October 1974 - July 1980.

Teaching

- BAE 103 Energy in Biological Systems, (3 cr.), Spring 2010, Spring 2009.
- BAE 417 Design of Machine Systems, (3 cr.), Fall 2010, Fall 2009, Fall 2008, Fall 2007.
- BAE 513 Soil Dynamics in Tillage and Traction, (3 cr.), Fall 2008, Spring 2007, Fall 2005.
- BAE 402/403 Design in Biosystems and Agricultural Engineering I & II, (4 cr.), 1997-2007.

Patents

- Licensed (with co-inventors) U.S. patent No. 4,813,216 Apparatus and Method for Automated Tobacco Harvesting to GCH International, Inc. to manufacture and market a mechanical burley tobacco harvesting system. May 2006.
- U.S. Patent Application No. US 11/562,865 for A TOBACCO HARVESTER LEG DEPLOYMENT AND UNLOADING MECHANISM. G.B. Day V, T.D. Smith, L.G. Wells, and I.J. Ross inventors. Filed November 22, 2006.
- U.S. Patent Application No. US 11/563,092 for A PORTABLE FRAME FOR CURING BURLEY TOBACCO. G.B. Day V, T.D. Smith, L.G. Wells, and I.J. Ross inventors. Filed November 24, 2006.
- U.S. Provisional Patent Application Serial No. 60/739,532 for HARVESTING SYSTEM FOR BURLEY TOBACCO OR SIMILAR PLANTS. G.B. Day V, T.D. Smith, L.G. Wells, and I.J. Ross inventors. Filed November 2005.

Principal Publications (last five years)

- Pitla, S.K., L.G. Wells, and S.A. Shearer. 2009. Integration of an Extended Octagonal Ring Transducer and Soil Coulterometer for Identifying Soil Compaction. Applied Engineering in Agriculture, 25(5):647-652.
- Bridges, T.C., L.G. Wells, M.A. Peters, and W.O. Peterson. 2006. Evaluation of labor requirements and work rates for conventional stripping of burley tobacco. Tobacco Science, 46:28-32.

- Wells, L.G., T.S. Stombaugh, and S.A. Shearer. 2005. Crop yield response to precision deep tillage. Transactions of ASAE, 48(3): 895-901.

Papers and/or Presentations at Technical Conferences and Symposia

- Wells, L.G. and S.K. Bodapati. 2009. Reconstructing soil after surface mining with minimal traffic compaction. Amer. Soc. Agr. & Biol. Engrg. paper no. 095621, St. Joseph, MI.
- Wells, L.G., S.K. Pitla, and T.G. Mueller. 2008. A system to measure soil compaction on-the-go with minimal surface disturbance. Amer. Soc. Agr. & Biol. Engrg. paper no. 084757, St. Joseph, MI.
- Bodapati, V.S. and L.G. Wells. 2007. Evaluation of a mechanical system for reconstructing soil without traffic compaction. Procs. of Amer. Soc. For Mining and Reclamation, Gillette, WY.
- Pitla, S.K., L.G. Wells, and S.A. Shearer. 2007. Identifying soil compaction using an extended octagonal ring transducer and soil coulterometer. Amer. Soc. Agr. & Biol. Engrg. paper no. 021083, St. Joseph, MI.
- Wells, L.G., T.D. Smith, and G.B. Day V. 2006. Evaluation of a mechanical burley harvesting system. paper no. AP-34, Proceedings of the 2006 CORESTA Congress, October 15-20, Paris, France.
- Pitla, S.K. and L.G. Wells. 2006. Development of an electrical-mechanical system to identify and map adverse soil compaction using GPS and GIS. ASAE paper no. 061056, St. Joseph, MI.
- Bodapati, V.S. and L.G. Wells 2006. Dynamic mechanical control for soil reconstruction. ASAE paper no. 061092, St. Joseph, MI.
- Wells, L.G. and C. Crofcheck. 2005. Educational objectives and outcomes at the University of Kentucky: Perspectives from a recently reviewed program. ASAE paper no. 057059, St. Joseph, MI.

Professional Societies

- American Society of Agricultural and Biological Engineers (member).
- American Society of Mining and Reclamation (member).

Institutional and Professional Service

- Chair, AGCO Student Design Competition Committee, American Society of Agricultural and Biological Engineers (2008-2009).
- Director of Undergraduate Studies, Biosystems and Agricultural Engineering, University of Kentucky (2005-2007).
- Scholarship Selection Committee, Biosystems and Agricultural Engineering, University of Kentucky (1978 to present).
- Department Review Committee, Biosystems and Agricultural Engineering, University of Kentucky (2006).
- Undergraduate Studies Team, College of Engineering, University of Kentucky (1998 to present).

JOHN WILHOIT, Ph.D., P.E.
60% Extension, 20% Research, 20% Teaching

Professional Preparation

University of Kentucky	Mechanical Engineering	B.S., 1981
University of Kentucky	Agricultural Engineering	M.S., 1983
Virginia Polytechnic Institute and State University	Agricultural Engineering	Ph.D., 1989

Professional Licensure

Professional Engineer (P.E.), since 1989, Virginia License # 0199489

Appointments and Experience

- Extension Associate Professor, Biosystems and Agricultural Engineering Department, University of Kentucky, September 2007-present.
- Instructor (part-time), Biosystems and Agricultural Engineering Department, University of Kentucky, January 2000-2007.
- Owner-Operator, Thistles End Farm, Woodford County, Kentucky, August 1999-present.
- Kentucky Master Logger Program. Taught continuing education courses on Forest Roads for logger certification program. 2001-2002.
- Associate Professor, Biosystems Engineering Department, Auburn University, July 1995-August 1999.
- Assistant Professor, Biosystems Engineering Department, Auburn University, July 1989-June 1995.
- Visiting Scientist, Instituto de Silvicultura e Industria de la Madera (Silviculture and Industrial Forestry Institute), Juarez University of the State of Durango (UJED), Durango, Mexico June-December 1996.
- International Education Specialist, Western Universities Agricultural Education Project (USAID), Sriwijaya University, Palembang, Indonesia, October 1983-October 1985.

Principal Publications (last five years)

- Wilhoit, J., G. Duncan, and D. Ash. 2010. New curing option emerges in burley. In: 2010 Tobacco Trends, Published by Farm Progress Companies Inc. in cooperation with UK, UT, and Virginia Tech Cooperative Extension Services. (Popular press article)
- Wilhoit, J., 2009. Low Cost Cold Storage Room for Market Growers. University of Kentucky Cooperative Extension Service AEN-96.
- Wilhoit, J., and B. Pearce. 2009. Burley Tobacco Curing Advisory. University of Kentucky Cooperative Extension Service Factsheet: TOB-4-09. Plant and Soil Science Department Tobacco Web Site Posting.
- Seebold, K., B. Pearce, A. Bailey, J. D. Green, G. Palmer, G. Schwab, G. Halich, L. Powers, W. Snell, L. Townsend, G. Duncan, L. Wells, J. Wilhoit, M. Velandia, V. Witcher, S. Bost, G. Burgess, D. Hensley, P. Denton, and N. Rhodes. 2009.

2009-2010 Kentucky & Tennessee Tobacco Production Guide. University of Kentucky Cooperative Extension ID-160. 60 p.

- Stombaugh, T., S. Shearer, J. Wilhoit, and S. McNeill. 2009. Saving Fuel in the Field. University of Kentucky Cooperative Extension Service AEN-94.
- Stombaugh, T., S. Shearer, J. Wilhoit, and S. McNeill. 2009. Proper Ballast and Inflation Pressure. University of Kentucky Cooperative Extension Service AEN-93.
- Wilhoit, J. and G. Duncan. 2008. Machines cut labor needs. In: 2008 Tobacco Trends, Published by Farm Progress Companies Inc. in cooperation with UK, UT, and Virginia Tech Cooperative Extension Services. (Popular press article)
- Wilhoit, J. and G. Duncan. 2008. Tools to Cure, Strip, Bale. In: 2008 Tobacco Trends, Published by Farm Progress Companies Inc. in cooperation with UK, UT, and Virginia Tech Cooperative Extension Services. (Popular press article)
- Seebold, K., B. Pearce, A. Bailey, J. D. Green, G. Palmer, G. Schwab, G. Halich, L. Powers, W. Snell, L. Townsend, G. Duncan, L. Wells, and J. Wilhoit. 2008. 2008 Kentucky Tobacco Production Guide. University of Kentucky Cooperative Extension ID-160. 56 p.

Honors and Awards

- Phi Beta Delta Honor Society for International Scholars
- Gamma Sigma Delta Agr. Honor Society; Alpha Epsilon Agr. Engr. Honor Society
- Pi Tau Sigma Mechanical Engineering Honor Society

Professional Societies

- American Society of Biological and Agricultural Engineers, sixteen years.

Service

- Member, Woodford County Agricultural Advisory Review Committee, 2006-present.
- Member, Versailles-Midway-Woodford County Planning Commission, 2002-2006.
- President of the Woodford County Farmers Market from 2001 to 2006.

STEPHEN R. WORKMAN, Ph.D., P.E.
90% Administration, 10% Research

Professional Preparation

The Ohio State University	Agricultural Engineering	B.S., 1982
The Ohio State University	Agricultural Engineering	M.S., 1983
North Carolina State University	Biological and Agricultural Engineering	Ph.D., 1990

Professional Licensure

Professional Engineer (P.E.), since 1999, Kentucky License #20726

Appointments and Experience

- Assistant Dean and Associate Director, KY Ag Experiment Station, College of Agriculture, University of Kentucky, Lexington, Kentucky. July 2009-present.
- Professor, Department of Biosystems and Agricultural Engineering, University of Kentucky, Lexington, Kentucky. July 2009-present.
- Natural Resources Coordinator, College of Agriculture, Agricultural Experiment Station, Lexington, Kentucky, February 2007-July 2009.
- Associate Professor, Department of Biosystems and Agricultural Engineering, University of Kentucky, Lexington, Kentucky. July 2001-present.
- Assistant Professor, Department of Biosystems and Agricultural Engineering, University of Kentucky, Lexington, Kentucky. July 1995-July 2001.
- Agricultural Engineer (Adjunct Assistant Professor in Agricultural Engineering) USDA-ARS Soil Drainage Research Unit, Columbus, Ohio. July 1994-June 1995.

Principal Publications (last five years)

- Fangmeier, D.D., W.J. Elliot, S.R. Workman, R.L. Huffman, and G.O. Schwab. 2006. Soil and Water Conservation Engineering, 5th Edition, Thomson-Delmar Publishing. 502 pgs.
- Workman, S.R. 2006. Precipitation, IN Soil and Water Conservation Engineering, 5th Edition, Fangmeier, D.D., W.J. Elliot, S.R. Workman, R.L. Huffman, and G.O. Schwab, Thomson-Delmar Publishing. pg 29-54.
- Workman, S.R. 2006. Channel Stabilization and Restoration, IN Soil and Water Conservation Engineering, 5th Edition, Fangmeier, D.D., W.J. Elliot, S.R. Workman, R.L. Huffman, and G.O. Schwab, Thomson-Delmar Publishing. pg 230-248.
- Workman, S.R. 2006. Wetlands, IN Soil and Water Conservation Engineering, 5th Edition, Fangmeier, D.D., W.J. Elliot, S.R. Workman, R.L. Huffman, and G.O. Schwab, Thomson-Delmar Publishing. pg 270-287.
- Workman, S.R. 2006. Drainage Principles and Surface Drainage, IN Soil and Water Conservation Engineering, 5th Edition, Fangmeier, D.D., W.J. Elliot, S.R. Workman, R.L. Huffman, and G.O. Schwab, Thomson-Delmar Publishing. pg 288-304.
- Workman, S.R. 2006. Water Table Management, IN Soil and Water Conservation Engineering, 5th Edition, Fangmeier, D.D., W.J. Elliot, S.R. Workman, R.L. Huffman, and G.O. Schwab, Thomson-Delmar Publishing. pg 305-332.
- Pereira da Silva, A.J., E.F. Coelho, J.H. de Miranda, and S.R. Workman. 2009. Estimating water application efficiency for drip irrigation emitter patterns on banana. Pesq. Agropec.Bras., Brasilia 4(7):730-737.

- Jintaridth, B., M.S. Coyne, C.J. Matocha, and S. Workman. 2009. Vegetation and soil depth affect phenol oxidase activity in a model riparian site. J. World Assoc. Soil Water Conserv., 4:1-15.
- Neto, O.R., J.H. de Miranda, J.A. Frizzone, and S.R. Workman. 2009. Local Head Loss of Non Coaxial Emitters Inserted in Polyethylene Pipe. TRANS of ASAE 52(3)729-738.
- Luck, J.D., S.R. Workman, M.S. Coyne, and S.F. Higgins. 2009. Consequences of Manure Filtration Through Pervious Concrete During Simulated Rainfall Events. Biosystems Engineering 102(4):417-423.
- Workman, S.R. and S.E. Serrano. 2008. Experimental Verification of Models on Nonlinear Stream Aquifer Transients. Journal of Hydrologic Engineering 13(12):1119-1124.
- Handayani, I.P., M.S. Coyne, C.D. Barton, and S.R. Workman. 2008. Soil Carbon Pools and Aggregation Following Stream Restoration in a Riparian Corridor: Bernheim Forest, Kentucky. Journal of Environmental Monitoring and Restoration 4:11-28.
- Luck, J.D., S.R. Workman, S.F. Higgins, and M.S. Coyne. 2008. Solid Material Retention and Nutrient Reduction Properties of Pervious Concrete Mixtures. Biosystems Engineering 100(3): 401-408.
- Singh, A. J.R. Bicudo, and S.R. Workman. 2008. Runoff and Drainage Water Quality from Geotextile and Gravel Pads Used in Livestock Feeding and Loafing Areas. Bioresource Technology 99(8):3224-3232.
- Serrano, S.E., S.R. Workman, K. Srivastava, and B. Miller-Van Cleave. 2007. Models of Nonlinear Stream Aquifer Transients. Journal of Hydrology 336(1-2):199-205.
- Luck, J.D., S.R. Workman, S.F. Higgins, and M.S. Coyne. 2006. Hydrologic Properties of Pervious Concrete. TRANS of ASAE 49(6):1807-1813.
- Barbari, M., L. Conti, B.K. Koostra, G. Masi, F. Sorbetti Guerri, and S.R. Workman. 2006. The Use of Global Positioning and Geographical Information Systems in the Management of Extensive Cattle Grazing, Biosystems Engineering 95(2):271–280.
- Srivastava, K, S.E. Serrano, and S.R. Workman. 2006. Stochastic Modeling of Transient Stream-Aquifer Interaction with the Nonlinear Boussinesq Equation. Journal of Hydrology 328(3-4):538-547.

Honors and Awards

- Loys L. Mather Outstanding Career Teaching Award, College of Agriculture Student Council, University of Kentucky, 2006.
- Lead-21 Leadership for the 21st Century, member of 2006-2007 Leadership Development Class.

Service

- National Committees: SW-05 Publication Review Committee, ASABE; SW-23 Drainage Group, ASABE; SW-21 Hydrology Group, ASABE; ASABE Section Steering Committee (1998-2008); Special Programs Committee, 7th International Drainage Symposium.
- Member, KY Agriculture Water Quality Authority, 2007-present.
- University of Kentucky, Natural Resources Coordinator, 2007-present.
- University of Kentucky, Tracy Farmer Center for the Environment Board, 2007-present.
- University of Kentucky, Precision Resource Management Committee, 2005-2008.

APPENDIX C – LABORATORY EQUIPMENT

- Electronics laboratory with 7 stations equipped with pc, microcontroller programmers, and basic electronics test equipment including digital oscilloscope, power supply, function generator, and digital multimiters
- 2 NIST traceable dewpoint hygrometers
- Soil bin for tillage, compaction, and traction testing
- Flumes for hydrology exercises
- 2 Thermal imaging cameras
- Armfield hydraulics training bench
- Various GPS equipment including 13 handheld GPS receivers, 12 PDA's with CF GPS, 6 submeter GPS receivers, and 8 RTK GPS receivers.
- Dynamic GPS test facility
- Air flow calibration chamber
- Grain storage and handling laboratory with several large bins and various conveyors
- 8 pneumatic and fluid power trainer benches
- PTO-driven dynamometer
- Yield monitor test facility
- Various farm equipment including 3 tractors with autosteer, combine, high clearance self propelled sprayer, planters, tillage tools, and manure handling and application equipment
- Instron universal testing apparatus
- 7 temperature/humidity environmental chambers
- Various wood and metal fabrication equipment including a CNC milling machine, computerized plasma cutting table, and state-of-the-art welding equipment.
- UV- Visible spectrophotometer (UV-Vis spec)
- High Performance Liquid Chromatography (HPLC)
- Gas Chromatography (GC)
- Fourier Transform Infrared Spectroscopy (FTIR)
- Near Infrared Analyzer (NIR)
- YSI 7100 Multiparameter Bioanalytical System (MBS)

APPENDIX D – INSTITUTIONAL SUMMARY

Provided by the College of Engineering as a separate document.

APPENDIX E - SUPPORTING DOCUMENTS

Alumni Survey Instrument
BAE Alumni Survey 2009
I. Personal Information
First Name:_____ Middle Name:_____ Maiden Name:_____
Last Name:_____ Gender: male / female
Telephone: (____) -_____- _____

Mailing Address Preferred Contact address: Personal / Employer (Please circle one)
Address 1:_____ City_____ __State_____
Country_____ Zip_____ (For Zip + 4, please include hyphen) Int. Postal Code_____

Address 2:_____ City_____ __State_____
Country_____ Zip_____ (For Zip + 4, please include hyphen) Int. Postal Code_____

Email Address:_____

Employer Address
Employer_____
Address 1:_____ City_____ __State_____
Country_____ Zip_____ (For Zip + 4, please include hyphen) Int. Postal Code_____

Address 2:_____ City_____ __State_____
Country_____ Zip_____ (For Zip + 4, please include hyphen) Int. Postal Code_____
Work Phone: (____) -_____- _____ Extension:_____
International Phone Number: _____

II. Professional Information
Do you intend to become a Licensed Professional Engineer? Yes / No
Did you take the FE or EIT Exam? Yes / No
If "Yes", date passed FE of EIT exam. _____ (mm/dd/yyyy)
Did you take the PE Exam? Yes / No
If "Yes", date passed PE exam. _____ (mm/dd/yyyy)

Please give us information on your first non-student employment, after graduating from the BAE Program.
Date Employed:_____ (mm/dd/yyyy)
Employer_____ Position Title_____
% Engineering:_____ (0-100) ** See explanation below

Starting Salary Range:_____ Employees Supervised:_____

Please give us information on your most recent promotion or current position.

Date Promoted or Current Date:_____ (mm/dd/yyyy)

Is your most recent promotion your current position? Yes / No (Please circle one)

Position Title:_____

% Engineering_____(0-100)**see explanation below

Starting Range when promoted or current salary:_____

Employees Supervised:_____

Please indicate your memberships in professional organizations:

III. Education Information

Degrees from University of Kentucky: BS_____ MS_____PhD_____(mm/dd/yyyy)

Based on your BAE education, please rank your acquired skill level for each of the following. Consider 5 to be very well prepared and 1 to be less than prepared.

Technical engineering knowledge_____

Communication _____

General non-technical knowledge (social factors, manufacturability, ethics, etc.):_____

Please list your advanced degrees:

Institution	Degree	Date (mm/dd/yyyy)

Continuing Education:

Training received during first year of employment.

Description	CE Credits	Date (mm/dd/yyyy)

Training received after first year of employment.

Description	CE Credits	Date (mm/dd/yyyy)

Comments:

**% Engineering- This measures whether our graduates are employed in the practice of engineering- the profession for which they sought an education. Estimate of the amount of time (percentage) in this position that was devoted to the practice of engineering. If you are working as an engineer of in management of engineers or other management that is aided by your engineering degree then your percentage will likely be high. If you work for a bank, became a medical doctor, or a trial lawyer then your percentage will be low. If you are not employed as a n engineer and you planned as a student to use your engineering degree to prepare you for a profession other than engineering (such as veterinary science, medical, etc) then put NA.

BAE Advisory Council Bylaws

April 25, 2001; Revised August, 2009
Biosystems and Agricultural Engineering Advisory Council
College of Agriculture, University of Kentucky

ARTICLE I. MISSION STATEMENT

A) The purpose of the Biosystems and Agricultural Engineering (BAE) Advisory Council is to:
   i) Support undergraduate and graduate education by providing input to the faculty on curriculum development and industry's expectations of program graduates.
   ii) Provide input and guidance to the faculty regarding overall programs, discovery (research) programs, and engagement (extension/outreach) programs of the department.

ARTICLE II. MEMBERSHIP

A) The membership of the Council shall include a Chair and at least eleven other members of the council composed of a significant proportion of alumni of the Biosystems and Agricultural Engineering program and/or appropriate engineering and agiculture professionals. The Department Chair or her/his designated representative shall serve as ex officio non-voting member and will be responsible for maintaining a record of meetings and business of the Council.
   i) The members shall serve three-year terms with equal or nearly equal number selected each year (approximately four members per year).
   ii) The Council may add such additional members as it may from time to time approve on a temporary basis.
B) New members will be confirmed by the Council annually upon recommendation by the Department Chair or her/his designated representative. Members may serve multiple and consecutive terms.
C) The Chair, Vice Chair, and Past Chair along with the Department Chair or representative shall form an Executive Committee and shall be authorized to act on behalf of the Council after seeking input from Council members.

ARTICLE III. OFFICERS

A) The Council shall have three officers, a Chair, Vice Chair, and Past Chair. The term of each officer shall be approximately one year, from one regular annual meeting to the next.
   i) Each year at the fall meeting the Council shall elect a Vice Chair. Upon such election the previous Vice Chair shall succeed to the office of Chair and the previous Chair shall succeed to the office of Past Chair.
   ii) Each officer of the Council must at the time of his/her election be a member of the Council. An officer may continue to serve after his/her term of Council membership may have ended and a successor may have been elected. If this occurs the officer shall continue to have all the rights and privileges of Council membership including the right to vote on any item before the Council until such time as his/her term as Past Chair of the Council shall end.
B) Duties of the Chair:
   i) Conduct annual business meetings of the Council

ii) Cooperate with BAE Department Chair and Staff in timely setting of times and places for Council meetings.
iii) Provide an agenda to each Council member 2 to 4 weeks prior to each meeting.
iv) Carry out Council decisions directly or by appropriate delegation.
v) Arrange for an orderly transfer of the Chair's file(s) and a copy of the then current bylaws at the close of the Chair's term.

C) Duties of the Vice Chair:
i) Assist the Chair in arranging and conducting Council business meetings.
ii) Serve as a member of the Executive Committee of the Council.
iii) Assume the duties of the Chair in the event of the resignation or disability of the Chair.

ARTICLE IV. PROCEDURES

A) The Council shall act in an advisory role to the Department Chair and faculty of BAE.
B) The Council shall receive reports from the Department Chair and faculty of BAE as needed to help handle its responsibilities, shall have the power to create special sub-committees of the Council, and shall discharge its special committees when their assignments have been completed or their usefulness otherwise ended.
C) The Council shall consider the failure of a Council member, from inability or otherwise, to perform the duties of his/her office, and may, by two-thirds vote, declare any position vacant. The Council shall thereupon appoint a member to fill the vacancy until the end of the normal term for that Council member. Such appointment shall not render the appointee ineligible for appointment or election to any office.

ARTICLE V. CONDUCT OF BUSINESS

A) Meetings. Regular Council meetings shall be held on at least an annual basis in the fall generally timed to coincide with BAE alumni events. The regular official meeting of the Council will be held at this time. Additional interim meeting(s) in the Spring or other selected time may be held to assist in accomplishing the purposes of the Council. Robert's Rules of Order will prevail unless modified by these bylaws. Members unable to attend may express their opinion in writing concerning agenda items to the Council Chair or the Department Chair. Other meetings may be called by the Chair or Department Chair using techniques such as conference calls, e-mail or "listserves".
B) Quorum. A quorum shall consist of 40% of the members of the Council. In the absence of a quorum, official business may be conducted by written ballot.
C) Voting. All matters except amendments to the bylaws and removal of members under Article IV, Section C, shall be decided by a simple majority vote of members present.

ARTICLE VI. CHANGES TO BYLAWS

A) Changes in the bylaws may be discussed at any meeting of the Council. Passage requires a two-thirds vote in writing of the Council membership within 30 days after receipt of the written proposed revision.

REINITIATION OF ADVIORY COUNCIL

A) Initial Officers. The initial officers of the Council shall be as follows:
i) The Chair shall be elected initially from the current Council membership prior to the fall meeting, 2009. Email ballot will be an acceptable means of election.
ii) The Vice Chair shall be elected by the membership of the Council at the first regular meeting in the fall of 2009.

iii) The Past Chair position shall remain vacant for the first year.

Terms filled will include the following classes:

iv) Class I (2009) (To be rotated off in Fall of 2011)

v) Class II (2009) (To be rotated off in Fall of 2012)

vi) Class III 2010 (To be rotated off in Fall of 2013)

New members will be nominated and recruited by the faculty prior to the Fall Meeting of 2009. At the fall meeting, the final slate of classes for all three terms will be recommended by the BAE Chair, considered, and voted upon by the new Council

Advisory Council Meeting Minutes

1:00 PM to 8:30 PM, Friday, June 11, 2010

Afternoon portion, Room 249, C.E. Barnhart Building
In attendance: Julia Parakkat, Erin Webb, Liz Bullock, Kristyn Ratliff, Jonathan Waits, Arlyn Wilcox, Ruth Wilcox, Grant Wonderlich, JP Jones, Scott Shearer, Sue Nokes, Czar Crofcheck

Meeting was called to order at 1:05 pm

The advisory council and the faculty members present introduced themselves.

Scott Shearer presented to the advisory council about the history and current activities in the department.

Sue Nokes presented to the advisory council about the ABET process and the purpose of the Self-Study.

Czar Crofcheck presented to the advisory council the specific areas that the advisory council needs to review and recommend actions.

- **Criterion 2: Objectives**
- **Criterion 3: Outcomes**
- **Criterion 4: Continuous Improvement Process**
- **Criterion 5: Curriculum**

During the discussion the advisory council made several helpful suggestions.

- The advisory council provided valuable feedback about word choice and even grammar. All of these editorial improvements are not documented, but have been incorporated into the Self Study.
- The absence of the word “environmental” from the department’s mission statement was questioned by Liz Bullock.
- The difference in the introductory words of the two objectives was questioned by Ruth Wilcox.
- There was discussion about whether the FE exam is really a measure of the abilities of the graduates 3-5 years after graduation. The wording in the metric was emphasized, “as a predictor of competence” and the advisory council was satisfied.
- The use of the PE was also questioned, since a large portion of graduates do not take the PE because it is not expected in their line of work. The faculty indicated that it is not held against us that all of the graduates take the PE and our goal is that the ones that do take it are able to pass it. The faculty asked the advisory council if they had any suggestions about what else could be measured.
- It was also noted that the metrics call for the percentage passing the PE the first time, but the data is not based on the initial passing rate.

- The metrics for objective 2 call for quantification of salary increases for the alumni. Some of the surveys returned did not include a current salary, there was no clarification if this meant that the individual had lost their job. Due to the lack of data, these data points were removed from the sample. The advisory council remarked that this didn't seem fair. It was suggested that the metric clearly state that increase percentage is based on employed alumni.
- The standard and goal for the FE metric were based on the average for the COE at UK. It was noted that this average was unavailable. It was suggested to use the national average instead.
- For outcome 5, the score from BAE 417 is a 61%, which is below standard. The draft of the self-study marked this as "No" action, with an explanation of why the score was low (not enough time to complete the assignment) and the intent of the instructor to give additional time next time. The advisory council advised that this should be marked as "yes", since there was in fact action taken.
- For outcome 8, student performance in a national design competition is one of the metrics. In the 2008-2009 year, there were no student competition entries. The advisory council discussed the importance of student design competitions and suggested that just participating in a student design competition should be reported as a success, not just when the students place in the completion.
- The advisory council provided feedback about the choice of verbs in Table 10.
- The advisory council reviewed Table 13. Percentage of Course Dedicated to each Outcome. The advisory council recommended that Outcome 11 (multi-disciplinary) and Outcome 14 (global appreciation) could have additional course time, because both topics are of greater importance in the workplace today. Maybe multi-disciplinary roles could be covered in senior design.

The advisory council agreed on the following recommendations:

1. The mission statement should include "environmental".
2. The wording of the objectives should be clarified.
3. For continuity, there should be a "tool" column in Table 5.
4. The standard and the goal for the FE in the objectives should refer to a national average, not a COE average.
5. The standard for passing the PE should be 70% and the goal should be 90%.
6. The metric for the PE should not include reference to taking the PE for the first time.
7. The metric for salary increase should clearly state that it is based on employed alumni.
8. The participation in student design competitions should be a success, not just when the students place in the competition.
9. The evaluation for outcome 5 should indicate that action was taken and the action should be included in Table 10.
10. There should be more class time on Outcome 11 & Outcome 14.

Czar Crofcheck presented about the current structure of the capstone senior design course. The advisory council was encouraged to submit ideas on how the course could be improved. Topics suggested during the meeting included troubleshooting, retrofits, decision making, lean systems, 6-sigma, impact analysis, and focus analysis.

General curriculum comments were also made.

Students need to understand where their salary will come from someday, for example in water resources salaries are basically paid with tax money, through a consulting agency. The professions class should also cover “informal” communication.

The afternoon portion of the meeting was adjourned at 6:05 pm.

Evening portion, 6:30 pm at Malone’s Banquet
In attendance: Julia Parakkat, Erin Webb, Liz Bullock, Kristyn Ratliff, Jonathan Waits, Arlyn Wilcox, Ruth Wilcox, Grant Wonderlich, JP Jones, Scott Shearer, Sue Nokes, Czar Crofcheck, Sarah Short, and Christina Lyvers

Sarah Short and Christina Lyvers presented on their Brazil Study Abroad Trip

Scott Shearer discussed the bylaws and the need to elect new members to the Advisory Council. Due to time constraints, it was decided to do so by email.

The evening portion of the meeting was adjourned at 8:35 pm

Submitted by Czar Crofcheck, June 15, 2010.

ABET Subcommittee Meeting after Advisory Council Meeting
June 15, 2010

In attendance, Czar Crofcheck and Sue Nokes

Order of business: to decide what recommendations from the alumni board can be incorporated immediately and which recommendations will have to be forwarded to the UGCC and the faculty.

Recap of the recommendations:

1. The mission statement should include "environmental".
2. The wording of the objectives should be clarified.
3. For continuity, there should be a "tool" column in Table 5.
4. The standard and the goal for the FE in the objectives should refer to a national average, not a COE average.
5. The standard for passing the PE should be 70% and the goal should be 90%.
6. The metric for the PE should not include reference to taking the PE for the first time.
7. The metric for salary increase should clearly state that it is based on employed alumni.
8. The participation in student design competitions should be a success, not just when the students place in the competition.
9. The evaluation for outcome 5 should indicate that action was taken and the action should be included in Table 10.
10. There should be more class time on Outcome 11 & Outcome 14.

The following items will be incorporated into the Self Study immediately: 2, 3, 4, 5, 6, 7, and 9.

The following items will need to be forwarded to the UGCC: 1, 8, and 10.

APPENDIX F – DATA FOR ASSESSING PROGRAM OBJECTIVES

Table 19. FE, PE, and Membership Data for Objective Assessment.

Graduation Year	n	Sat for the FE	Passed the FE	Took the PE	Passed PE	Member-ship
98-99	5	4	4	1	1	3
99-00	5	4	4	2	2	2
00-01	3	3	3	2	2	3
01-02	5	5	5	2	2	4
02-03	10	8	7	2	2	6
03-04	6	6	5	2	1	3
04-05	7	6	5	1	1	3
05-06	8	6	5	0	0	5
06-07	6	3	3	0	0	3
07-08	12	9	7	0	0	7
99-08	67	54	48	12	11	39

Table 20. Employment and Salary Data for Objective Assessment.

Graduation Year	n	Employed*	First Salary (adjusted)	Current Salary	Increase in Pay	Increase in Adj. Pay**	Supervisor
98-99	5	5	$42,408	$65,000	206%	160%	3
99-00	5	4	$40,651	$79,000	258%	207%	1
00-01	3	3	$48,232	$91,667	285%	236%	1
01-02	5	5	$44,708	$63,000	173%	145%	0
02-03	10	10	$37,765	$50,500	158%	136%	3
03-04	6	6	$50,734	$66,667	151%	133%	3
04-05	7	7	$45,949	$60,000	143%	129%	4
05-06	8	8	$41,261	$43,571	111%	104%	1
06-07	6	6	$46,940	$34,000	84%	81%	2
07-08	12	11	$44,013	$33,333	81%	81%	2
99-08	67	65	$43,713	$53,906	149%	129%	20

* Employed is defined as students that are employed within 6 months or attend graduate school.

** Salaries were adjusted to 2009 dollars.

APPENDIX G – DATA FOR ASSESSING OUTCOMES

The following data was collected and evaluated in 2008-2009. Revised assessment tools were established in Fall 2009. The complete assessment given in Criterion 3 is based on the assessments from 2008-2009 and additional data collected in 2009-2010. The additional data is contained in the discussion above in Criterion 3.

For all of the assessments that are based on class assignments in BAE courses, the data are collected each semester. For all of the assessments that are based on FE scores, the data are collected in June of every year and the scores from the fall and the spring exam may be combined for a single year average.

Outcome 1- Graduates must demonstrate their ability to apply knowledge of mathematics, science and engineering to solve problems.

Assessment

a) BAE 427/447. Homework assignments in each course were selected that included problems with an emphasis on math and science content. The average for the 2008-2009 year on these assignments was 88% for BAE 427 and 87% for BAE 87%. These scores indicate that the students are able to utilize their understanding of math and science to solve problems.

b) In order to determine the capabilities in mathematics of students nearing completion of the BAE program, performance in the math sections of the Fundamentals of Engineering (FE) examination were analyzed. Average FE exam scores of University of Kentucky BAE students were normalized by average scores of all students in the nation taking the 'Agricultural Engineering' examinations from 2005 through 2009. The metric standard for normalized FE scores is 1.0 or above. Normalized scores of 1.0 or greater indicate that our students did better than the national average on that particular portion of the exam. Figure 10 shows normalized scores in mathematics. There appears to be an increase in the normalized score over time. The overall average (2004-2009) and the average for the last review year (2008-2009) were both 1.0 (**meets standard**).

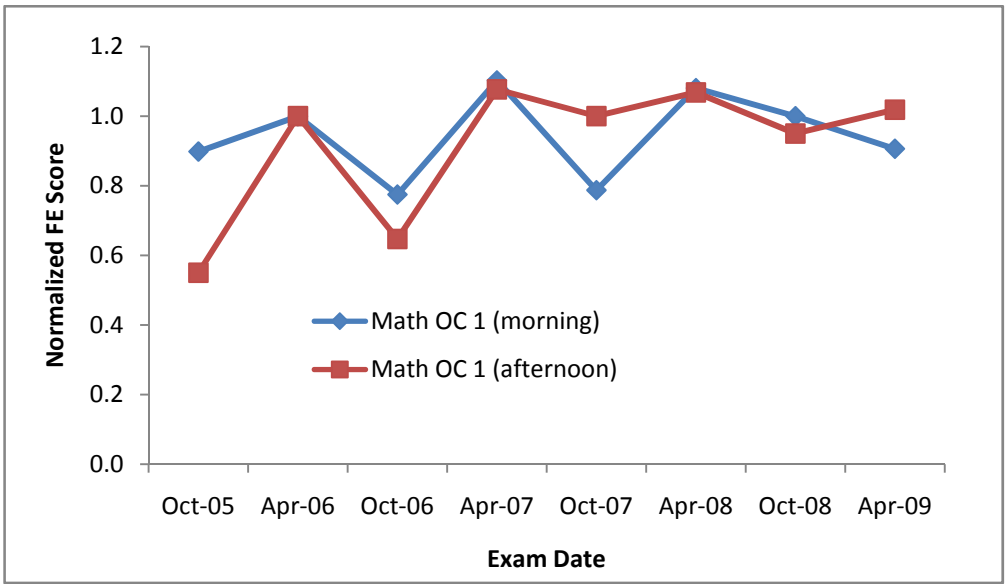

Figure 10. Normalized scores of BAE students in mathematics on FE exams, 2005-2009.

Response

On balance, these results indicate that Outcome 1 has been attained over the evaluation period.

Outcome 2- Graduates should demonstrate an ability to use techniques, skills and modern engineering tools necessary for engineering practice.

Assessment

a) BAE 402/403. This assessment was added in Fall 2009, hence there is no data for 2008-2009.

b) The apparent success in attaining Outcome 2 is supported by plotting BAE student scores from the 'computer' section of the FE examination normalized by the average scores of all students taking 'Agricultural Engineering' examinations between 2004 and 2009 (see Figure 11). University of Kentucky BAE students consistently achieved normalized scores well above the metric goal of 1.0 over the period (**meets standard**). We will continue to monitor these results regarding possible implications relative to attainment of Outcome 2.

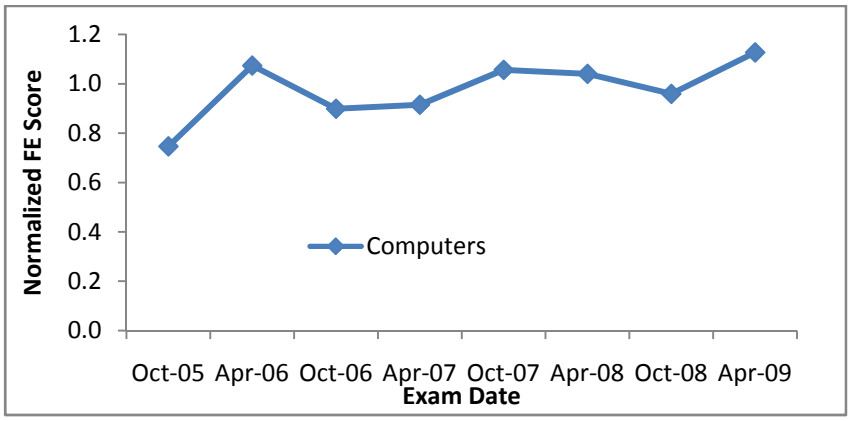

Figure 11. Normalized scores of BAE students in computer usage on FE exams, 2004-2009.

Response

All target assessment thresholds are exceeded relative to Outcome 2.

Outcome 3- Graduates should be able to design and conduct experiments, as well as to analyze and interpret data.

Assessment

a) In the Spring 2009 BAE 202 class (Probability and Statistics for Biosystems), the final lab assignment focused on design of experiments and analyzing and interpreting data (the same assignment that had been assigned in 2007). The average score on the lab assignment was 92% (the score in 2007 was 91%), which **meets goal**. The class performed well on the assignment. Unlike 2007, all of the students mentioned that the treatments needed to be assigned randomly. However, there were still problems with identification of the experimental unit. Several students thought that the response variable was the experimental unit. In the next class, the definition of experimental unit will be emphasized.

b) In 2004, students in BAE 305, DC Circuits and Microelectronics, were given open-ended laboratory assignments to evaluate their ability to formulate experiments, acquire and analyze data, and determine required results. All laboratory experiments in this class are designed to be open-ended task assignments that force students to formulate experiments and decide what data are needed to report the requested results. Two specific metrics were used. The first was the average score of the final laboratory experiment, which was a culmination design laboratory. The second was a comparison of average lab scores from the first half of the semester to the second half. The average score of culmination laboratory was 95.6% (in 2008, the score was 92.3%), which **meets goal**. In addition, the average for the lab reports done in the second half of the course was higher than the average of the lab reports done in the first half of the course, 92.7% for the first half and 95.7% for the second half. In 2008, these averages were 92% and 90%, respectively. The data show that the overall class scores increased in the latter half of the semester. BAE 305 students handled the open-ended laboratory assignments better as the semester progressed; the students'

ability to design experiments and then select an appropriate method to communicate the experiment's results increased. Students are achieving Outcome 3.

c) In BAE 403 (BAE Design II), each final senior design report included a statistical analysis. A grade was assigned to each team for their statistical analysis. In 2008, the team grades were A, B, B, B, B, C, and C. As a result, additional class time was allotted for discussion of statistical analysis. In 2009, both teams received an A on their statistical analysis, which **meets goal**. This was a combination of the additional class time and the difference in the nature of the statistical analysis due to the different design problems. The recommendation for the coverage of statistical analysis in the senior design course is to continue to stress the importance of sound statistical analysis.

Response

The assessments in BAE 202, BAE 305, and BAE 403 indicate that BAE students have demonstrated the capability of achieving Outcome 3. We plan to continue current presentation of curriculum content relating to this outcome pending future assessment.

Outcome 4- Graduates must demonstrate an ability to identify, formulate, and solve engineering problems.

Assessment

a) BAE 427/447. Homework assignments in each course were selected that included problems with an emphasis on solving engineering problems. The average for the 2008-2009 year on these assignments was 88% for BAE 427 and 87% for BAE 87%. These scores indicate that the students are able to solve engineering problems.

b) The normalized scores for the various FE sections used to assess Outcome 4 are shown in Table 21. Overall, the scores appear to be improving over time. This is most likely because more students are taking the exam. For this analysis, the averages of the scores for the entire review period (2005-2009) and for the previous year (2008-2009) were considered (the last two columns in the table). FE scores for 2004-2005 are not included in this review because the test prior to Oct 2005 contained different sections divisions, making it difficult to compare to newer data.

Table 21. Normalized scores of BAE students on FE exam (Outcome 4 sections).

Normalized FE Results	Oct-05	Apr-06	Oct-06	Apr-07	Oct-07	Apr-08	Oct-08	Apr-09	05-09 Ave.	08-09 Ave.
Engineering Mechanics (Statics and Dynamics)	1.2	0.9	0.7	1.1	1.0	1.0	1.1	1.1	1.0	1.1
Strength of Materials	0.6	0.9	0.4	0.8	0.4	1.1	1.1	1.0	0.94	1.0
Material Properties	0.2	0.6	1.2	1.1	0.8	0.9	1.0	1.0	0.88	1.0
Fluid Mechanics	1.1	1.0	0.7	1.1	0.8	1.0	0.9	0.8	1.0	0.87
Thermodynamics	0.6	0.8	0.9	1.2	0.8	1.1	0.8	0.7	0.92	0.75
Application of Engineering Mechanics	0.5	0.8	1.2	1.0	0.9	1.0	1.1	0.9	0.93	1.0
Engineering of Materials	0.8	0.9	1.2	0.4	0.6	0.9	1.4	1.3	1.0	1.3
Fluids	0.6	1.0	0.7	0.8	1.0	1.0	1.0	1.1	1.0	1.1
Thermodynamics and Heat Transfer	0.9	0.7	0.6	1.2	0.5	1.1	1.1	1.2	1.0	1.2
Overall	0.7	0.8	0.9	0.9	0.7	1.0	1.1	1.0	0.9	1.0
Fluids Average	0.9	1.0	0.7	0.9	0.9	1.0	1.0	0.9	1.0	1.0

For 2005-2009,, the overall combined FE normalized score is a 0.948, which **does not meet standard** (this includes sections Engineering Mechanics, Strength of Materials, Material Properties, Fluid Mechanics, Thermodynamics, Application of Engineering Mechanics, Engineering of Materials, Fluids, and Thermodynamics and Heat Transfer). The same score for the 2008-2009 review period is 1.0 (**meets standard**).

Depending how the numbers are interpreted (considering the 2005-2009 average or the 2008-2009 average) all of the metrics **are meeting** at least **standard**, except Thermodynamics. The BAE Department is taking a closer look at how thermodynamics is reinforced in BAE courses, specifically BAE 447, Bioprocess Engineering Fundamentals. In addition, the UGCC decided to analyze how Applications of Engineering Mechanics is reinforced in BAE courses, specifically BAE 417 (Design of Machine Systems) and BAE 437 (Land and Water Resources Engineering).

Changing the standard for the metric was also discussed. It was decided that a better approach would be to use the assessment to identify areas that could be improved. It should be noted that the last area identified as a concern was dynamics (several years ago) and that these scores are now noticeably at or above standard.

It should also be noted that the BAE students do well on the Thermodynamics and Heat Transfer section of the FE examination, but our students are not getting high grades in these classes. This supports the belief of the UGCC that our students do in fact receive additional training in these subjects after taking the EM and ME courses.

Response

The tracking the FE examination scores in engineering science during the past review period offers strong evidence that Outcome 4 is being achieved. Although, the coverage of thermodynamics and application of engineering mechanics should be reinforced.

Outcome 5- Graduates must demonstrate an ability to design a system, component, or process to meet desired needs.

Assessment

a) The primary means of assessment of Outcome 5 is the evaluation of assignments and examinations administered in the BAE core design courses:

   BAE 417 Design of Machine Systems
   BAE 427 Structures and Environment Engineering
   BAE 437 Land and Water Resources Engineering
   BAE 447 Bioprocess Engineering Fundamentals

   The students' capabilities in design application in a variety of disciplines are measured by carefully structured exercises. Students are required to take three of these courses along with three or four additional technical elective courses.

   BAE 417 - Design of Machine Systems

   Measurement Method: Students were tasked with designing a mechanical winch mechanism, which required appropriate specification of a V-belt drive, a roller chain drive and a helical gear drive. They were also required to specify dimensions and material properties for one shaft contained in the mechanism and to specify bearings for that shaft. The design required 6-8 hours of work: students were given 2 weeks to complete the assignment.

   Results: The average score on this assignment was a disappointing 61% with a standard deviation of 14.8% (the score in 2007 was 85.1%). Previous homework assignments had indicated that students had mastered the methods needed to complete the assignment and it appears that students were not willing to commit the necessary time to complete the assignment.

   Instructor Recommendation: My first inclination is to give the students the assignment early in the semester so that they can work on it as they have more time (Larry Wells).

   BAE 427 - Structures and Environment Engineering

   Measurement Method: BAE 427 students were assigned >45 design-oriented problems in 12 distinct homework assignments throughout the course during the Spring 2008 semester. Students were required to analyze the problem, identify both prescriptive code requirements and explicit design methodologies, report technical citations used, and list assumptions made in recommending a design solution.

   Results: An example homework assignment required use of beam superposition theory to determine design loads prior to recommending the appropriately sized

timber for a structural application. The average score on the homework assignment was an 87.6%, where the highest grade was an A and the lowest grade was an E (where the highest possible grade was an A). Adjusting values by omitting one student's grade who did not have prerequisite courses yielded an average score of 93.5% for this particular example.

BAE Course	Outcome	Score	Std Dev	N	P S	% of course	Comments
427	5	87.6% 93.5%	23.9% 2.39%	15/15 14/15			 adjusted

Instructor's Recommendation: All students enrolled in the course and having the prerequisites demonstrated a satisfactory level of competency in analysis and design for both the structural and environmental aspects of this course. Students were surprised to find that there may be many general solutions to a problem; and that often, they must modify some of their initial assumptions in the beginning to move toward an optimized solution in the end. This methodology was used to develop and enhance the students' engineering judgment (Rich Gates, who is no longer on faculty at UK).

BAE 437 - Land and Water Resources Engineering

Measurement Method: Four exams and a final were given to the students during the course. In all cases, the students were required to demonstrate an ability to use their design capabilities.

Results: The first exam covered rainfall distribution, determination of the design storm, and runoff potential. The class average on this exam was 15.4/18 (86%) indicating that the students had a good grasp of the material. This average was about 4% higher than the previous year. One student did poorly on the exam, with most students performing at or above the average. The low on the exam was a 7.75/18 with a standard deviation of 2.9.

The second exam covered erosion and the design of channels including the determination of stream channel stability, design of culverts, and the design of stable grassed waterways. The class average on this exam was 15.2/18 (84%), which was 5 percentage points lower than the previous year. One student scored a 7.75/18 and the test had a standard deviation of 2.9.

The third exam covered the design of treatment wetlands, groundwater hydraulics, and surface drainage. The class average was 16.7/18 (93%) with the low being 12.5/18 and the test standard deviation was 1.6. Three years ago, the average was 88% with most of the errors occurring because of the notation of $\log_e$ in the text rather than ln. This was a fundamental error caused by a lack of understanding of basic algebra. The students seemed to be unaware that the two notations were the same quantity (an elementary math problem). In 2008 and 2009, the instructor emphasized the notation. The result was the highest test average in each case.

The fourth exam covered water table management, sprinkler irrigation principles and the sizing of pipes in a sprinkler system. The class average was 15.6/18 (87%). The

low on the exam was 13/18 with a standard deviation of 2.1. Overall, the class did about the same on this exam compared to the previous year, but similar to previous years. The primary problem was with irrigation, which was reinforced on the final.

The final exam primarily covered key material that was part of the overall course objectives (runoff, culvert design, grassed waterways, subsurface drain size, and sprinkler design). The average on the final was 17.3/20 (87%). The low was 12.5/20 with a standard deviation of 2.4. Overall, the class did well, considering that the exam included most of the more difficult design problems of the course.

Instructor's Recommendation: Throughout the semester, the students were required to complete numerous designs of systems or components within hydrology. Their performance on exams and the final indicates that most of the students were capable of designing these systems by the end of the course. Many of the students came into the class will little or no background in hydrology (Steve Workman).

BAE 447 - Bioprocess Engineering Fundamentals

Measurement Method: In fall of 2008, a homework assignment was selected to be representative of the material presented in BAE 447.

Results:

BAE Course	ABET Outcome Number	Score	Std. Dev.	N	P S	% of Class	Comments
447	5	9/10	2.8	12	P	100	Fall, 08

(the score in 2007 was also 9/10)

Instructor's Recommendation: The performance of the class was slightly lower than in 2007. The problem required the students to select and size a tube and shell heat exchanger for a corn ethanol plant. The project was open-ended and a few students had difficulty with the problem, although the majority of the students completed the problem successfully. The projects were considerably more involved than typical PE exam questions (Mike Montross).

Response

The assessment indicates that BAE students are able to effectively apply engineering principles in design, as indicated in the four BAE core area design courses. Most scores exceeded the metric goals. We must continue to monitor these instruments to determine that design proficiency is acceptable.

In 2008, there was a decrease in the metric score for BAE 417. This will be addressed by giving the students additional time and motivation to complete the assignment.

Outcome 6- Graduates should gain experience in solving BAE problems that are vague or poorly constrained.

Assessment

a) Students completed three formal oral presentations and one boardroom style question and answer presentations. The presentation skills of the students were varied, from

adequate to excellent. The goal of the presentations was to convey the current progress status and likelihood of completion. The students prepare four written reports over the course of the two semesters. Both teams did an adequate job of putting together their written reports. The average grades for the oral and written reports are shown in Figure 12.

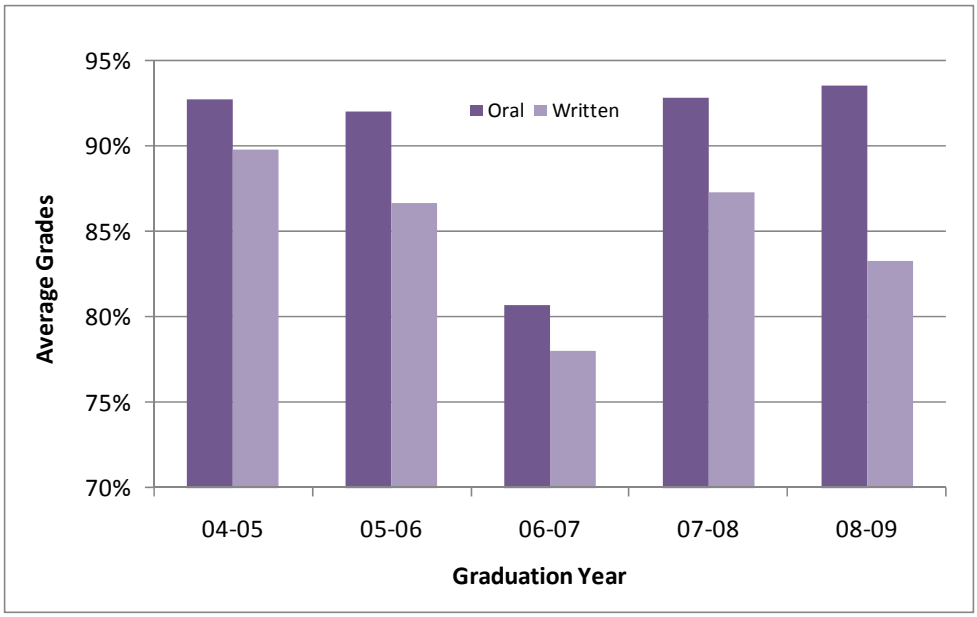

Figure 12. Average grades of BAE students on oral and written reports in the capstone design course, 2004-2009.

Instructors' Comments 2008-2009:

"Written and oral reports met the overall requirements of both courses. However, because of the dysfunctional nature of the team, the students failed to fully utilize the constructive feedback provided by the course instructors. In general the team had to be goaded into making changes. Written reports often lack sufficient detail to insure clear communications between the team and management (course instructors). None of the team members took leadership to make a very good report into a superior report. The oral progress and final presentations would have benefitted from more preparation and rehearsals, a fact that should be considered for future course offerings." – Dr. Shearer

"Written and oral reports met the overall requirements of both courses. However, because of the frustration of the team in being able to actually install the system in a house due to the timing of the design of the rest of the house, the team never did really gel into getting a completed project. In general the team had to be lead into defining what decisions needed to be made and then making decisions on how to progress. The written reports typically lacked sufficient detail to insure clear communications and review drafts required extensive revision. The oral progress and final presentations would have benefitted from more preparation and rehearsals." – Dr. Colliver

Additional instructors' comments are available in previous yearly assessment documentation.

Response

By the very virtue of our senior design experience, the students are given the opportunity to approach and solve a vague design problem. Our assessment of individual design projects indicates that we are achieving Outcome 6.

Outcome 7- Graduates should be exposed to research and technical literature and have the ability to interpret key issues and concepts.

Assessment

a) To assess Outcome 7, assignments were administered in the BAE core design courses BAE 417, BAE 427, BAE 437 and BAE 447 (see the assessment for Outcome 5 for further details about the content in these courses). The assignments involved finding and interpreting information from technical literature for use in design applications in these courses.

BAE 417 - Design of Machine Systems

Measurement Method: Students were given two laboratory assignments in which they were required to utilize ASABE standards in assessing a mechanism. In one assignment, students were tasked with examining a John Deere 7220 tractor and assessing compliance with standards associated with ergonomic aspects operator controls. In the second assignment, students were tasked with applying requirements of equipment safety standards to a prototype mechanism under development.

Results: The average score on the ergonomic standards assignment was 94.7 with a standard deviation of 6.1, while the average score and standard deviation on the safety standards assignment were 94.7 and 3.2, respectively.

Instructor Recommendation: The students demonstrated a thorough understanding of the standards and were able to apply them to typical agricultural machines (Larry Wells).

BAE 427 - Structures and Environment Engineering

Measurement Method:

In the Spring 2008 semester, BAE 427 students were required to obtain the latest edition of the National Design Specification for Wood Construction, which was used extensively in the first half of the course. Students were provided access to design/reference materials including ASABE Standards, the 2006 International Building Code, Manual of Steel Construction, and the ASHRAE Handbook of Fundamentals, among others. The second half of the course focused on development and maintenance of the environments within the various structures, which were designed in the first half of the course. Use of each of these references required the student to make judgments on the applicability of the standard or formula under consideration, and ultimately to evaluate the design recommendation against practical standards. The major metric for evaluation of this outcome is based in the homework assignments.

Results: Each homework assignment required the use of at least one of the previously listed technical references. Students were required to use and cite the appropriate document to obtain design solutions. Time permitting, "different" results were discussed in class. The average score on all homework assignments taken together was an 82%, where the highest grade was an A and the lowest grade was an E (where the highest possible grade was an A). Adjusting values by omitting one student's grade who did not have prerequisite courses yields an average score of 86% for this analysis.

BAE Course	Outcome	Score	Std Dev	N	P S	% of course	Comments
427	7	82.0% 86.0%	16.9% 7.39%	15/15 14/15			 adjusted

Instructor's Recommendation: The homework assignments present the best opportunity for the student to gain design experience in a "controlled environment". That is to say, they have the opportunity to succeed or fail in a recommended design solution without fear for loss of life or limb, based on their results. This is essential in learning the basic concepts of design and the continuing development of engineering judgment. It was initially thought that end-of-semester deadlines and conflicts affected the students' participation in homework assignments, however, the average grades (both adjusted and unadjusted are within 2 percentage points of each other for the two halves of the semester). A considerable amount of time was required to complete the homework assignments and those that put in the time received the higher grades (Rich Gates).

BAE 437 - Land and Water Resources Engineering

Results: Outcome 7 refers to the student's ability to utilize and interpret available information in their work. All exams in BAE 437 are open book ,to allow the student to develop their skills in assessing key information for the solution of problems. The text for BAE 437 is in a handbook format with numerous tables and figures for solving problems and is the primary resource for the PE exam. In addition to the text, the students were provided material from the ASABE Standards for use in waterway design and the design of subsurface drains. Finally, the students used technical literature from irrigation manufacturers for the design of sprinkler and drip systems.

Although all of the exams required extensive use of the text in BAE 437, the technical literature from irrigation and the ASABE Standards were used in exam 4. The students scored 87% on this exam indicating they were capable of utilizing reference material in the exams.

In addition to the use of these materials in the exam, a midterm project was assigned to obtain and summarize a research article from the library. The research articles included topics such as the effect of climate variations on flooding, routing models for stream flow, and the efficacy of vegetated waterways. These reports were the best I have received for this assignment. The students, many of whom had never had a

hydrology course, were able to read the articles and discuss the results in some detail. The average for the journal review was 97%. (Steven Workman)

BAE 447 - Bioprocess Engineering Fundamentals

Measurement Method: In fall of 2008, a homework assignment was given in which the students were required to consult published design standards and/or use technical literature (journal articles) to arrive at a final solution.

Results:

BAE Course	ABET Outcome Number	Score	Std. Dev.	N	P S	% of Class	Comments
447	7	7/10	4.0	12	P	100	Fall, 08

(07:8/10)

Instructor's Recommendation: Two projects were assigned during the semester that required students to use technical literature to solve the projects. The measurement was based on the students that had to ask me for material properties or to explain the technical drawings for the heat exchangers. I will try to assign more projects that require the students find technical data on vendor web sites or in their literature (Mike Montross).

Response

Assessments from the 2008-2009 yearly assessment, presented here, and assessments from previous years indicate that Outcome 7 is being achieved.

Outcome 8- Graduates must demonstrate effective interpersonal, formal and technical communication skills whether oral or written.

Assessment

a) In BAE 400, the last speech in the class is designated as a formal oral presentation. This presentation highlighted oral technical presentation skills learned in the BAE program. The presentation is evaluated by three evaluators (faculty members or toastmaster members) and a grade assigned between 0 and 10, with 0 being the lowest and 10 being the highest possible. The average and standard deviation of this measurement is reported for the class as well as the number of students in the class.

BAE Course	ABET Outcome Number	Score	Std. Dev.	N	P S	% of Class
400	8	8.67	0.56	11	P	95

(07: 8.74)

Evaluation was completed by three faculty members, who included the instructor; two of the evaluators had toastmaster experience. The instructor and the two other evaluators considered the speeches to be excellent. The students were well prepared. The score of 86.7% **meets goal** for this objective.

b) In BAE 402/403, students presented three formal oral presentations and one boardroom style question and answer presentation. The presentation skills of the students varied from being adequate to excellent. The goal of the presentations was to convey the current progress status and likelihood of completion. The students prepared four written reports over the course of the two semesters. Both teams adequately completed their written reports. Figure 19 shows the average grades for these written and oral reports over the 5 years of 2004-2009. All grades **meet goal**, except the oral grade in 06-07, which still **meets standard**. The two senior design teams from 2008-2009 were unable to enter the AGCO national student design competition (one of team members on both teams was a post baccalaureate student.)

Instructors' Comments 2008-2009:

"Written and oral reports met the overall requirements of both courses. However, because of the dysfunctional nature of the team, the students failed to fully utilize the constructive feedback provided by the course instructors. In general the team had to be goaded into making changes. Written reports often lack sufficient detail to insure clear communications between the team and management (course instructors). None of the team members took leadership to make a very good report into a superior report. The oral progress and final presentations would have benefitted from more preparation and rehearsals, a fact that should be considered for future course offerings." – Dr. Shearer

"Written and oral reports met the overall requirements of both courses. However, because of the frustration of the team in being able to actually install the system in a house due to the timing of the design of the rest of the house, the team never did really gel into getting a completed project. In general the team had to be lead into defining what decisions needed to be made and then making decisions on how to progress. The written reports typically lacked sufficient detail to insure clear communications and review drafts required extensive revision. The oral progress and final presentations would have benefitted from more preparation and rehearsals." – Dr. Colliver

c) There were no student design contest entries during this academic year.

Response

A variety of assessment methods implemented over the evaluation period indicate that BAE students, for the most part, are acquiring excellent oral and written communication skills, at or above our metric goals. In the middle of the assessment period, the students were required to turn in rough drafts of their written reports to the faculty advisors for additional feedback. It appears that the change did increase the scores. Requiring feedback helped reinforce the concept that feedback is necessary and vital for any effective writing.

Outcome 9- Graduates must recognize the need for, and ability to engage in life-long learning.

Assessment

a) Measurement Method: The need for life-long learning was addressed briefly in a presentation on the benefits of professional organizations (Question #8). The students' recognition of the necessity for life-long learning was addressed on the BAE 400 final exam. The average score (between 0 and 10) are reported.

BAE Course	ABET Outcome Number	Score	Std. Dev.	N	P S	% of Class
400	9	9.44	0.73	11	P	3

(07: 9.64)

The average score for Question #8 on the final was 9.44. The need for life-long learning was presented. The discussion during the presentation on professionalism was well received. This is considered an excellent score with no changes required.

Response

The students appear to recognize the need for life-long learning.

Outcome 10- Graduates should be able to work within a team approach to complete projects that include multiple facets.

Assessment

a) In BAE 402/403, evaluations of the teams were made by the team members and the project advisor. The team member evaluations were better than usual. Both teams worked very well together this year. Neither team really complained about teammates' performance.

Individual Advisor Comments

"The students appeared to be functioning well as a team through the first semester where they defined the scope of the problem and identified and ranked potential solutions. However, as the team transition to assigning individual tasks, the performance of the team as a whole began to degrade. At one point none of the team members took responsibility for insuring that edited reports were submitted in a timely fashion. This was partially rectified when one of the team/advisor meetings was devoted to discussion of organization and responsibilities.

For the most part fabrication of the prototype sensing system was a team effort with good progress through most of this phase. The testing phase was somewhat more protracted than desired, and was attributed to a lack of leadership in the design of field test investigations. This phase of the project just happened, and was plagued by a number of mis-steps. In the end the students again showed creativity as a team when it can to developing a model to convert sensor reading to tank volume, going from a 27 term cubic model to a three term piecewise model." – Dr. Shearer

"The students appeared to be functioning well as a team through there was not a clear leader in the team. The first semester where they defined the scope of the problem it

appears to be an overall discussion without clear delineation of responsibilities. During the second semester however the team did break into assigning individual tasks, however there was no clear direction due somewhat to a moving target that was presented by the architects and the other design teams.

The fabrication of the system initially was in the lab to be used for testing. As the second semester progressed the focus changed to a numerical analysis of the problem due to other design teams needing information from the hot water team design and the fact the house was not going to be completed enough to do testing. Individuals within the team served to interact with the other teams and provided leadership in the overall design of the rest of the house. In general the team made good progress during the design phase however they needed considerable guidance and traveled down several blind paths. In the end, the students showed creativity as a team and were able to meet the challenges presented to them." – Dr. Colliver

Response

All assessments of BAE students with regard to teamwork effectiveness indicate that this outcome is being attained to a relatively high degree. There are occasional indications that a few students do not contribute to team assignments as would be expected by most employers of engineers. These situations must be diligently monitored so that corrective action can be taken if these instances persist or if assessment of teamwork effectiveness declines over time.

Outcome 11- Graduates should demonstrate an appreciation for working in a multidisciplinary environment.

Assessment

a) One of the speeches in BAE 400 was structured around a "Contemporary Issue". Each student selected a non-engineering disciplinary role and had to research and develop a presentation based on the viewpoint of another profession. It is the intent of this speech to demonstrate an appreciation for working in a multi-disciplinary environment. The student's participation in this effort was graded on a 0-10 point basis. In addition, two questions (#9 and #10) were included on the BAE 400 final regarding an appreciation of working in a multi-disciplinary environment.

BAE Course	ABET Outcome Number	Score	Std. Dev.	N	P S	% of Class
400	11	8.95	0.5	11	P	5
400	11	8.89	1.30	11	P	5

(07: N/A, 8.11)

The students selected their contemporary issue topic. This was an excellent method for selecting speech topics dealing with the engineer's role in society and dealing with other professions. The students also benefited from their own classmates discussing a diverse set of topics dealing with applying engineering in society.

Final Questions 9 and 10. The students demonstrated an appreciation for working in multi-disciplinary teams. All metrics **meet goal**.

Response

The assessment for this outcome from BAE 400 indicates that we are meeting this requirements for Outcome 11.

The topic of multidisciplinary issues is discussed, but not assessed in BAE 402/403. Possible inclusion of an assessment for Outcome 11 in BAE 402/403 will be considered during the 2009-2010 review cycle.

Outcome 12- Graduates should demonstrate an understanding of professional and ethical responsibility.

Assessment

a) In BAE 400, one of the lectures focuses on professionalism and the opportunities for professional involvement, while another lecture tackles the issues of engineering ethics. A question was included on the BAE 400 final that addressed the student's recognition of the need for and benefits of involvement in a professional organization. A second question concerned the students' understanding of engineering ethics. The answers to these two questions were graded on a 0 to 10 point basis. The two scores were averaged and standard deviation reported with the number of students.

BAE Course	ABET Outcome Number	Score	Std. Dev.	N	PS	% of Class
400	12	9.06	1.48	11	P	5

(Score in 2007: 8.58)

The scores on the final examination questions #11 and #12 increased over last year because the website of the National Society of Professional Engineers (NSPE) had been studied in detail throughout the semester. The BAE students obviously used this NSPE website to answer the questions. Overall, the students became aware of the role of professional societies. The metrics **meet goal** for this outcome.

b) For the review period of October 2005 through April 2009, the average score on the ethics section on the FE examination is shown in Figure 13. Average scores were normalized by the mean score of all students taking the 'Agricultural Engineering' version of the FE examination in any given year. The overall normalized average was 1.0, which meets standard. There does appear to be an increase in the score over time, although it also seems to have reached a plateau.

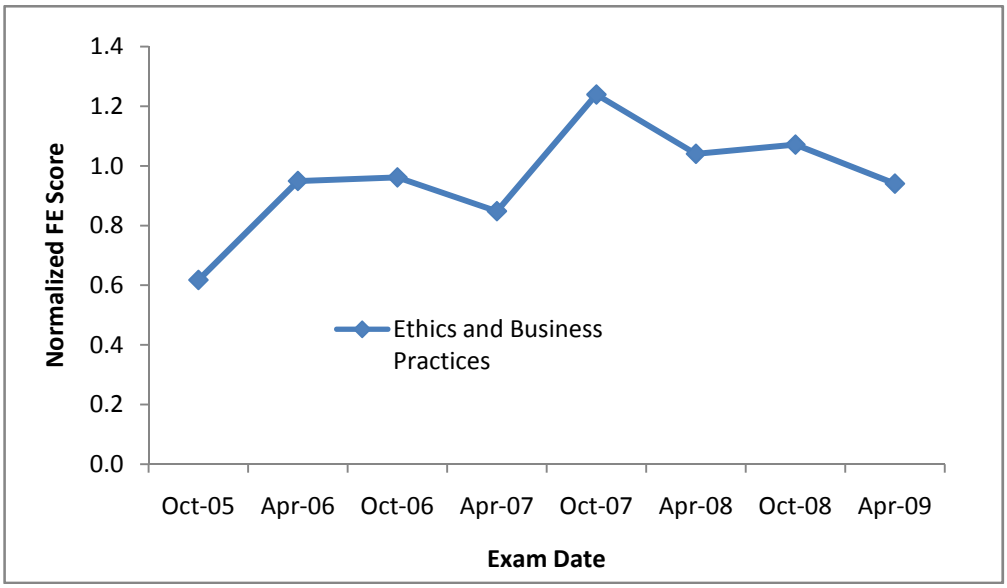

Figure 13. Normalized scores of BAE students in ethics on FE exams, 2005-2009.

Response

Current assessment indicates that Outcome 12 is being satisfactorily attained. These measurements will be monitored in the next evaluation period to assure continuance of this success.

Outcome 13- Graduates should demonstrate knowledge of contemporary issues.

Assessment

a) This assessment was introduced in Fall 2009, hence there is no data for 2008-2009. For Spring 2010, students in senior design were asked to write a paragraph about the contemporary issues associated with the various design projects in the class. The class did a very good job identifying the contemporary issue with an average score of 85%.

Response

These average grades indicate that Outcome 13 is being accomplished. We will continue to monitor these grades and seek other means of assessing this outcome.

Outcome 14 - Graduates should demonstrate the broad education necessary to understand the impact of engineering solutions in global and social contexts.

Assessment

a) Assignments were administered in two of the core BAE design courses, BAE 417 (Design of Machine Systems) and BAE 437 (Land and Water Resources Engineering) to assess this outcome. Since the BAE students are required to take 3 of the 4 design courses, by evaluating this outcome in 2 of the 4, the BAE Department is able to assess all students in one or both courses.

In BAE 417, students were tasked with describing how an existing agricultural machine, or one conceived of by a student, should be designed, manufactured and marketed to a developing country. Students were asked to specifically address how the government, economy and culture of the country of choice would affect determination of design features, manufacturing methods, cost and marketing methods. This was an optional extra-credit assignment and four of nine students completed the assignment. Most students addressed the economics conditions and governmental constraints in their reports. All of the students sought to address the needs of the developing countries, though not always using practical methods. Most reports were lacking in meaningful consideration of available or practical manufacturing methods with regard to societal or cultural conditions which would affect utilization of the mechanisms or systems recommended. Students did an adequate job of identifying and citing references relevant to their topic. The average score on the exercise was 7.5/10 with a standard deviation of 0.4, which **meets standard**. The instructor recommendation for next year is to assign this exercise early in the semester next fall and to require it of all students.

b) In BAE 437, a midterm project is assigned to search the popular press (newspapers, magazines, and Internet) to find articles that described a hydrologic event. The students were to relate the articles to material learned in BAE 437. Topics included storm sewer problems, the effects of global climate change, rain gardens, and the consent decree in Lexington. In their discussions, students related much of the findings back to the basic hydrologic principles, including runoff protection and rainfall intensity. Students questioned some of the information from the popular press. The class average on the project, to relate engineering information to real-life issues, was 96%, which **meets standard**. As with the assignment about journal reviews, students' reports were well done.

Response

Assessment of this outcome meets standard and indicates that we are achieving Outcome 13.

Outcome 15- Graduates should know the importance of and be engaged in the process of becoming a Registered Professional Engineer.

Assessment

a) In BAE 102, the number of students who correctly understand the process to become a Registered Professional Engineer is reported as the Score below. The question is asked twice, once at the beginning of the semester and again at the conclusion of the class.

BAE Course	ABET Outcome Number	Score	N	P S	% of Class	Comments
102	15	16/21 step 1 7/21 step 2 4/21 step 3	21	P	76% 33% 20%	Question asked before topic introduced in class

		0/21 step 4			0%	
102	15	19/21 step 4 2/21 other	21	P	90% 10%	Final Exam

The students' knowledge of professional registration, at the end of the course, was deemed acceptable **(meets goal)**. This is an introductory class to BAE: BAE majors will encounter this topic in other courses, and will have the necessary background to understand the steps involved in becoming a registered professional engineer.

b) In BAE 400, one class session was focused on the procedures, rules, and benefits of Professional Engineering Registration. Two questions on the BAE 400 final addressed the student's recognition of the importance and benefit of Professional Registration. The answers were graded on a 0 to 10 point basis, summed into one score, and the average and standard deviation reported with the number of students **(meets goal)**.

BAE Course	ABET Outcome Number	Score	Std. Dev.	N	P S	% of Class
400	15	9.17	1.8	11	P	5

Response

The assessment results indicate that this outcome is being satisfactorily achieved. In both the BAE senior seminar and capstone design courses, the merits of professional registration must continue to be emphasized.

Outcome 16- Graduates should have been active in student clubs and professional organizations.

Assessment

a) Table 11 shows the number of students included in each graduation year along with the number of students involved in student clubs or professional organization. Members are considered to be those who actively participate, while the leaders are those individuals holding officer positions. The 2004 standard for membership was 70% and the goal was 80%. The data indicate that we are meeting standard only for 2005-2006 and 2006-2007.

Table 22. Student activity in extra-curricular clubs and organizations.

Year	Number	Members	Leaders	Members	Leaders
04-05	10	6	5	60%	50%
05-06	12	9	3	75%	25%
06-07	8	6	2	75%	25%
07-08	28	19	6	68%	21%
08-09	17	8	4	47%	24%
04-09	75	48	20	64%	27%

During the 2008-2009 yearly evaluation, it was decided that an additional measure should be taken to ensure that we are meeting this outcome. The UGCC recommended and the faculty approved tracking the involvement of our students during the freshman and senior years as well. In BAE 102, students are expected to attend BAE Student Branch meetings. Hence, this attendance should be an additional metric for Outcome 16. The instructor of BAE 102 would be responsible for collecting the data, where the goal would be 100% and the standard would be 90%. In BAE 402/403, students are expected to be a member of ASABE. Hence, this membership would apply toward the metric for Outcome 16. The instructor of BAE 402/403 would be responsible for collecting the data, where the goal would be 100% and the standard would be 90%. Finally, the goal/standard for the current metric should be revised to 75% for goal and 50% for standard. The current metric deals with "active members" as indicated by the students themselves, during their exit interview. In summary, for Outcome 16, the recommendation is to add two new metrics and to change the current metric's goal/standard to 75% for goal and 50% for standard.

Under the new goal and standard, we are meeting standard for all years, except 2008-2009. In part, this was why we decided to also track student involvement in the freshman and senior year.

An additional indicator of professional development with student organizations is our students' performance in the ¼-scale tractor student design competition, sponsored by ASABE. In the last years (2004-2009), over 20 students have participated on design teams. Each year, a majority of the students travel to Peoria, IL for the tractor competition. They typically raise over $25,000 in gifts and in-kind donations each year to pay for expenses. In addition, several students have had the opportunity to travel to the annual ASABE meeting to present their designs.

In addition to attending the Southeast ASABE Student Rally and the Mid Central ASABE Student Rally each year (funding permitted), the UK BAE Student Branch has hosted the event twice in the last few years. Attendance ranges from about six to eighteen students, depending on the timing during the semester and finances.

Response

The outstanding annual involvement of students in both ¼-scale competition and the rally clearly indicates students' appreciation of, and interest in, professional organizations. The move away from strictly ASABE involvement for students (i.e., ASHRAE and IBE) has somewhat complicated tracking. Additional exposure to local BAE Student Branch meetings in the freshman year and to the national professional societies in the senior year will further support this outcome.

External Review

Biosystems and Agricultural Engineering Departmental Review

March 8-9

Review Team: Gary Palmer - Assistant Director of Agriculture and Natural Resources (Chair); Larry Holloway - College of Engineering, Research; Seth DeBolt - Horticulture, Research; Mike Montross - Biosystems and Agricultural Engineering, Research; Mark Purschwitz - Biosystems and Agricultural Engineering, Extension; and Alicia Modenbach - Biosystems and Agricultural Engineering, Graduate Student.

The Department of Biosystems and Agricultural Engineering (BAE) has many assets, including a positive environment and a collaborative atmosphere among the various groups within the department and with other departments. The Department Chair sets the tone for the department and is approachable, confident and works well with others in the department. She keeps abreast of activities within the department without resorting to micromanagement. The relationship that the department has with the College of Engineering is unique and a positive association for students and faculty, offering students access to extended scholarship opportunities.

The department is fortunate to have exceptional lab space and facilities with well-educated technical staff that are supportive to faculty and students. Interactions between faculty and technical support staff are mutually respectful with faculty providing realistic objectives and schedules for completion of projects. The department as a whole has a very collaborative environment. The technical staff's interactions with students are positive. Interactions often include assisting with student projects, helping with design and offering their expertise when needed.

The department has experienced an unprecedented influx of undergraduate students, which presents opportunities as well as challenges. The reason for the upswing in enrollment is not clear, but factors such as the name change (the name of the department several years ago and the name of the major more recently), newer building, influence of a new recruiter, and the economy were cited as possible causes. Student numbers may have reached a plateau in all colleges at the University of Kentucky (UK) as well as other universities, and the higher numbers in BAE may be somewhat self-correcting as the economy recovers. A larger pool of undergraduates may provide more opportunities for selection of graduate students for graduate programs. Larger undergraduate numbers may put some strain on resources and increase class size, which could impact student's contention that they have a better experience in smaller classes, like those currently in BAE.

The job pool for graduates is good, which helps with student recruitment. Students indicate that the BAE website, as well as the department's involvement in the quarter-scale tractor competition, attracted them to BAE initially. The quarter-scale tractor design and pulling competition offers national exposure, and the team has placed in the top five eight times in 13 years further providing recognition to the department and college. The student branch meetings, which are associated with the national organization, are an asset for the students who take advantage of them. The availability of student scholarships from the College of

Agriculture and College of Engineering are also an asset to students. Work options are available to almost any student needing or wanting to work within the department. However, students feel that the experience from these jobs with the department is not perceived to count as much as jobs with industry. Students who have experience in other institutions indicate that the department is more open than others. There is indication that faculty encouragement is a factor in retention of students into the graduate program following their undergraduate degree. The faculty in BAE also has good contact with industry and alumni, which provides opportunities for employment after graduation.

The graduate program in BAE is strong; however, there is room for expansion provided that funding can be found to support the increase. Currently, students find a good level of funding for assistantships and indicate funding as a primary deciding factor for choosing BAE at the University of Kentucky. Almost all graduate students are receiving some support. The Director of Graduate Studies maintains a healthy mix of international students at approximately 30%.

The professional society is highly promoted by the faculty and department and attendance at the Annual International Meeting provides a forum for students to network and present their work to a larger audience. The department is well represented at national meetings, and UK is often one of the most visible universities in attendance at the national meetings.

Graduate students feel that they are lucky to have the level of lab access, as well as printing, computer and statistical support that is available to them. Graduate students receive good cooperation with office staff and tech support. All faculty in the department are considered approachable and non-intimidating. Engineering associates are considered an asset and interact with students on a regular basis. Students in general were very happy with their graduate experience in the department, but were critical of Graduate School interactions.

The level of multidisciplinary activities is high with BAE faculty and associates actively serving on various teams in the college. BAE has a high level of grant funding compared to other departments, which provides some needed support for student assistantships and other needed resources. Collaborations with universities in Brazil have created an international avenue for problem solving and a positive atmosphere for research.

BAE has always had a good web presence, but care is needed to make sure links and resources are up to date. The business manager in the department has helped with the department chair transition, and the student services coordinator has taken some burden off of the teaching faculty and created a more positive atmosphere for students.

BAE Review Needs & Recommendations

Areas of Specialization

The Machine Systems Automation Engineering specialization area has been a cornerstone of BAE in the past and an area that the University of Kentucky has established a reputation for excellence. Loss of key faculty (Scott Shearer) and an impending retirement (Larry Wells) has diminished the status of this program to a significant extent. One faculty person may not be sufficient to cover the research and teaching needs resulting from Drs. Shearer and Wells' retirements. Students don't have access to needed classes in this discipline and may feel that a specialization with an emphasis in Machine Systems Automation Engineering is diminished due to lack of appropriate courses. Industry is clamoring for qualified applicants in this area but could find that Kentucky students are not as well prepared in this area as in the past. While the economic environment overshadows problems of this nature, the department should devise a plan to reduce the deficiency in this area and a long range plan for future support. The department should explore whether existing faculty could provide some support in this area or if this should be a priority for a future faculty position.

In general the department has seen a reduction in DOE in research. There is concern that retirements in the near future will further diminish an already shrinking faculty. The department needs to determine future direction based on current areas with strong faculty support and identify areas that need more support if they are to become or continue as areas of emphasis. Some of these areas that need attention or decisions as to direction or support are: greenhouse systems (former faculty support from Richard Gates) (although traditional support may not be justifiable, non-traditional uses, such as uses for biomass production, may still need attention), animal facilities (an area mentioned frequently by agents and clientele), water quality (while this area has faculty support, laboratory equipment, and technical support are limited). Effort is needed to make sure traditional areas such as water quality maintain appropriate laboratory equipment and upgrade in the skill level of the technical support quality as in other areas.

The department is short on information for certain subjects with increasingly reduced expertise in certain fields. Hard decisions may need to be made regarding what disciplines will be covered and what has to be dropped. Some of these specializations are still advertised to students but often don't have faculty or resources to serve these specializations. BAE should explore Extension opportunities to share resources and expertise with neighboring states in those areas where BAE has inadequate support.

Student Support

An unprecedented increase in undergraduate enrollment brings many challenges to the department regarding the ability to accommodate such an influx. Although student numbers may self-correct to some extent as the economy recovers, the department in the short term will still have to determine if adjustments are needed to accommodate students with less

traditional interests or allow the department to drive the students' courses of study. However, with student interest changing and faculty support shifting, the need for flexibility within the department to accommodate students such as those preparing for biomedical fields is advised. However, some of the response may be limited by faculty expertise.

Continued collaboration and contact is advised with Biomedical Engineering to keep lines of communication open. BAE faculty could use additional help to advise students preparing to go into the biomedical field. Teaming with College of Engineering to meet some of the needs of these students may be the best solution. The department should explore ways to collaborate with the College of Engineering on courses such as bioinstrumentation, etc. Growth areas in general should be evaluated to determine the level of support and specialty needed to accommodate students.

More resources may be needed in the future if other programs in other departments continue to promote specific BAE courses as technical courses for their majors. An example is BAE 103 where an increase in enrollment could be a burden on BAE faculty in the future.

Undergraduates would benefit from more opportunities to be on the Ag campus. The department should explore possibilities that would bring students to functions on the Ag campus so that students feel more included in the College of Agriculture.

While any students who want to work can usually find opportunities, other avenues should be promoted that will provide students with experience in the field of study. Internships during the summer may be favored over co-ops due to the time requirements for a degree. However, students and faculty should be proactive in arranging internships and co-ops. Invitations to companies by faculty to speak to the Student Branch would further improve working relationships with industry and the job market. This could improve departmental relationships with industry and educate them on skills possessed by students from BAE. Increased enrollment may increase competition for departmental jobs and internships for students.

It is problematic as enrollment increases that the Director of Undergraduate Studies often does not have access to student records that would help in evaluating the number of students in each major. The college should explore ways to improve access so that the DUS doesn't have to go to extreme measures to get the student major information.

Graduate program

Current mix of foreign and domestic students is good and can be maintained to some extent by the Director of Graduate Studies. Funding may negatively influence potential expansion of graduate programs although potential for growth exists. Bioenvironmental engineering, food and bioprocessing and machine systems (specifically the precision agriculture area) have seen consistent numbers of students over the last five years.

Communication with graduate students needs to be evaluated in areas such as course requirements, development of graduate committees (some students feel that they must rely on other students instead of faculty), and statistical support (again students feel that availability of the service is not readily apparent and spread by word of mouth by students).

Name Recognition

BAE has suffered in the past from name recognition issues. A name change in the past from Agricultural Engineering to Biosystems and Agricultural Engineering resolved some issues but may have created others. While this committee doesn't recommend a name change, considerable effort should be made to promote the department in as many arenas as possible. Since BAE participates in many Extension programs initiated by other departments that work with specific commodities, BAE may not receive the level of recognition that it deserves. In most cases faculty members are a part of a bigger interdisciplinary team and not the lead. Finding the right faculty to serve on teams can be an issue. While faculty are comfortable with their role, the need for recognition or credit is important to their careers. Faculty feel that their efforts are appreciated and recognized by their commodity colleagues and that clientele recognizes their efforts, but want to make sure that college administration recognizes these efforts.

Students also suffer with name recognition issues with prospective employers not always understanding their degree or if they are qualified for a specific job. The Ag Student Council restricted access of BAE students, citing that BAE students are not in the College of Agriculture due to their degree in Engineering. This has left some BAE undergraduate students feeling isolated and not included within the college. One student was denied the chance to run for an Ag Student Council position because the council didn't recognize their degree as part of Agriculture. Larry Grabau has been notified to seek clarification on this issue. The department should help students to develop ways to market themselves by using more recognizable terms for résumés and other forms of communication with prospective employers.

BAE should look for ways to promote the efforts of the department. The mechanization field day that was held on an annual basis several years ago was an effective tool that brought recognition to the department. While that may not be the appropriate venue today, similar efforts should be explored to determine the most appropriate way to showcase the programs within the department. This should extend to opportunities to promote BAE to industry.

Extension

Extension FTE's have fluctuated and teaching loads now required of all faculty may change traditional Extension efforts within the department. Regimented teaching schedules don't mesh well with a need for flexible Extension schedules, although the message from the current provost is that non-traditional schedules are discouraged. The College of Engineering has

developed non-traditional academic schedules for the PEIK Instutite that should be considered as possible models to better accommodate Extension schedules.

With increased teaching assignments, concerns about money for travel at past levels of support, and changing demographics, Extension specialists need to explore current options for program delivery that could reduce unnecessary travel and that would accommodate teaching schedules. Some off campus personnel have adopted conferencing and collaboration technology that has been well received by agents and others. These tools also allow more communication with supervisors and support staff. While these tools may help Extension specialists interact and provide service to well-educated, technologically savvy, farmers, there are also Amish/Mennonite farmers that must be served using more traditional methods. Extension specialists are encouraged to find common ground while providing each segment of the farming community with delivery methods suitable to their needs. Documentation of these efforts is encouraged. Impact reports and other means of documenting success should be explored to assess if programs are producing the level of success that justifies the effort. Areas with the most impact may have to be favored over less productive efforts. Extension specialists are encouraged to develop resources for agents and train them to deliver some high demand programs to reduce the burden on specialists. Specialists will remain in high demand for certain programs.

Publications and Plans:

Extension publications and plans need serious attention. Many are outdated and may recommend materials and actions that are outdated, that we now know to be incorrect, or that could be potentially dangerous or present a safety issue. The department with assistance from the Extension coordinator should develop a review schedule to work through all publications and plans as time permits. Those that are no longer useful should be removed from the college publication site. Those that have historical value should be moved to an archive site that contains sufficient disclaimers to clearly indicate concerns about the information. Some individual publications and plans may need disclaimers added to further emphasize caution. Publications or plans that still have some value should be considered for revision if faculty with expertise in the area are still an active part of the department. Original authors should be a consideration for revision if available. Web links should be reviewed so that the number of broken links to internal publications and plans are resolved.

Surveys of agents and clientele indicate that these groups still consider structure plans to be an area of need. However, since the department has deemphasized plan development and support due to demand, personnel sufficient to provide the service, and legal issues, a clear position should be developed to make sure that this message is conveyed in such a manner that the department's position is understood and that agents and clientele aren't left with a feeling of ill-will toward the department. Office staff taking calls from agents and clientele often struggle to provide the right resources requested or find the best person for referral within the department. Office staff need a clear plan for referrals. Without direction and current material

available, producers and agents may be referred to resources that are outdated, potentially dangerous, or that reflect poorly on the department.

Extension publication rates appear a little low, but records may not reflect collaborations with other departments that results in articles included in inter-department publications. Efforts should be made to fully recognize collaborative publication efforts with other departments and to convey this to administrations.

Credit for Scholarly Work

Credit for scholarly activities was indicated as a concern by various groups during the review. BAE has many internal resources that should be fully identified with current faculty if that expertise is still represented within the department. Extension specialists felt that grant writing may not be fully appreciated as a good use of time by administration. The grant environment is still new to some but many are adjusting. There are areas such as machine systems which do not have adequate access to Federal funding. Faculty in disciplines with little funding may need to explore options and collaboration with industry as possible sources of funding. The department needs to push publication as a visible way of documenting activity. The department should send a consistent message to graduate students regarding publication and have recently adopted a publishing incentive program similar to Entomology. However, continuation of the program may be contingent on available of future funding sources. A review process equal to that used for numbered publications should be established and promoted to departmental performance review committees as well as college administrations so that credit is given for scholarly activities. The department should set the tone for the level of review needed for various forms of scholarly activities, especially those that are conducted in a non-traditional manner.

IT services should look at tools that will allow impact assessment of digital resources. With resources limited, new digital ways of reaching appropriate audiences should be explored. Contact with agents can be improved if all specialists embrace the use of communication tools like MS Lync and use it for agent training and other forms of collaborations with agents.

Department Facilities and Equipment

Lab facilities are an asset to the department, and a mechanism should be adopted for better coordination of labs and equipment. Movement of equipment needs to be monitored to reduce inventory burden. All faculty and staff are encouraged to keep inventory requirements in mind to reduce current problems locating equipment and computers. Labs should be maintained in a presentable manner (while maintaining consideration for the need to be productive) so that they serve as a safe environment and are not a detriment to student recruitment. The age and condition of some equipment is a concern and communications with the Federal Excess Property Program should be considered as a possible means to acquire affordable equipment, especially fabrication equipment. Until recently, the BAE technical staff

used to performed minor maintenance, like changing oil, on departmental vehicles (a function now required to be performed by Facilities Management). However, a standard policy is supported for all departments, and the need for maintaining valuable assets such as vehicles by regularly scheduled maintenance outweighs the economy of departmental maintenance.

Time Between Classes

Distance between colleges is an issue for students, but some BAE faculty hold their classes in the College of Engineering to reduce stress on students. Instructors in the College of Engineering don't always appreciate the interruptions from late students even though time is not sufficient for students to get from a class in the Ag College to College of Engineering. While a problem for many students in the College of Agriculture, this is beyond the scope of this report, but included to recognize this issue. Some courses might be remotely broadcast so students don't have to cross campus.

Implementation Plan

UK Program Review Implementation Plan

*This **required** form is described as Appendix A in AR II-I.0.6.*

College/Unit: Biosystems and Agricultural Engineering **Date:** October, 2012

Recommendation/ Suggestion	Source I/E/H*	Accept/ Reject**	Unit Response (resulting goal or objective)	Actions (including needed resources)	Time Line
Devise a plan to support machine systems automation engineering in the long run.	I/E	A	Department reevaluated our hiring plan, and decided to hire a Machine Systems Engineer before the planned bioprocessing engineer.	We will hold interviews in January, with the intent to have a new faculty member in the department by Fall 2013.	Position advertised: November 2012; Interviews: January 2013; offer extended: February 2013
Determine future department direction based on current areas with strong faculty support and identify areas that need more support.	I/E	A	These difficult decisions regarding faculty hires and supported courses must be made by the entire faculty. Faculty consensus must be reached on whether or not to keep offering our Structures and Environment Course when we have no faculty member in Lexington to teach the course.	Held faculty meeting in August, 2012 to agree on faculty hiring order. Course offering: determined by December 2012 to meet course schedule deadline.	August 2012 December 2012
Effort is needed to ensure traditional areas such as water quality maintain appropriate lab equipment and technical support skills.	E	R	Our goal is to use our laboratory resources and technical staff efficiently. In order to best serve our diverse faculty we have pooled the technical staff resources and grouped our analytical equipment in shared labs. Departmental staff were reorganized a few years ago to eliminate this problem. Coordination with Alex Fogle or Manish Kulshrethra on lab/technician support needed should alleviate this problem.		
Explore extension opportunities to share resources and expertise with neighboring states (both where KY needs expertise and where KY has	I/E	A	Our goal is to collaborate with neighboring states so that we are able to meet the needs of the citizens of Kentucky in as efficient a manner as	Discuss opportunities with BAE chairs of Purdue, The Ohio State University, Penn State, and Tennessee	Summer 2013

expertise to lend).			possible.		
The need for flexibility within the department to accommodate students such as those preparing for biomedical fields is advised.	E	A	Our objective for our undergraduate curriculum is to provide a core set of courses that all students take; then give the students flexibility in their areas of specialization. Some of our flexibility in terms of BME is limited because very few undergraduate biomedical engineering courses are offered on campus, and those that are require senior status.	Educate all faculty members about the pre-biomedical engineering option to dispel misconceptions.	Seminar Spring 2013
BAE Faculty may not be equipped to adequately advise students preparing to go into the biomedical field. Teaming with College of Engineering to meet some of the needs of these students may be the best solution.	E	R	The department's goal is to maintain close ties with the Center for Biomedical Engineering so that our students are well-prepared for entering graduate school, and also for obtaining the latest information for our students regarding internships and REUs. Invite new BME faculty to give department seminars. Organize faculty/students to tour CBME when they offer an open house. Maintain communications with the Chair of BME.		
BAE should look for ways to promote the efforts of the department. The mechanization field day that was held on an annual basis several years ago was an effective tool that brought recognition to the department. While that may not be the appropriate venue today, similar efforts should be explored to determine the most appropriate way to showcase the programs within the department. This should extend to opportunities to promote BAE to industry.	E	R	Showcasing the programs in our department is a priority year round. Under some of the other recommendations we are addressing the visibility of the BAE department and ways to promote BAE to industry. The diversity of our departmental programs has increased greatly since the days of the mechanization field day, and it is unclear what venue would work to accomplish the recommendation.		
The College of Engineering has developed non-traditional academic schedules for the PEIK Institute that should be considered as possible models to better accommodate	E	R	I am unaware of any Extension schedule that has not been accommodated to allow that faculty person to teach. We have to defend the non-traditional use of classrooms,		

Extension schedules.			but we have always been willing to do this for anyone who has requested this.		
Publications or plans that still have some value should be considered for revision if faculty with expertise in the area are still an active part of the department. Original authors should be a consideration for revision if available. Web links should be reviewed so that the number of broken links to internal publications and plans are resolved.	E	A	BAE has wrestled with this issue for several years due to differing opinions among the faculty regarding the usefulness of older extension publications. Our goal is to update or archive all publications greater than 10 years old, and once that is done we will tackle the newer ones.	We hired an Extension Associate Sr. to coordinate this effort, along with our faculty Extension Coordinator. Revising our extension web page and publications is a goal on both of their 2013 work plans. I anticipate the work taking the entire calendar year.	2013
Credit for scholarly activities was indicated as a concern by various groups during the review. BAE has many internal resources that should be fully identified with current faculty if that expertise is still represented within the department.	E	A	I believe this recommendation is similar to the previous item – please see above.	The faculty extension coordinator will work with our senior extension associate faculty member to identify resources with current faculty.	2013
Lab facilities are an asset to the department. A mechanism should be adopted for better coordination of labs and equipment.	E	A	I believe this comment refers to some labs that are underutilized by the faculty assigned to them. We also have some labs that are over-utilized.	Bring this topic to a faculty meeting. Changing the way laboratory space is allocated would be a culture change for the department. We have improved the coordination of equipment by creating a lab manger position who oversees equipment use.	Spring 2013
The department should explore ways to collaborate with the College of Engineering on courses such as bioinstrumentation, etc.	E	A	Our unit's objective is to leverage resources in the bioinstrumentation area to offer a senior/graduate level course which serves the needs of our students, as well as the CBME and possibly EE students.	Talk to Larry Holloway and Dave Puleo regarding the possibility of co-teaching or cross-listing course Develop syllabus jointly if class is feasible and begin implementation through the College and Senate.	Spring 2013 Fall 2013
Growth areas in general should be evaluated to determine the level of support and specialty needed to accommodate students.	I/E	A	Our objective for the Department is to have balanced enrollment growth, consistent with our faculty strength and available space.	As a department determine what our ideal enrollment growth would be. Devise a recruitment plan to encourage students to major in under-populated specializations.	Summer 2013 Summer/Fall 2013
More resources may be needed in the future if other programs in other departments continue to promote specific BAE courses as technical courses for their majors. An example	E	A	Our goal is to have necessary resources in place to be prepared for enrollment growth.	Work with KHP to take BAE 103 off their elective list. Work with CE to predict BAE 202 enrollment in time to have sufficient	Fall 2012 Fall 2012 and ongoing

is BAE 103 where an increase in enrollment could be a burden on BAE faculty in the future.				resources in place.	
Undergraduates would benefit from more opportunities to be on the Ag campus. The department should explore possibilities that would bring students to functions on the Ag campus so that students feel more included in the College of Agriculture.	E	R	Students are free to attend any Ag functions they would like. BAE 102 students are encouraged to attend COE and COA functions, so that they understand they are welcome in both Colleges.		
While students who want to work can usually find opportunities, other avenues should be promoted that will provide students with experience in the field of study	I/E	A	Our goal is to have every student graduate with some BAE job experience, whether through working in the department or in industry.	Talk to Jeff Snow/Marci Hicks about working with alumni. Work with alumni to set up contact database for students to find internships. Educate students regarding internship opportunities	Spring 2013 Spring 2013-2015 Spring 2013-2015
The college should explore ways to improve access so that the DUS doesn't have to go to extreme measures to get student major information.	E	R (college concern)	Goal for department is to minimize efforts to retrieve data necessary for decision making, but this task needs to be handled at the college level. We'll talk to Dr. Grabau regarding this challenge and solicit his input on how to proceed.		
Communication with graduate students needs to be evaluated in areas such as course requirements, development of graduate committees (some students feel that they must rely on other students instead of faculty), and statistical support (again students feel that availability of the service is not readily apparent and spread by word of mouth by students).	E	A	Our departmental goal is to initiate standardized communication to graduate students so that the requirements are clearly laid out for the students and are consistent between students.	The new graduate students' seminar would be an excellent place to discuss the requirements. We could develop a flow chart for course and committee requirements. Our student services coordinator can be charged with staying current with the statistical consultant information.	Spring 2013 Summer 2013 Spring 2013
BAE has suffered in the past from name recognition issues. Considerable effort should be made to promote the department in as many arenas as possible.	I/E	A	This is a persistent challenge for all BAE-like departments in the country. One objective is to have more companies at the career fair that ask for our students.	Work with the Career Fair people to invite our alumni to rent a booth. Devise a simple, clear, consistent message regarding our dept. and display it on the web page and educate our students.	Spring 2013 Summer 2013

The Ag Student Council restricted access of BAE students, citing that BAE students are not in the College of Agriculture due to their degree in Engineering.	I/E	A	Historically our students have served on the Ag Student Council. Our goal is to have representation on the council.	Talk to Dr. Grabau regarding this issue and see what, if any, are his concerns.	Spring 2013
The department should help students develop ways to market themselves by using more recognizable terms for résumés and other forms of communication with prospective employers.	I/E	A	This relates to the recommendation two above this one. Our goal is to educate our students to market themselves clearly and accurately.	Devise a simple, clear, consistent message regarding our dept. and display it on the web page and educate our students.	Summer 2013
Extension specialists need to explore current options for program delivery that could reduce unnecessary travel and that would accommodate teaching schedules.	E	A	The departmental objective is to use departmental resources as efficiently as possible, including program delivery. To this end, the department wants to provide support to faculty members who want to deliver programs from a distance.	Our department is hiring an Extension Associate Senior to assist with distance learning and web delivery pedagogy and technology.	February 2013
Documentation of distance program delivery efforts is encouraged. Impact reports and other means of documenting success should be explored to assess if programs are producing the level of success that justifies the effort. Areas with the most impact may have to be favored over less productive efforts.	I/E	A	The departmental objective is to use departmental resources as efficiently as possible, including program delivery. To this end we must self-evaluate and continually improve our effectiveness.	Our extension associate senior will be charged with assisting faculty in evaluating programs also. In addition, I am asking for each faculty member to write specific program goals for 2013-2014, for which they will be held accountable.	February 2013 and ongoing
Extension specialists are encouraged to develop resources for agents and train them to deliver some high demand programs to reduce the burden on specialists. Specialists will remain in high demand for certain programs.	E	A	The departmental objective is to use departmental resources as efficiently as possible, including program delivery. To this end, the department wants to provide support to faculty members who want to deliver programs from a distance.	Our department is hiring an Extension Associate Senior to assist with distance learning and web delivery pedagogy and technology. I am asking for each faculty member to write specific program goals for 2013-2014, for which they will be held accountable, and these high-demand programs will be identified in this process.	February 2013
Extension publications and plans need serious attention. Many are outdated and may recommend materials and actions that are outdated, that we now know to be incorrect, or that could be potentially dangerous or present a safety issue. The department with assistance from the Extension coordinator should	I/E	A	The goal of the department is to have an up-to-date collection of extension products available on the web. There is also interest in keeping archives for historical purposes.	Our extension leader has organized the extension faculty to perform this review. It was decided that the outdated plans/pubs that have historical value will be clearly marked as such so outdated material will not be taken as current best practice. The extension	Fall 2012 – Fall 2013 Ongoing

develop a review schedule to work through all publications and plans as time permits.				leader is in charge of this revision.	
A clear position should be developed to make sure that the department's policy on plans is conveyed in such a manner that the department's position is understood and that agents and clientele aren't left with a feeling of ill-will toward the department.	E	A	The goal of the department is to have an up-to-date collection of extension products available on the web. There is also interest in keeping archives for historical purposes.	Our extension leader has organized the extension faculty to perform this review. It was decided that the outdated plans/pubs that have historical value will be clearly marked as such so outdated material will not be taken as current best practice. The extension leader in charge of this revision.	Fall 2012 – Fall 2013 Ongoing
Office staff taking calls from agents and clientele often struggle to provide the right resources requested or find the best person for referral within the department. Office staff need a clear plan for referrals.	E	A	Our departmental goal is accurate, timely customer service. To that end, the office staff need to have regular refresher sessions on who is handling each type of extension questions.	The department chair will work with the extension faculty members to develop a flow chart detailing who will be handling each type of extension question. The flowchart will be updated each semester.	Spring 2013 Review at start of each semester
Extension publication rates appear a little low, but records may not reflect collaborations with other departments that results in articles included in inter-department publications. Efforts should be made to fully recognize collaborative publication efforts with other departments and to convey this to administrations.	I/E	A	The BAE discipline is conducive to collaboration, and the department strongly encourages our engineers to work with others within the College of Ag and elsewhere to solve "real" problems. Our goal is to be recognized for our ability to collaborate, and to function on our own when appropriate.	The extension database is not collaborator-friendly; therefore our department must keep track of any extension publications on which our faculty members are authors. The extension associate senior will be tasked with keeping such a database.	Spring 2013 and ongoing
Faculty in disciplines with little funding may need to explore options and collaboration with industry as possible sources of funding.	I/E	A	The objective of this suggestion is for every faculty person to have sufficient money available to conduct an active research program.	During performance reviews, discuss funding for research program. Assist scientists brainstorming on potential funding sources. Hold scientists accountable for following up with potential funding sources.	Spring 2013 Spring 2013 December 2013 – December 2014
The department needs to push publication as a visible way of documenting activity. The department should send a consistent message to graduate students	I/E	A	Our goal is for every active scientist (faculty/staff/student) to contribute at least 2 papers per year to the department (one per year for newer graduate students).	During evaluations ask for 2013-2014-2015 goals. Hold people accountable for the goals they set.	Spring 2013 December 2013 –

regarding publication of their work and explore a publishing incentive program like that used by Entomology as long as funding sources are available.				Continue to reward graduate students with money for publishing.	December 2014 Ongoing
A review process equal to that used for numbered publications should be established and promoted to departmental performance review committees, as well as college administrations, so that credit is given for scholarly activities. The department should set the tone for the level of review needed for various forms of scholarly activities, especially those that are conducted in a non-traditional manner.	E	A	For those faculty members who produce scholarly work in an unconventional format, our objective is to have a method to fairly evaluate the product and include this effort appropriately in their performance review.	Extension coordinator – list scholarly products Devise review strategy for these items. Review and rate items. Include in performance review. Evaluate the process and iterate.	Fall 2013 Spring 2014 Summer 2014 Fall 2014 Spring 21015
IT services should look at tools that will allow impact assessment of digital resources. With resources limited, new digital ways of reaching appropriate audiences should be explored.	E	A	Our objective is to track the hits to our web site and pages, using something like Google analytics, and to tie this information into performance appraisal and quality improvement.	Hire new web/distance learning staff person. Evaluate traffic statistics that have been collected. Devise quality improvement plan.	Spring 2013 Summer 2013 Fall 2013
Movement of equipment needs to be monitored to reduce inventory burden. All faculty and staff are encouraged to keep inventory requirements in mind to reduce current problems locating equipment and computers.	I/E	A	Our goal is to have an accurate database of our capital and departmental equipment (estimated from $500-$2,000), complete with a photograph and location for each item.	November 2012 inventory went much more smoothly than November 2011 inventory, thanks to the database developed and populated by Alex Fogle with Julie Tolliver's assistance. The faculty and staff were educated about inventory protocol, and we will do this annually for new employees.	November 2011 – November 2012 August 2013
Labs should be maintained in a presentable manner (while maintaining consideration for the need to be productive), so that they serve as a safe environment and are not a detriment to student recruitment.	I/E	A	Our goal is to have productive, safe, orderly laboratories. We will save samples until the data are published or for 5 years, whichever comes first. Apparatii that have not been used for the past year or more will go to long-term storage, and be disposed of if not used within 5 years.	Alex Fogle initiated a major clean-up of the labs in August 2012 with the intent of eliminating items that have not been used in the last 5 years. Labs will be reviewed annually for accumulated clutter, and these areas will be cleaned up appropriately.	August 2012 Annually
The age and condition of some equipment is a concern and communications with the Federal Excess Property Program should be	E	A	Our goal is to have a safe, well-maintained machine shop that is capable of performing the required tasks for our faculty and students.	Prioritized list of maintenance needs, prioritized list of replacement needs, communicate with FEPP to be in a position to acquire needed	May 2013

considered as a possible means to acquire affordable equipment, especially fabrication equipment.				equipment as it becomes available.	
Distance between colleges is an issue for students, but some BAE faculty hold their classes in the College of Engineering to reduce stress on students.	E	A	Our goal is to have students' course schedules such that they are only required to commute to the BAE building once per day. This can be accomplished by either beginning their day at CEB with then the remainder of their classes on Main campus, or vice versa.	Equip first year and transfer students with the bus schedule. Continue working on a schedule for BAE classes that eliminates the need for students to travel back and forth multiple times per day.	August 2013 Spring/Fall 2013
Some courses might be remotely broadcast so students don't have to cross campus.	E	R	Remotely broadcast would not be practical because we do not have the facilities to do that. We are working on putting more classes on-line which would accomplish the same thing.		

*** Source of Recommendation (I = Internal recommendation; E = External Review Committee recommendation; H = Unit Head recommendation)**
**** Accept/Reject Recommendation (A=Accept; R=Reject)**

Unit Head Signature: _____ **Unit Head Supervisor Signature:** _____ **Date:** _____