

**Wichita State University
College of Engineering
FY 2008-2009 KBOR Program Review
Dean's Response
BS, MS and PhD in Aerospace Engineering**

College of Engineering Academic Program Review Process Overview

During academic year 2005-2006 the College of Engineering underwent an extensive and inclusive strategic planning process with input from the College Industry Advisory Board (IAB), leadership, faculty, staff and students. The final outcome of this process was a ten-year strategic plan for the College. From this plan and based on the Wichita State University (WSU) mission, the mission and vision of the College of Engineering, as stated below, were developed and approved by the Wichita State University Provost and Vice President for Academic Affairs and Research.

Vision

The College of Engineering at Wichita State University will be recognized nationally and internationally for its: experience-based undergraduate and graduate degree programs; collaborative efforts with industry; and research programs to support the economic development and global competitiveness of the Wichita metropolitan area, the state of Kansas, and the nation.

Mission

The College of Engineering at Wichita State University is committed to:

- *Prepare graduates who will engage effectively and responsibly in the practice of the engineering profession in a global economy and in pursuing advanced engineering education.*
- *Conduct applied and basic research to support and contribute to the social and economic well-being of citizens and organizations in the Wichita metropolitan area, the state of Kansas and beyond.*
- *Cultivate the spirit of entrepreneurship and the connection between engineering and business that encourages technology commercialization.*
- *Improve continuously the engineering pedagogical methods employed in delivering its academic programs.*
- *Foster and value diversity of ideas and people through early student recruitment, outreach programs, and the recruitment and development of faculty role-models.*
- *Encourage scholarship in all its dimensions.*
- *Evolve thoughtfully in response to the needs of industry and the changing world.*

The Aerospace Engineering (AE) undergraduate program objectives and outcomes as well as the mission of the AE graduate programs are in complete alignment with the CoE vision and mission above.

College Assessment Process

The purpose of the assessment process at the college level is to ensure that the college follows a strategic direction that serves well all its constituents and that there is a system in place that allows for

continuous improvement in the achievement of the college mission and vision. The input in this process is gathered from a College IAB and Student and Faculty Advisory Boards to the Dean. The College IAB provides input to the Dean and Chairs at least twice per academic year on college and departments strategic direction matters and overall engineering education issues. In addition, this board assists in the establishment or revision of the college's mission and vision and the evaluation of the achievement of these. The other two boards interact with the dean at least twice a semester to discuss topics such as laboratory infrastructure needs and overall quality of the educational or job experience. An additional tool used by the Dean to gather input from the faculty is the College of Engineering Faculty Survey of Department Chairperson.

Every undergraduate program in the CoE has its educational objectives and outcomes. The program objectives are statements that describe the expected accomplishments of graduates during the first few years after graduation while outcomes are statements that describe what students are expected to know and able to do by the time of graduation.

The primary assessment tools for the program objectives are the Alumni Surveys, Employer Survey and Industrial Advisory Board meetings. There is a process to establish or determine the objectives, how the program ensures that the objectives are achieved, and a system of ongoing evaluation that leads to continuous improvement of the program.

The process for determining and evaluating program objectives involves the program faculty, alums, employers, program or department IAB and the Program Curriculum and Assessment Committee and students. This process is repeated every year in most of the programs.

As part of the process to ensure the achievement of objectives, the Dean's Office administers the Alumni Survey every fall and sends the data gathered to the departments. Every fall the departments analyze the Alumni Survey data from the previous year, along with the Employer Survey data and the input received in the IAB Spring meeting. The Curriculum and Assessment Committee of the program consider this information and revise or update the program objectives and objective target levels and recommends curriculum changes and laboratory upgrades or enhancements. The recommendations are further reviewed by the IAB and approved or modified by the departmental faculty.

The desired outcomes of the academic programs are for the most part observed as attributes of the program graduates. These were developed by the faculty with input from the IAB and the students. The outcomes of every program essentially replicates the (a) through (k) outcomes of criterion 3 of Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET).

Assessment tools for the program outcomes vary by program but may include: Fundamentals of Engineering Examination, core knowledge exams developed by program faculty, prerequisite exams, course folders or portfolios, alumni surveys, graduating senior exit surveys and interviews, senior project evaluation by faculty and professional engineers, specific class exam questions and projects and co-op experience evaluation by employers and students. Every outcome is assessed by at least one tool but on the average three tools are used per outcome.

The process to ensure the achievement of the program outcomes is repeated every year and involves data collection and analysis by the program Curriculum and Assessment Committee, recommendations of changes from the committee, consideration of those changes by the IAB of the program and approval of the changes by the departmental faculty. The final step in closing the loop in the process is the implementation of faculty approved changes and modification to the catalog.

Bachelor of Science in Aerospace Engineering

After the approval of the College's mission and vision, the Department of Aerospace Engineering (AE) reviewed its undergraduate Program Educational Objectives (PEOs). The AE Department also reviewed the eleven program outcomes. This review process was triggered by the updates to the College mission and vision but it is a standard step in the ABET continuous improvement process and in fact the AE Department performs it on a regular basis.

The assessment of the undergraduate programs in the College of Engineering is the responsibility of the department offering the program. However, there is a coordinating body at the College level called the ABET Task Force in which each department has at least two representatives; the department chair plus a faculty member. This task force is chaired by the College ABET Coordinator and its charge includes the maintenance and updating of the assessment tools common to all programs (e.g., the Alumni Survey and the Cooperative Education Employer Survey), sharing of information and best practices and review of data collection methods and schedules. The ABET Task Force has been in place at least since the year 2001 but it has been meeting consistently since fall 2005. The Dean of the College of Engineering meets with this task force at least twice a year on regular years and at least four times during the year before an ABET visit.

The success in meeting the AE undergraduate PEOs is a function of how well graduating students master the program outcomes. The mastery of the program outcomes is assessed through multiple tools including but not limited to: Aerospace Engineering Department Assessment Exam (AEDAE), Graduating Senior Exit Survey, Alumni Survey and Cooperative Education Survey. Most of these assessment tools are applied every year. Therefore, the AE Department is assessing the undergraduate students' mastery of the program outcomes continuously.

In spring 2007, the Bachelor of Science (BS) in AE was subjected to a mock ABET accreditation visit conducted by an experienced evaluator who reviewed the self-study report, curriculum content, laboratory facilities, college and institution support for the program, PEOs and program outcomes' review and assessment processes, and faculty size and credentials. Minor recommendations were provided by the mock visitor on how to present some of the assessment results in the self-study report; everything else received high marks in this review. The actual ABET accreditation visit took place in fall 2007 and the College was informed of the full accreditation of the program (six years) in August 2008. By the time the KBOR BSAE program review is over, this program would have been under some sort of comprehensive review for 24 months. As it is required by ABET, all these program reviews have involved not only the department chair but all the faculty members in the department.

Master of Science and Doctor of Philosophy in Aerospace Engineering

The mission of the graduate programs, Master of Science (MS) and Doctor of Philosophy (PhD), in AE is *to prepare students for careers in aerospace engineering and related field, and for graduate study*. There are eight objectives associated with these programs which are supportive of the mission. The department has not identified specific program outcomes to be used to measure the student mastery of program content or skills developed.

The assessment of the graduate programs in the College of Engineering is the responsibility of the department offering the program. However, there is a coordinating body at the College level called the Graduate Committee (GC) in which each department is represented. This committee is chaired by the College Associate Dean and is in charge of overseeing the development and implementation of the assessment plans for the individual graduate programs, sharing information and best practices on assessment, recruitment and operation of the programs. The GC meets on a regular basis and also handles common challenges and opportunities to multiple graduate programs.

One of the main sources of data for the assessment of the success in meeting the AE graduate program objectives is the Graduate School Exit Survey which provides feedback on the degree of satisfaction of the graduates with the educational experience they received at WSU.

Use of Data

In reviewing the three academic programs offered by the AE Department, multiple sources of information and data were used including the report provided by the WSU Office of Institutional Research for Program Review, faculty activity reports and a productivity analysis covering years 2003 to 2007, the assessment data for the undergraduate AE program as well as the most recent Graduate School Exit Survey results. The assessment data for the BS in AE is based on the application of direct and indirect assessment tools. The data comes from surveys, interviews, assessment exams, targeted projects and assignments and faculty observations. Different constituents including faculty, students, employers and alumni are sources of input in this assessment process.

The recommendations included below as well as the fiscal implications of these are based on all the data analyzed as part of the program review process and the College of Engineering productivity measures included in Table 1.

Significant Program Changes

As a result of the BS in AE program review the Department of AE has:

- increased the availability and use of Computer Aided Design (CAD) software in the curriculum,
- added the offering of tutorials for the use of MATLAB and ANSYS,
- increased the use of computer tools in the curriculum,
- enhanced the capabilities of one of the teaching laboratories,
- included an experimental structures component in the course AE 512,
- improved student advising procedures, and

Table 1. College of Engineering Productivity (Five-Year Average).

Measure\Department	AE	ECE	IME	ME
# of undergraduate students/Faculty	20.13	31.74	6.8	26.24
# of MS students/faculty	5.83	21.05	11.61	10.94
# of PhD students/faculty	1.35	2.12	1.78	1.29
# of journal articles/faculty	0.5	?	1.27	1.18
# of conference proceedings	1.58	?	2.53	2.12
external funds awarded/faculty (\$/year)	\$208,529	\$111,592	\$85,225	\$51,591
Credit hours/faculty	372.16	688.28	420.94	446.73
Degrees awarded/faculty	4.27	15.09	5.84	8.27

- implemented the Engineer 2020 program.

The Engineer 2020 program requires that to fulfill the requirements for a BS in AE degree at WSU, each student completes at least three of the following: a. Undergraduate Research, b. Cooperative Education or Internship, c. Global Learning or Study Abroad, d. Service Learning, e. Leadership, and f. Multidisciplinary Education. With the Engineer 2020 program the students will:

- a) develop
 - a. ability to design and conduct experiments, as well as to analyze and interpret data;
 - b. ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
 - c. ability to function on multi-disciplinary teams;
 - d. ability to identify, formulate, and solve engineering problems;
 - e. understanding of professional and ethical responsibility;
 - f. ability to communicate effectively; and
 - g. ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- b) obtain
 - a. the broad education necessary to understand the impact of engineering solutions in a global, economic, environment, and societal context; and
 - b. knowledge of contemporary issues.
- c) recognize the need for, and an ability to engage in, life-long learning.

No major changes to the AE graduate programs have been implemented in the last five years.

Summary and Recommendations

From the data presented in both program reviews, undergraduate and graduate, it is clear that the AE Department faculty size and qualifications are adequate to offer the three academic programs; BS, MS

and PhD. The productivity of the AE faculty as it is measured by the last five year average for the number of conference proceedings (1.6/faculty member), the amount of funded research (\$300,159 awarded/faculty member), the number of undergraduate students/tenured or tenure track faculty (19/faculty member), among others, should be commended. It is clear that the programs offered by the AE Department supports the WSU mission as an urban serving research institution and are key to the economy of the city of Wichita, the state of Kansas and the nation. Further, the undergraduate PEOs and the graduate program objectives are being met. There is also evidence that the undergraduate program outcomes are being mastered by the graduates from the AE program.

The College of Engineering heavily depends on the release money generated by the faculty in the AE Department to conduct its operations. Therefore, it is strongly encouraged that the level of funded research and specifically faculty release be maintained if not increased.

As part of BS in AE continuous improvement process it is recommended that:

- The experimental structures component of the course AE 512 be made permanent.
- Additional follow up be given to the rating of the AE program by students and alumni to determine if the increase in enrollment in key junior and senior courses has any impact in the quality of the educational experience offered by the department.
- The system in place to follow up the placement of graduates be expanded.

The graduate programs in the AE Department could benefit from the following:

- A separate set of program objectives and outcomes for each one of the two graduate programs, MS and PhD.
- An assessment process for student mastery of the program outcomes for each one of the two graduate programs.
- Increase the number of PhD students.
- Expansion of the system in place to follow up the placement of graduates.

The expansion of the Engineer 2020 program should continue. It is also recommended that as many AE faculty members as possible continue to be involved in the College of Engineering Faculty Enhancement program. The work of the First Year Engineering Program Task Force should also continue with active participation of the AE faculty.

Fiscal Implications of Recommendations

The AE Department is encouraged to maintain its commitment to academic excellence and program objectives as well as the continuous improvement process of its academic programs. The size and qualifications of the current AE faculty are adequate to support these goals and the offering of the BS, MS and PhD programs with current enrollment levels.

The AE Department currently has half of a faculty position unfilled in the area of structures and solid mechanics which will be used for a joint appointment with the National Institute for Aviation Research (NIAR). This position must be filled if the recommendations above are to be implemented successfully. Another potential fiscal implication of implementing the above recommendations is the need for additional information technology and non-information technology laboratory support. The College of Engineering did have four persons providing support in these areas, however, since summer of 2008 that number went down to two when some of the information technology responsibilities were moved to UCATS. If providing additional technical support becomes an imperative, a combination of resources from research projects and faculty release will be a potential source of funding to cover the cost of such support.

Program Review Department Report



Click here for the Kansas Board of Regents' instructions and definitions for Program Review.

ENGINEERING

AEROSPACE

		2002	2003	2004	2005	2006	2007	2008	Avg-5 year
Section I: Part A: Academic Instruction Expenditures (fiscal year)	1. Salaries/Benefits	\$969,764.00	\$1,138,299.00	\$910,731.00	\$1,074,211.00	\$1,250,456.00	\$1,181,955.89	\$1,262,017.35	\$1,135,874.25
	5 Year Average								
	2. Other Operating Exp.	\$87,979.00	\$74,876.00	\$55,297.00	\$142,254.00	\$69,997.00	\$86,275.74	\$105,003.77	\$91,765.50
	5 Year Average								
	3. Total	\$1,057,743.00	\$1,213,175.00	\$966,028.00	\$1,216,465.00	\$1,320,453.00	\$1,268,231.63	\$1,367,021.12	\$1,227,639.75
Section I: Part B: Student Credit Hour Production (fiscal year)	5 Year Average								
	1. Lower Division	770	888	807	828	768	828	1119	870
	5 Year Average								
	2. Upper Division	1877	2011	2199	2471	2506	2725	2876	2555.4
	5 Year Average								
Section I: Part D: Percentage of Departmental SCH taken by: (fall)	3. Masters	840	836	825	852	904	901	1068	910
	5 Year Average								
	4. Doctoral	194	153	127	121	103	191	108	130
	5 Year Average								
	5.Total	3681	3888	3958	4272	4281	4645	5171	4465.4
Section I: Part E: Departmental Faculty (fall)	5 Year Average								
	1. Their Undergraduate Majors	47.6	51.4	55.4	53.8	57.5	55.6	57.2	55.9
	5 Year Average								
	2. Their Graduate Majors	22.7	21.2	21.1	21.9	19	18.9	18.3	19.84
	5 Year Average								
Section I: Part F: Actual Instructional FTE (fall)	3. Non-Majors	29.7	27.4	23.5	24.3	23.5	25.5	24.5	24.26
	5 Year Average								
	1. Tenured/Tenure Track	11	12	10	11	12	11	11	11
	5 Year Average								
	2. Tenured/Tenure Track	11	12	10	11	12	11	11	11
Section I: Part F: Actual Instructional FTE (fall)	5 Year Average								
	3. Total Tenured Faculty	10	11	10	10	11	10	10	10.2
	5 Year Average								
	Total Instructional Faculty FTE	11	14	11	13	13	12	11	12
	5 Year Average								
Section I: Part F: Actual Instructional FTE (fall)	1. Tenured/Tenure Track	8.31	9.64	8.38	10.02	10	10.63	7.7	9.346
	5 Year Average								
	2a. Instructor of Record (IOR)	1	1	0.5	0.23	0	0.25	0.5	0.296
	5 Year Average								
	2b. Not Instructor of Record	0	0	0	0	0	0	0	0
Section I: Part F: Actual Instructional FTE (fall)	5 Year Average								
	3. Other Instructional FTE	1	1	3.75	2.08	2.16	1	2	2.198
	5 Year Average								
	4.Total FTE	10.31	11.64	12.63	12.33	12.16	11.88	10.2	11.84
	5 Year Average								
Section I: Part F: Actual Instructional FTE (fall)	5. SCH generated by	1257	1145	1105	1530	1710	1783	1610	1547.6
	5 Year Average								
	6. SCH generated by GTA's	207	369	207	141	0	75	93	103.2
	5 Year Average								
	7. SCH generated by Other	299	239	553	305	271	431	699	

Program Review Program Report

ENGINEERING

AEROSPACE

Note: Year is fiscal year (summer, fall, spring). If data are from the fall only, it is from the fall of the fiscal year. For example, FY 2008 is Fall 2007 data.

AEROSPACE ENGINEERING

Section II: Part A: Majors in the Discipline (fall)	2002							2003							2004							2005							2006							2007							2008							Avg-5 year
	2002							2003							2004							2005							2006							2007							2008							
1. Freshmen/Sophomores (optional)	93							97							102							92							113							121							138							
5 Year Average	99							109							113							123							135							138							133							113.2
2. Jrs., Srs., 5th Year Majors																																																		
5 Year Average	70							69							64							78							68							66							74							128.4
3. Masters																																																		
5 Year Average																																																		
4. 1st Prof / Specialist / Certif.	0							0							0							0							0							0							0							70
5 Year Average	25							15							18							13							15							17							18							0
5. Doctoral																																																		
5 Year Average	287							290							297							306							331							342							363							16.2
6. Total																																																		
5 Year Average	25							24.6							25.8							25.8							26.6							26.7							26.2							327.8
1. Average ACT Composite																																																		
5 Year Average	15							15							15							16							18							16							12							26.22
2. LOW ACT																																																		
5 Year Average	32							32							32							33							34							34							34							15.4
3. High ACT																																																		
5 Year Average	50							57							57							58							69							71							63							33.4
4. Number Reporting an ACT Score																																																		
5 Year Average	50.51%							52.29%							50.44%							47.15%							51.11%							51.45%							47.37%							63.6
5. Percent Reporting ACT Score																																																		
1. Associate	0							0							0							0							0							0							0							49.51%
5 Year Average	22							24							33							28							30							45							30							0
2. Baccalaureate																																																		
5 Year Average	12							13							17							19							17							12							13							33.2
3. Masters																																																		
5 Year Average	0							0							0							0							0							0							0							15.6
4. First Prof / Specialist / Certificate																																																		
5 Year Average	9							2							3							3							0							1							5							0
5. Doctorate																																																		
5 Year Average	43							39							53							50							47							58							48							2.4
6. Total																																																		
5 Year Average																																																		

Section II: Part B: ACT Scores of Undergraduate Jrs., Srs (fall)

Section II: Part C: Degrees Conferred (fiscal year)

Wichita State University
GRADUATE SCHOOL
KANSAS BOARD OF REGENTS FY 2009 PROGRAM REVIEW
Doctor of Philosophy in Aerospace Engineering
Master of Science in Aerospace Engineering

Review process: Members of the WSU Graduate Council reviewed the Self-Study Report provided by the Department of Aerospace Engineering.

Program: MS students are required to complete a minimum of 30 graduate semester credit hours for a thesis and 33 hours for a directed-project option. PhD program requirements were not listed. During 2002-2008, the department averaged 69 MS students and 17 PhD students yearly. An average of 15 MS degrees and 3 PhD degrees were awarded annually.

Mission: The self-study describes a single mission statement for both programs. The linkage between this mission and its related program objectives and the university's teaching and research mission is apparent but is not explicated. However, linkages with service aspects of the university's mission are not apparent.

Program faculty: There are twelve faculty members in the department. Graduate faculty strengths, productivity, and qualifications are very strong, with appropriate level of grad faculty membership. Only partial information was provided about the percent of graduate courses taught by full-time and tenure-track faculty, so it is difficult to judge adequacy for both the programs. Because it is difficult to separate the data for the MS and PhD programs (such as, Teacher/student ratio) it is difficult to judge adequacy for each program. The self-study reports that 20 graduate students are supported by external funding, but this data is not broken out by program.

Curriculum and Student Outcomes: Both the sequencing and frequency of graduate courses seem adequate, evidenced by student satisfaction data and by average time to degree completion. Data were provided concerning student diversity. Admission standards and admission outcomes for each program appear adequate. Since the PhD program requires GRE scores, these would be helpful evidence for documenting the quality of admissions. Data were provided about student presentations but were not specific concerning which program. The AE Department seems to have a solid process and structure for program and objective evaluation in place. No data were provided concerning what particular changes have been made as a result of these, although the department may have documented this in their annual Graduate Program Assessment Report. The graduate programs as a whole appear to meet all stated objectives. Objectives concerning student achievement appear to simply reflect program requirements rather than assessing the extent of mastery of various aspects of the curriculum. That is, data are not provided as mastery of program content.

Student Needs/Employer Demands: Employer needs are well-documented and accounted for by program requirements, and the placement data support how well the department prepares students for their goals.

Recommendations: Considering the differences between MS and PhD programs, we recommend that the department create separate mission statements for each, that these address service criteria, and that the linkages between program mission facets and college and university's missions are made more explicit. To the extent possible, information about the MS and PhD programs should to be broken out separately.

Submitted by Abu Masud, Associate Dean of the Graduate School

Approved by the Graduate Council on November 20, 2008

Graduate Program Review

Self-Study Report



WICHITA STATE UNIVERSITY

**Department of Aerospace Engineering
Wichita State University**

November 5, 2008

Graduate Program Review - Self-Study Report
Department of Aerospace Engineering, Wichita State University
November 5, 2008

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Introduction

The purpose of this report is to demonstrate Aerospace Engineering (AE) is delivering a quality graduate program consistent with the department, college, and university mission.

The following criteria are considered:

- Centrality, with respect to fulfilling the WSU mission and goals
- Quality, as assessed by faculty strengths, productivity, and qualifications and the curriculum
- Demonstrated need by students and employers
- Services the program provides to the discipline, university, and beyond
- Cost effectiveness

Centrality

The subsequent material addresses the Aerospace Engineering program's focus with respect to the college and university mission and goals.

The Wichita State University mission statement, provided in Appendix I, declares:

"faculty and staff strive to provide a comprehensive, metropolitan university of national stature by providing students with the educational and cultural tools required to thrive in a complex world; to achieve individual responsibility in their lives; and to become effective citizens in the local, national, and global community. To accomplish this mission, the University will maintain a wide range of degree programs that deliver quality teaching, that make original contributions to knowledge and human understanding, and that serve as agents of community service."

The College of Engineering mission states a commitment to:

- Prepare graduates who will engage effectively and responsibly in the practice of the engineering profession in a global economy and in pursuing advanced engineering education.*
- Conduct applied and basic research to support and contribute to the social and economic well being of citizens and organizations in the Wichita metropolitan area, the state of Kansas and beyond.*
- Cultivate the spirit of entrepreneurship and the connection between engineering and business that encourages technology commercialization.*
- Improve continuously the engineering pedagogical methods employed in delivering its academic programs.*
- Foster and value diversity of ideas and people through early student recruitment, outreach programs, and the recruitment and development of faculty role models.*
- Encourage scholarship in all its dimensions.*
- Evolve thoughtfully in response to the needs of industry and the changing world.*

To uphold the university and college missions, the AE faculty established the following objectives for the undergraduate program:

- To provide an undergraduate education to its students that will produce aerospace engineering graduates who are sufficiently knowledgeable of the fundamental principles of engineering to meet the requirements of potential employers in not only the Wichita region, but in the global community*

- b. To provide an undergraduate education that prepares capable students to pursue graduate studies in aerospace engineering and related fields*

In a similar fashion, the following statement outlines the AE department's graduate program mission:

To prepare students for careers in aerospace engineering and related fields, and for graduate study

Central to this mission are the following AE graduate program objectives:

- a. To ensure the admission of qualified students into the program each year*
- b. To provide qualified faculty for the program*
- c. To provide appropriate laboratories and access to them for the program*
- d. To provide an appropriate variety of graduate courses for the program*
- e. To enroll a sufficient number of students to support the courses offerings*
- f. To achieve an acceptable placement rate within one year of graduation either in jobs or in graduate programs for further study*
- g. To ensure graduates are satisfied with the program (three years after graduation)*
- h. To ensure continued quality of student performance during the program*

Clearly the Aerospace Engineering department's graduate program mission statement is aligned with both the university and college missions. Furthermore, the department utilizes an established process to assess graduate program quality. Specifically, outcomes for the program objectives (i.e., *a-h*, listed above) are evaluated every year.

Quality

This section addresses AE program quality considering faculty and curriculum elements.

Faculty

Table 1 summarizes basic information on the AE faculty. All twelve, tenure-track, AE members have a Ph.D. degree in their field of specialization. They come from eight different universities - each with excellent engineering programs. The average university-level teaching experience is approximately twenty years. In addition, the faculty has an average of over three years of industrial or government experience to complement their academic backgrounds.

Table 1 Aerospace Engineering Faculty Information

Name	Rank	Highest Degree	Principle Area of Expertise	Institution from which Highest Degree Earned & Year	Years of Experience		
					Govt. / Industry Practice	Total Faculty	This Institution
K. Hoffmann	Prof.	Ph.D.	Aerodynamics	Univ. of Texas	0	19	19
W. Horn	Prof.	Ph.D.	Structures	Univ. of Texas	6	32	25
L.S. Miller	Prof.	Ph.D.	Aerodynamics	Texas A&M Univ.	0	21	20
R. Myose	Prof.	Ph.D.	Propulsion	Univ. So. Cal.	2	17	17
M.G. Nagati	Assoc. Prof.	Ph.D.	Flight Mechanics	Iowa St. Univ.	14	25	25
M. Papadakis	Prof.	Ph.D.	Aerodynamics	Wichita St. Univ.	1	23	23
S. Keshavanayana	Asst. Prof.	Ph.D.	Structures	Wichita St. Univ.	0	4	4
K. Rokhsaz	Prof.	Ph.D.	Flight Mechanics	Univ. Mo. - Rolla	0	23	18
B. Smith	Prof.	Ph.D.	Structures	Kansas St. Univ.	3	47	44
J. Steck	Prof.	Ph.D.	Flight Mechanics	Univ. Mo. - Rolla	3	19	19
M. Violette	Asst. Prof.	Ph.D.	Structures	Univ. of Texas	10	1	1
C. Yang	Assoc. Prof.	Ph.D.	Structures	Louisiana St. Univ.	2	15	11

Given the second AE department graduate program objective (i.e., *objective-b.* listed previously, “to provide qualified faculty for the program”) the following holds:

- All 12 AE faculty (100%) are Graduate Faculty members and 10 have Doctoral Chairing status, as approved by the Graduate School
- All adjunct faculty members teaching graduate-level courses hold at least Graduate Faculty Affiliate status as approved by the Graduate School
- During the academic year 2007-2008, regular faculty members taught 17 of 23 total graduate level courses offered (74%)

Table 2 summarizes some measures of graduate faculty productivity based on results from 2003 to 2007. Obviously, the AE faculty is extremely active in graduate advising, research, and scholarship. The department averages over \$3.6 million in external funding and more than 31 significant publications a year.

Table 2 AE Faculty Productivity Summary

Parameter	Yearly Average
Journal Publications	6
Conference Proceedings	19
Contract Reports	12
Other Publications	11
Presentations w/o Proceedings	43
Accepted Proposals	17
Previously Accepted Proposals	9
Rejected Proposals	6
Pending Proposals	4
Funded Research	\$3,601,905
Funded Faculty Release	\$206,521
Match Faculty Release	\$48,267
Funding for Students	\$408,940
M.S. Advising	42
Ph.D. Advising	17
M.S. Directed-Projects Completed	8
M.S. Thesis Completed	7
Ph.D. Dissertations Completed	3

The research emphasis aligns with local, state, and national aerospace (e.g., aviation) interests. Activity is focused chiefly in the areas of structures (especially composites), aerodynamics (applied, computational, and experimental), and flight-mechanics.

Perhaps most important, AE faculty involve graduate students in virtually all aspects of the research they conduct. Besides assisting with the work, graduate students are usually always publication co-authors.

Additionally, the research and scholarship efforts enhance faculty teaching and mentoring abilities at both the graduate and undergraduate levels.

The current graduate program professor-to-student ratio is 0.12 (or 8.7 graduate students for each professor). Graduate class sizes are ideal, typically 10 to 30 students, allowing the faculty and students to interact very effectively.

One-on-one mentoring and learning is key within the AE graduate program. Each faculty member, on average, advises approximately 4 M.S. and 2 Ph.D. students every year. Working closely with students completing a thesis, directed-project, or dissertation represents a significant contribution.

Approximately 20 graduate students are supported, on average, each year using external funds. This number is based on Table 2 data assuming each student receives approximately \$20,000 per year in support.

Curriculum

Besides research elements, the AE graduate program curriculum supports fundamental student needs. Course offerings are substantial and timely. As was outlined previously, an AE graduate program objective is to “*provide an appropriate variety of graduate courses for the program*” (i.e., *objective-d*, listed previously).

Excluding thesis and dissertation hours, the goal is to provide 10 or more graduate courses each fall/spring semester. The AE department meets or exceeds this target, regularly offering between 10 and 13 graduate-level classes each semester. Furthermore, all courses are offered after 4:00 PM, to assist part-time students who work in the local aerospace industry.

The department utilizes a Graduate School Exit survey to measure student satisfaction with the variety of courses offered by the department. During the 2007-2008 academic year, 88% of the respondents indicated the variety of AE courses offered helped them complete their degree requirements in a timely manner.

Students

Approximately 15 M.S. and 3 Ph.D. students graduate from the AE program each year. They take about 3 and 7.3 years, respectively for a M.S. and Ph.D., to complete their degree. It's critical to recognize only about 31% of these students have a traditional full-time status. A majority are professional engineers working at local aerospace companies. As such they work at least 40-hours a week and take classes and complete degree requirements during evenings and weekends. Obviously this situation impacts their pace to graduate.

The following sections provide information on AE graduate student demographics. With respect to gender (for the latest 5-years):

- 14% are female
- 13% of the M.S. students are women
- 25% of the Ph.D. students are women

Table 3 outlines the minority student demographic data.

Table 3 AE Graduate Student Demographics (5-Year Average)

	Hispanic	Asian	Black	American Indian	White	International	Missing
Percent of Total	1%	8%	0%	0%	48%	32%	10%

Applicants for the M.S. degree program are admitted to the graduate program under one of the following categories (if they meet the associated requirements).

- Admission with Full Standing - A minimum Grade Point Average (GPA) of 3.0 on a 4.0 scale during the last two years or sixty credit hours of prior studies, or

- Admission on Probation - A minimum grade point average of 2.75 to 3.0 during the last two years or sixty credit hours of prior studies□

International applicants who did not receive prior degrees from an English-speaking university are expected to score a minimum of 550 in TOEFL. Graduate coordinators may impose additional admission requirements for applicants whose previous degrees are not in aerospace engineering.

Specific AE graduate program admission objectives include:

- Admit fewer than 20% of the qualified applicants in the Probation category
- Admit only international applicants who meet the minimum TOEFL 550

Greater than 80% of the M.S. program applicants are admitted under the Full Standing category with a GPA of 3.0 or higher. All international students meet the TOEFL score requirement. Hence AE graduate program *objective-a* is satisfied (i.e., “To ensure the admission of qualified students into the program each year”).

Admission to the Ph.D. program requires that the student has completed (or nearly completed) a M.S. degree in engineering or physical science. Scores for the General Test of the Graduate Record Examination (GRE) must be submitted. Some students may find it necessary to take prerequisite courses to be able to meet the course breadth requirements. The student is recommended to the graduate dean for admission by the department chairperson in consultation with the department graduate coordinator.

Program Assessment

As has been mentioned, the department utilizes an established process to assess graduate program goals. Indeed, outcomes for the program objectives are evaluated every year.

A Graduate Assessment Committee, composed of the two graduate coordinators and a third member appointed by the department chairperson, meets annually to review assessment results and to provide program feedback. The same committee also reviews the program mission, objectives, outcomes, and the assessment process periodically and in consultation with other faculty members.

Although listed previously in this report, the AE program objectives are presented again for easy reference. The AE graduate program objectives are:

- To ensure the admission of qualified students into the program each year*
- To provide qualified faculty for the program*
- To provide appropriate laboratories and access to them for the program*
- To provide an appropriate variety of graduate courses for the program*
- To enroll a sufficient number of students to support the courses offerings*
- To achieve an acceptable placement rate within one year of graduation either in jobs or in graduate programs for further study*
- To ensure graduates are satisfied with the program (three years after graduation)*
- To ensure continued quality of student performance during the program*

Outcomes for *objective-a*, *-b*, and *-d* were discussed, and noted as satisfied, already. Results for the remaining objectives are included in the following sections.

Appropriate and accessible laboratories are critical to offering an excellent graduate program. The following outlines specifics related to *objective-c* (i.e., “To provide appropriate laboratories and access to them for the program”) listed above:

- Appropriate technical personnel must be available for department laboratory service and maintenance
- A questionnaire is administered to students for their feedback on the lab quality and accessibility

Relevant *objective-c* outcomes are as follows:

- The College of Engineering employs two full-time technicians to help maintain the college laboratories
- The AE department has developed a new Flight Dynamics laboratory
- The department shares six department laboratories with those of the WSU National Institute for Aviation Research (NIAR)
- The most recent Graduate School exit survey indicates 70% of the respondents feel that the laboratories are very accessible to them (compared with 56% university-wide)

The department seeks to enroll a sufficient number of graduate students yearly. Specific targets (for *objective-e*) include enrolling more than 50 degree-bound students per semester and granting in excess of 10 M.S. degrees per academic year.

The AE program has exceeded these targets. For the period from 2002-2008 the department averaged 69 M.S. and 17 Ph.D. students yearly. Furthermore, an average of 15 M.S. and 3 Ph.D. students graduate each year.

Besides maintaining enrollment, the AE graduate program seeks for students to “achieve an acceptable placement rate within one year of graduation either in jobs or in graduate programs for further study” (i.e., *objective-f*). The target is for 85% of the program graduates to be placed within one year of graduation either in jobs or in graduate programs for further study.

Student tracking is a difficult endeavor. Nonetheless, since 2003 approximately 88% of the AE graduates were placed in either jobs or graduate programs within one year of graduation (based on data in the AE department annual Graduate Program Assessment Report).

Relative to *objective-g*, the department seeks for at least 70% of the graduates to express satisfaction with their education three years after graduation. Recent Graduate School Exit Survey results indicate 82% of the AE graduates are satisfied or very satisfied with their graduate studies at WSU.

The continued quality of student performance is also critical (i.e., *objective-h*). Specific requirements include:

- Students must maintain at least a cumulative 3.00 GPA to retain Full Standing status
- Students are required to complete a minimum of 30 graduate semester credit hours for the thesis or 33 hours for the directed-project option
- Thesis or directed-project option students are required to pass an oral examination
- Non-thesis option students are required to pass a written examination
- Students are encouraged, but not required, to submit their thesis for publication

The following outlines average results (i.e., *objective-b*) for the period from 2003-2008:

- About 5 students are placed on probation and 1 is dismissed every year for GPA violations
- All graduates meet the credit hour and examination requirements
- Graduate students coauthor approximately 3 journal and 11 national conference publications each year

Program Feedback

As mentioned previously, a department Graduate Assessment Committee meets annually to review assessment results and to provide program feedback. This same committee also periodically reviews the program mission, objectives, outcomes, and the assessment process. Significant concerns or changes are raised in consultation with program faculty.

No noteworthy changes to the AE graduate program have been implemented in the last five years. As was noted in the previous section, objectives and targets are being met.

However, the existence of specific goals, objectives, targets, and an assessment plan greatly assist the department in accurately tracking program performance. As such, an effective mechanism to implement feedback or needed changes exist.

Demonstrated Need

Wichita is often called the “Air Capital of the World.” As such there is a clear need for aerospace engineers in Kansas. Indeed, the demand is widely expected to increase (dramatically) given the looming retirement of the “baby boomer” generation. By 2009 “an estimated one-in-four U.S. aerospace workers will be eligible to retire” and as of 2005 over 55% of the workforce is older than 45 (Aviation Week & Space Technology, Feb. 5, 2007, p. 44).

Retaining Kansas’ proud aviation heritage is dependent to a large degree on the availability of qualified aerospace engineers. The Wichita State University Aerospace Engineering program is uniquely qualified, through historical linkages, established abilities, and developed infrastructure, to meet the needs of the aerospace world.

As the nation’s 6th aeronautical engineering program, the AE department has evolved with Kansas’ aviation industry. Many of our faculty and alumni have played, and still play, a pivotal role in history. Furthermore, AE faculty have developed significant and unique aerospace related infrastructure on-campus.

The Walter Beech Memorial Low Speed Wind Tunnel, which just celebrated its 60th anniversary, is a great example of infrastructure critical to the aerospace industry, our students, faculty, and the U.S. Indeed, the need for this and other labs fueled the growth of the National Institute for Aviation Research (NIAR).

Aerospace Engineering faculty and students play a critical (usually lead) role in establishing, building, and operating these impressive facilities (e.g., the wind tunnel and the NIAR). Most importantly, without industry, community, and state support much of this infrastructure would not exist.

Over 69% of the AE program graduate students are part-time, given they are full-time engineers working at local companies. Considering this situation, all graduate-level courses are offered after 4:00 PM. This convenient "worker-friendly" approach meets the needs of engineers who desire promotion opportunities, through further education, as well as the needs of local aircraft companies seeking a skilled work force with up-to-date technical knowledge. Indeed, local industry directly reimburses employees for WSU tuition costs.

A measure of the Ph.D. program quality is related to the placement of graduates. Doctoral graduates have gone on to teach aerospace engineering or mechanical engineering at universities such as Auburn University, Louisiana Tech, Parks College, Texas A&M, Western Michigan, and Wichita State. Others have found employment in research and development groups of leading aerospace companies as well as government agencies.

External research funds awarded to AE faculty and the NIAR also illustrate the need for the graduate program. Much of the sponsored research is collaborative and applied in nature, utilizing students as a core resource.

Service

Aerospace Engineering department faculty actively serve on professional society technical committees. During 2007 alone, faculty served on 21 committees at the national, regional and local level. Moreover, 3 faculty members served as officers of professional societies at the regional and national level.

In 2007, faculty members organized 3 sessions at technical conferences. In addition, they collectively taught 5 workshops and made 12 invited presentations.

Every year, faculty review papers for leading journals (e.g., AIAA Journal, Journal of Aircraft, and SAE Transactions Journal of Aerospace). Over 30 papers were reviewed in 2007 alone.

Recruitment activities are considered quite important by the department faculty. The vast majority participates in the annual Wallace Scholarship Invitational whereby top high school students are recruited. Other general public activities include the LEGO-Mindstorm and Kansas' Best competitions, where faculty members serve as judges and advisors. Another event where faculty members serve as judges is the annual College of Engineering Open House where student projects are showcased to the public.

As a WSU department with a Ph.D. program, faculty members are quite active. They serve on dissertation committees not only within the college, but also throughout the university.

The department's faculty members also serve on university, college, and department committees, such as the university appeals court, university exceptions committee, university general education committee, university supreme court, and university tenure and promotion committee. Other faculty members serve on the university faculty senate along with many of its ad hoc committees.

Cost Effectiveness

An accurate program cost effectiveness assessment requires access to budget and student credit hour production numbers. This information is quite difficult to obtain for universities outside Kansas. Consequently, a comparison of cost per credit hour will be made between state universities with aerospace engineering graduate programs, namely Wichita State University and the University of Kansas (KU).

The AE department state funded expenditures, from 2002 to 2008, averaged \$1,201,302 per year. The average student credit hour production for this same period is 4,271 annually (1,031 of which are graduate level). Hence the average annual cost per credit hour is \$281/hr. KU's cost per credit hour in 2003 was over \$400/hr.

As was mentioned earlier, the AE department is also very successful in garnering external research funding from industry and government (e.g., Boeing, Hawker-Beechcraft, Bombardier-Learjet, Cessna, FAA, and NASA). The average has been approximately \$3.6 million per year since 2003 (approximately 3-times the state funding allocation).

Put simply, the external funds allow the department, college, and university to do more than is normally possible. Faculty are released to directly support the research work, hence freeing funds to hire needed adjuncts and graduate students. Furthermore, critical infrastructure is often developed (e.g., labs, expertise) using the money. The related experiences and facilities enhance our ability to support both research and academic needs.

In short, the external research funding greatly increases the AE department's ability to respond to local, state, and national needs on a limited budget.

Conclusions

The Aerospace Engineering graduate program fulfills the mission and goals of the university, college, and department. In summary:

- The faculty is extremely productive and qualified (e.g., averaging over 31 significant publications, \$3.6 million in external funds, and the advising of nearly 90 graduate students each year)
- Students and employers demonstrate a clear need for the program (e.g., almost 70% of the graduate student population comes from local industry, with their support via tuition reimbursements)
- Faculty and students contribute significantly to the well being of the university, the local community, the state, and the U.S. (e.g., faculty serve leaderships roles in professional organizations, review journal articles, and participate in many committees)
- The program is delivered in a very efficient and cost effective manner (e.g., we have an excellent cost per credit hour and over \$3.8 million in external funds each year)
- A clear mechanism to evaluate and improve the program exists and is utilized yearly (e.g., the yearly AE department Graduate Program Assessment Report)

Appendix I - University Mission

Wichita State University is committed to providing comprehensive educational opportunities in an urban setting. Through teaching, scholarship, and public service, the University seeks to equip both students and the larger community with the educational and cultural tools they need to thrive in a complex world, and to achieve both individual responsibility in their own lives and effective citizenship in the local, national, and global community.

High quality teaching and learning are fundamental goals in all undergraduate, graduate, and continuing education programs. Building on a strong tradition in the arts and sciences, the University offers programs in business, education, engineering, fine arts, and health professions, as well as in the liberal arts and sciences. Degree programs range from the associate to the doctoral level and encompass 75 fields of study; non-degree programs are designed to meet the specialized educational and training needs of individuals and organizations in south central Kansas.

Scholarship, including research, creative activity, and artistic performance, is designed to advance the University's goals of providing high quality instruction, making original contributions to knowledge and human understanding, and serving as an agent of community service. This activity is a basic expectation of all faculty members at Wichita State University.

Public and community service activities seek to foster the cultural, economic, and social development of a diverse metropolitan community and of the state of Kansas. The University's service constituency includes artistic and cultural agencies, business and industry, and community educational, governmental, health, and labor organizations.

Wichita State University pursues its mission utilizing the human diversity of Wichita, the state's largest metropolitan community, and its many cultural, economic, and social resources. The University faculty and professional staff are committed to the highest ideals of teaching, scholarship, and public service, as the University strives to be a comprehensive, metropolitan university of national stature.

Appendix II - College of Engineering Mission

The College of Engineering at Wichita State University is committed to:

- Prepare graduates who will engage effectively and responsibly in the practice of the engineering profession in a global economy and in pursuing advanced engineering education.
- Conduct applied and basic research to support and contribute to the social and economic well being of citizens and organizations in the Wichita metropolitan area, the state of Kansas and beyond.
- Cultivate the spirit of entrepreneurship and the connection between engineering and business that encourages technology commercialization.
- Improve continuously the engineering pedagogical methods employed in delivering its academic programs.
- Foster and value diversity of ideas and people through early student recruitment, outreach programs, and the recruitment and development of faculty role models.
- Encourage scholarship in all its dimensions.
- Evolve thoughtfully in response to the needs of industry and the changing world.

Undergraduate Program Review

Self-Study Report



WICHITA STATE UNIVERSITY

**Department of Aerospace Engineering
Wichita State University**

November 21, 2008

Undergraduate Program Review - Self-Study Report
Department of Aerospace Engineering, Wichita State University
November 21, 2008

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Introduction

The purpose of this report is to demonstrate Aerospace Engineering (AE) is delivering a quality undergraduate program consistent with the department, college, and university mission.

The following criteria are considered:

- Centrality, with respect to fulfilling the WSU mission and goals
- Quality, as assessed by faculty strengths, productivity, and qualifications and the curriculum
- Demonstrated need by students and employers
- Services the program provides to the discipline, university, and beyond
- Cost effectiveness

Much of this report's content is from an accompanying, and continual, effort related to accreditation. Specifically, the AE department also works to meet standards established by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET). We simply call it "ABET."

ABET requires accredited undergraduate programs to utilize a comprehensive process of continuous improvement. Programs must establish clear objectives, quantifiably measure progress, achieve minimum outcomes, and effectively identify changes as needed to improve the program. Constituent (i.e., students, alumni, industry, graduate programs, etc.) needs are paramount within the effort.

Accreditation reviews involve generation of a comprehensive self-study document and a campus visit by a qualified team of evaluators. At minimum, programs seeking accreditation are reviewed every 6-years. The WSU AE program completed an ABET visit in the fall of 2007. The EAC ABET reported on their review in the summer of 2008. The AE program received full accreditation.

Centrality

The subsequent material addresses the Aerospace Engineering program's focus with respect to the college and university mission and goals.

The Wichita State University mission statement, provided in Appendix I, declares:

"faculty and staff strive to provide a comprehensive, metropolitan university of national stature by providing students with the educational and cultural tools required to thrive in a complex world; to achieve individual responsibility in their lives; and to become effective citizens in the local, national, and global community. To accomplish this mission, the University will maintain a wide range of degree programs that deliver quality teaching, that make original contributions to knowledge and human understanding, and that serve as agents of community service."

The College of Engineering mission states a commitment to:

- Prepare graduates who will engage effectively and responsibly in the practice of the engineering profession in a global economy and in pursuing advanced engineering education.*
- Conduct applied and basic research to support and contribute to the social and economic well being of citizens and organizations in the Wichita metropolitan area, the state of Kansas and beyond.*

- c. Cultivate the spirit of entrepreneurship and the connection between engineering and business that encourages technology commercialization.*
- d. Improve continuously the engineering pedagogical methods employed in delivering its academic programs.*
- e. Foster and value diversity of ideas and people through early student recruitment, outreach programs, and the recruitment and development of faculty role models.*
- f. Encourage scholarship in all its dimensions.*
- g. Evolve thoughtfully in response to the needs of industry and the changing world.*

To uphold the university and college missions, the AE faculty established the following undergraduate Program Educational Objectives (PEOs):

- a. To provide an undergraduate education to its students that will produce aerospace engineering graduates who are sufficiently knowledgeable of the fundamental principles of engineering to meet the requirements of potential employers in not only the Wichita region, but in the global community*
- b. To provide an undergraduate education that prepares capable students to pursue graduate studies in aerospace engineering and related fields*

Clearly the Aerospace Engineering department's undergraduate program mission statement is aligned with both the university and college missions.

Quality

Information in this section addresses AE program quality considering faculty and curriculum elements.

Faculty

Table 1 summarizes basic information on the AE faculty. All twelve, tenure-track, AE members have a Ph.D. degree in their field of specialization. They come from eight different universities, each with excellent engineering programs. The average university-level teaching experience is approximately twenty years. In addition, each faculty member has an average of over three years of industrial or government experience to complement his or her academic backgrounds.

Table 1 Aerospace Engineering Faculty Information

Name	Rank	Highest Degree	Principle Area of Expertise	Institution from which Highest Degree Earned & Year	Years of Experience		
					Govt./ Industry Practice	Total Faculty	This Institution
K. Hoffmann	Prof.	Ph.D.	Aerodynamics	Univ. of Texas	0	19	19
W. Horn	Prof.	Ph.D.	Structures	Univ. of Texas	6	32	25
L.S. Miller	Prof.	Ph.D.	Aerodynamics	Texas A&M Univ.	0	21	20
R. Myose	Prof.	Ph.D.	Propulsion	Univ. So. Cal.	2	17	17
M.G. Nagati	Assoc. Prof.	Ph.D.	Flight Mechanics	Iowa St. Univ.	14	25	25
M. Papadakis	Prof.	Ph.D.	Aerodynamics	Wichita St. Univ.	1	23	23
S. Keshavanayana	Asst. Prof.	Ph.D.	Structures	Wichita St. Univ.	0	4	4
K. Rokhsaz	Prof.	Ph.D.	Flight Mechanics	Univ. Mo. - Rolla	0	23	18
B. Smith	Prof.	Ph.D.	Structures	Kansas St. Univ.	3	47	44
J. Steck	Prof.	Ph.D.	Flight Mechanics	Univ. Mo. - Rolla	3	19	19
M. Violette	Asst. Prof.	Ph.D.	Structures	Univ. of Texas	10	1	1
C. Yang	Assoc. Prof.	Ph.D.	Structures	Louisiana St. Univ.	2	15	11

Table 2 summarizes some measures of faculty productivity based on results from 2003 to 2007. Obviously, the AE faculty is extremely active in student advising, research, and scholarship. The department averages over \$3.6 million in external funding and more than 31 significant publications a year. Clearly, these efforts enhance and demonstrate AE faculty abilities to deliver an outstanding undergraduate program.

Table 2 AE Faculty Productivity Summary

Parameter	Yearly Average
Student Credit Hours	2004
Journal Publications	6
Conference Proceedings	19
Contract Reports	12
Other Publications	11
Presentations w/o Proceedings	43
Accepted Proposals	17
Previously Accepted Proposals	9
Rejected Proposals	6
Pending Proposals	4
Funded Research	\$3,601,905
Funded Faculty Release	\$206,521
Match Faculty Release	\$48,267
Funding for Students	\$408,940
B.S. Advising	229
M.S. Advising	42
Ph.D. Advising	17
M.S. Directed-Projects Completed	8
M.S. Thesis Completed	7
Ph.D. Dissertations Completed	3

During the 2008 academic year, regular faculty members taught 34 of 47 (i.e., 72%) undergraduate (i.e., 700- or lower) level courses offered. Qualified adjunct-faculty, most with prior academic experience and Ph.D. degrees, are used to meet some teaching needs. On average, only one Graduate Teaching Assistants (GTA's) is used each semester, given most of our graduate students are either busy supporting faculty with research or working full-time.

AE student credit hours have been increasing since 2003 (from about 1,700 to 2,400 SCH). Program specific class sizes have been growing steadily over the last three years. Currently, approximately 60 students are enrolled in two core junior-level AE courses. This situation represents almost a doubling in class size, since 2005. Indeed, the faculty is attentive to concerns such an increase could compromise our ability to deliver content and to interact effectively with students.

The current professor-to-student ratio is 0.04 (or 22.6 AE undergraduate students for each professor). Based on data from the Aerospace Department Chairs Association (ADCA), AE programs around the country have an average professor-to-student ratio of approximately 0.07 (or 14.3 AE undergraduate students for each professor). Obviously, an improved ratio is desired for WSU.

The AE faculty is clearly qualified and capable. Furthermore, their productivity is astonishing. However, current or increased student enrollment levels strain the faculty's ability to deliver courses,

advise students, seek external research funds, and to publish at desired levels. Adjustments (e.g., additional faculty or enrollment changes) might be required to sustain overall program quality.

Curriculum

The undergraduate program has been developed and refined over time by department faculty, most of who have considerable academic and industrial experience. Input from constituents (i.e., students, employers, alumni, etc.) has also been used to further refine the curriculum content.

To ensure the stated program educational objectives (i.e., PEOs) are achieved, the department has structured its curriculum and other educational opportunities to lead students to the program outcomes required for successful entry into engineering practice or further study at the graduate or professional level. These same outcomes provide the graduate with a sound foundation for subsequent career development and ultimate success in the engineering profession.

Specifically, mathematics, statistics, and science courses in chemistry and physics provide basic knowledge required for understanding and analyzing engineering systems. Subsequent studies in materials science, aerodynamics, structures, propulsion, and aircraft stability and control enable the graduate to apply engineering principles to create, analyze and improve aerospace processes, devices, and systems to meet customer needs.

Design and other open-ended problems assigned to students throughout the curriculum help students develop sound engineering judgment. The design experience is distributed throughout the curriculum and culminates in the senior year two-semester capstone design courses (AE 528 and AE 628). The principal purpose is to integrate material, covered by earlier individual courses, into an aerospace vehicle design process.

Finally, the social science and humanities courses students select assist them in developing an understanding of the societal context in which they will practice engineering. This experience includes issues related to environmental, legal, aesthetic, and human aspects of an engineering project. Furthermore, as of fall of 2001, all students must take a general education Issues and Perspectives course in “Professional and Ethical Issues in Engineering.”

This course was designed by the WSU Department of Philosophy, via a request from the College of Engineering. As a result, ethics, professionalism, life-long learning, and societal perspectives of engineering projects are complimented in the engineering curriculum.

135 credit hours are required to complete the AE B.S. degree. Course offerings are substantial and timely. The program is designed such that students can complete a degree in 4-years. However, students and faculty must be attentive to assure prerequisites are met. This case becomes very important during the junior year when certain core courses are offered as two-part sequences. Given this approach, and basic staffing limitations, these and other related classes are offered only once an academic year.

Approximately half of the AE seniors participate in the cooperative education program, working locally or out of town. Not surprisingly, the NASA Johnson Space and Dryden Flight Research Centers tours are the most popular. Obviously, such experiences dramatically compliment the student's education.

A variety of assessment techniques are employed to determine if the curriculum and other educational opportunities are producing the desired outcomes, thus assuring the achievement of program objectives (i.e., PEOs). Assessment tool details and desired outcomes are described in the Program Assessment section of this document.

Students

This section of the report provides basic information on students in the AE program.

On average approximately 32 undergraduate students graduate from the program each year (based on data for 2003-2007). They take about 4.7 years to complete their degree. With respect to gender, 16.8% of the graduating students between 2003-2007 were women. Table 3 outlines minority student demographic data.

Table 3 AE Undergraduate Student Demographics (5-Year Average)

	Hispanic	Asian	Black	American Indian	White	International	Missing
Percent of Total	2.5%	9.3%	0%	0%	48%	27.2%	7.6%

Applicants for the B.S. degree are admitted to the program as long as they meet the College of Engineering admissions requirements. The university catalog states:

“All entering students with a declared interest in engineering will be admitted to the College of Engineering in program status. Engineering students must complete the following courses, each with a grade of C or better, within the first 48 hours: (a) ENGL101/100, ENGL102, and COMM 111, and (b) MATH 242, or their equivalents.

Transfer students must present an earned GPA of 2.000 or higher on a 4.000 scale for all prior college work in order to be fully admitted into the College of Engineering. Transfer students with a GPA of less than 2.000 may petition for probationary admission.”

The quality of students starting the program is also important to consider. Based on data from 2002-2007, entering AE students have an average ACT score of 26. Interestingly, the average high-score for students during this same period is 34.

Students must maintain a 2.00 grade point average to remain in the program. The university catalog states:

“Students are placed on academic probation if any of the following grade point averages is less than 2.000 and if they have attempted at least 6 credit hours at Wichita State University: (1) cumulative grade point average of all college/ university work, (2) WSU grade point average and (3) engineering major grade point average. Academic probation is not removed until all grade point averages are at least 2.000. Transfer students admitted on probation must complete at least 12 hours of credit work at Wichita State before probation may be removed.”

Program Assessment and Feedback

As has been mentioned previously, the department utilizes an established process (e.g., ABET) to assess program quality and to logically affect undergraduate program changes.

Specific objectives and outcomes directly related to the program are evaluated yearly and externally reviewed during the ABET accreditation cycle.

For convenience, the Program Educational Objectives (PEOs) are shown again:

- a. To provide an undergraduate education to its students that will produce aerospace engineering graduates who are sufficiently knowledgeable of the fundamental principles of engineering to meet the requirements of potential employers in not only the Wichita region, but in the global community*
- b. To provide an undergraduate education that prepares capable students to pursue graduate studies in aerospace engineering and related fields*

Interestingly, these objectives are not static. Department faculty utilize program-related input, from students, employers, and graduates, to regularly review the Program Educational Objectives. Hence, a mechanism to change or update the PEOs exists.

The following AE undergraduate program outcomes are central to measuring success in meeting the PEOs. Graduating students are expected to clearly demonstrate:

- a. An ability to apply knowledge of mathematics, science, and engineering*
- b. An ability to design and conduct experiments, as well as to analyze and interpret data*
- c. An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability*
- d. An ability to function on multi-disciplinary teams*
- e. An ability to identify, formulate, and solve engineering problems*
- f. An understanding of professional and ethical responsibility*
- g. An ability to communicate effectively*
- h. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context*
- i. A recognition of the need for, and an ability to engage in life-long learning*
- j. A knowledge of contemporary issues*
- k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice*

The above outcomes are evaluated utilizing a variety of methods related to the following:

- Curriculum
- Design activities
- Aerospace Engineering Department Assessment Exam (AEDAE)
- Graduating senior exit survey
- Alumni survey
- Employer survey

Table 4 identifies how each assessment activity relates to specific program outcomes. Interestingly, each individual activity provides results for multiple outcomes.

Table 4 Relationship Between Assessment Activities and Program Outcomes

Assessment Activity	Program Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
Curriculum	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
General Education Program						✓	✓	✓		✓	
Design Throughout Curriculum	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Capstone Design & Laboratory Courses	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
AE Department Assessment Exam	✓	✓			✓						
Alumni Survey	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Cooperative Education Survey	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

The following paragraphs provide additional information on each assessment activity.

The program curriculum technical aspects are designed to ensure that students are exposed to a broad range of fundamental topics in science and aerospace engineering. The curriculum is consistent with requirements specified in ABET Program Criteria for aerospace programs.

Program outcomes, specifically (a) through (k), are emphasized and monitored in all program courses through class activities, such as homework, projects, and exams.

Instructors note outcome related concerns, problems, suggestions, or observed improvements in a dedicated course folder. Timely monitoring and appropriate course adjustments, in most cases, are identified this way. Simple changes are listed in the course folder for other instructors to review. Complicated or significant program concerns are forwarded to the department for action.

Final course grades are not used to assess program outcomes. Student performance for outcomes contained within assignments or exams are assessed.

Education in humanities and social sciences is addressed within university general education policy guidelines. This curriculum aspect reflects the desire to provide students with a broad education beyond engineering and to educate good citizens. Such education is necessary to ensure awareness of the world's intricacies and to develop an appreciation for other peoples' values and cultures.

The general education process incorporates the following four assessment principles:

- Addresses the nature of the program
- It is in the hands of people who know most about it
- It is continuous
- Involves faculty, students, administrators, and academic advisors

In this process, a three-year cycle addresses the Introductory, Further Studies, and Issues and Perspective courses. Assessment of the program beyond the Basic Skills courses (English I, English II, and Communication 111) is accomplished through the following:

- Program monitoring
- Tracking student outcomes
- Other institutional feedback

The General Education Committee is developing a matrix showing within which general education courses students apply their library research, mathematical, and written and oral communication skills. Students and advisors will use this matrix when planning courses of study to ensure students obtain practice in applying their newly acquired skills.

Instructors are responsible for measuring student outcomes with respect to the general education goals pertinent to their courses, while the General Education Committee interviews graduating seniors with respect to dispositions and behaviors. The individual course instructors will supply the General Education Committee with data on outcomes once in each three-year cycle.

Outcomes for each Basic Skills course are stated for students in the course syllabi. Common exit exams are conducted in each of the Basic Skills courses. Each basic course has used in-course pretests and posttests to assess student progress. Basic Skills course committees for each discipline review assessment data and make decisions regarding issues that might bear on students' mastery of basic skills requirements. A Basic Skills course director coordinates the program in each discipline.

Design activities distributed throughout the curriculum are used to expose students to complex and varied difficulty, open-ended problems. Depending on course level, some problems go beyond the material covered in the course, requiring the students to self-educate. Special emphasis in capstone design courses is placed on "soft" issues, such as ethics and awareness of the world beyond the classroom. These skills are measured in the courses and affect the students' assignment and final grades. Furthermore, within the process, instructors identify and address potential outcome related problems.

In addition to the technical content in capstone design and laboratory courses, teamwork, communications, and self-education are specially emphasized. Student competence levels, in these skills, are measured and reflected in their assignment and final course grades. Furthermore, within the process, instructors identify and address potential outcome related problems.

The Aerospace Engineering Department Assessment Exam (AEDAE) is administered to students during the capstone senior design course. This exam covers the following five courses: statics, dynamics, mechanics of materials, thermodynamics, and basic aerodynamics. The exam format is similar to the National Council of Examiners for Engineering and Surveying (NCEES) Fundamentals of Engineering (FE) exam. AEDAE results are compared, for trends, with those from the national and statewide FE exam. Since no attempt is made to normalize the AEDAE results, the raw scores cannot be used for assessment. However, compiled yearly results provide trends that allow monitoring the program over time. The exam results, when compared with the national and statewide FE exam results, provide especially meaningful data about the progress made by the department over time.

The department chairman conducts an annual (constituent) exit interview during the student's senior year. This interview consists of two segments: a questionnaire (Graduating Senior Exit Survey) that the student fills out at their leisure and an oral interview. The survey aims to determine students'

satisfaction with their educational experience while at WSU and serves as a diagnostic tool for faculty members in delivering the Program Educational Objectives.

The alumni survey, with elements common to the College of Engineering and questions that produce Aerospace Engineering Program-specific responses, is mailed to all living Aerospace Engineering Program graduates every two years. In this survey, alumni are asked a variety of questions, many of which are directly related to program outcomes.

While this is not a cooperative education program by ABET definition, considerable student numbers participate in the university's cooperative education program. Companies employing these students are asked to complete a survey (Employer Survey) evaluating participants in interpersonal skills, communication skills, technology skills, and professional adaptation. Additionally, they are asked to review the frequency of outcomes activity (i.e., Outcomes a-k).

Specific assessment results are too extensive to present in the current document. Perhaps most importantly, students and alumni respectively indicated an 82% and 86% favorable rating of the AE program. Cooperative education employers gave their student workers an 80.2% rating. Although these results are acceptable, the faculty is eager to make improvements.

All of the assessment results provide valuable information and feedback for the department. Indeed, a summary of recent changes is provided in the following table (Table 5).

Table 5 A Summary of Assessment Related Program Actions and Changes (2008)

Basis	Actions and Changes
Exit Interviews	<ul style="list-style-type: none"> Increased the availability and use of CAD software in the program Added tutorials for MATLAB and ANSYS use Advanced computer tool use is now more continuous in the program A materials testing machine (e.g., a MTS) was purchased and a small wiffle-tree test fixture was built for class and project use An experimental structures component was added, on a trial basis, to AE 512
AEDAE Exam Scores	<ul style="list-style-type: none"> More AE courses now include C-or-better grade prerequisites A "Threshold Learning" course concept has been explored (with mixed results) A new student self-survey was administered, to obtain greater information on non-academic circumstances potentially affecting student performance
Other	<ul style="list-style-type: none"> A new course folder format has been implemented, to better focus assessment and outcome improvement Improved student advising procedures have been established The Co-Op student and employer surveys are being modified to improve feedback

As was mentioned in the Introduction, accreditation reviews involve generation of a comprehensive self-study document and a campus visit by a qualified team of ABET evaluators. Under favorable circumstances, programs seeking accreditation are reviewed every 6-years (as opposed to shorter intervals).

The WSU AE program completed an ABET visit in the fall of 2007. The EAC ABET completed their review in the summer of 2008, awarding the AE program full accreditation.

Demonstrated Need

Wichita is often called the “Air Capital of the World.” As such there is a clear need for aerospace engineers in Kansas. Indeed, the demand is widely expected to increase (dramatically) given the looming retirement of the “baby boomer” generation. By 2009 “an estimated one-in-four U.S. aerospace workers will be eligible to retire” and as of 2005 over 55% of the workforce is older than 45 (Aviation Week & Space Technology, Feb. 5, 2007, p. 44).

Retaining Kansas’ proud aviation heritage is dependent to a large degree on the availability of qualified aerospace engineers. The Wichita State University Aerospace Engineering program is uniquely qualified, through historical linkages, established abilities, and developed infrastructure, to meet the needs of the aerospace world.

As the nation’s 6th aeronautical engineering program, the AE department has evolved with Kansas’ aviation industry. Many of our faculty and alumni have played, and still play, a pivotal role in history. Furthermore, AE faculty have developed significant and unique aerospace related infrastructure on-campus.

The Walter Beech Memorial Low Speed Wind Tunnel, which just celebrated its 60th anniversary, is a great example of infrastructure critical to the aerospace industry, our students, faculty, and the U.S. Indeed, the need for this and other labs fueled the growth of the National Institute for Aviation Research (NIAR).

Aerospace Engineering faculty and students play a critical (usually lead) role in establishing, building, and operating these impressive facilities (e.g., the wind tunnel and the NIAR). Most importantly, without industry, community, and state support much of this infrastructure would not exist.

Based on a 2007 department survey, approximately 68% of the current undergraduate students work more than 20-hours a week. Many participate in the Cooperative Education program or work directly with local companies, or with WSU faculty involved in aerospace related research or testing (e.g., NIAR). This situation underscores the needs of local aircraft companies seeking a skilled work force with up-to-date technical knowledge.

A measure of the program quality is also related to the placement of graduates. B.S. graduates have gone on to study aerospace engineering at universities such as Stanford, Washington University, Cornell, Texas A&M, University of Texas, and Georgetown. Others have found employment in leading aerospace companies as well as government agencies.

External research funds awarded to AE faculty and the NIAR also illustrate the need for the undergraduate program. Much of the sponsored research is collaborative and applied in nature, utilizing students as a core resource.

Service

Aerospace Engineering department faculty actively serve on professional society technical committees. During 2007 alone, faculty served on 21 committees at the national, regional and local level. Moreover, 3 faculty members served as officers of professional societies at the regional and national level.

In 2007, faculty members organized 3 sessions at technical conferences. In addition, they collectively taught 5 workshops and made 12 invited presentations.

Every year, faculty review papers for leading journals (e.g., AIAA Journal, Journal of Aircraft, and SAE Transactions Journal of Aerospace). Over 30 papers were reviewed in 2007 alone.

Recruitment activities are considered quite important by the department faculty. The vast majority participates in the annual Wallace Scholarship Invitational whereby top high school students are recruited. Other general public activities include the LEGO-Mindstorm and Kansas' Best competitions, where faculty members serve as judges and advisors. Another event where faculty members serve as judges is the annual College of Engineering Open House where student projects are showcased to the public.

As a WSU department with a Ph.D. program, faculty members are quite active. They serve on dissertation committees not only within the college, but also throughout the university.

The department's faculty members also serve on university, college, and department committees, such as the university appeals court, university exceptions committee, university general education committee, university supreme court, and university tenure and promotion committee. Other faculty members serve on the university faculty senate along with many of its ad hoc committees.

Cost Effectiveness

An accurate program cost effectiveness assessment requires access to budget and student credit hour production numbers. This information is quite difficult to obtain for universities outside Kansas. Consequently, a comparison of cost per credit hour will be made between state universities with aerospace engineering graduate programs, namely Wichita State University and the University of Kansas (KU).

The AE department state funded expenditures, from 2002 to 2008, averaged \$1,201,302 per year. The average student credit hour production for this same period is 4,271 annually (3,240 of which are undergraduate level). Hence the average annual cost per credit hour is \$281/hr. KU's cost per credit hour in 2003 was over \$400/hr.

As was mentioned earlier, the AE department is also very successful in garnering external research funding from industry and government (e.g., Boeing, Hawker-Beechcraft, Bombardier-Learjet, Cessna, FAA, and NASA). The average has been approximately \$3.6 million per year since 2003 (approximately 3-times the state funding allocation).

Put simply, the external funds allow the department, college, and university to do more than is normally possible. Faculty are released to directly support the research work, hence freeing funds to hire needed adjuncts and students. Furthermore, critical infrastructure is often developed (e.g., labs, expertise) using the money. The related experiences and facilities enhance our ability to support both research and academic needs.

In short, the external research funding greatly increases the AE department's ability to respond to local, state, and national needs on a limited budget.

Conclusions

The Aerospace Engineering undergraduate program fulfills the mission and goals of the university, college, and department. In summary:

- Student credit hour production has increased
- The faculty is extremely productive and qualified (e.g., averaging over 31 significant publications, \$3.6 million in external funds)
- Students and employers demonstrate a clear need for the program
- The program curriculum aligns with local, state, and national aerospace (e.g., aviation and ABET) interests
- Faculty and students contribute significantly to the well being of the university, the local community, the state, and the U.S. (e.g., faculty serve leaderships roles in professional organizations, review journal articles, and participate in many committees)
- The program is delivered in a very efficient and cost effective manner (e.g., we have an excellent cost per credit hour and over \$3.8 million in external funds each year)
- A clear mechanism to evaluate and improve the program exists and is utilized yearly (e.g., the Engineering Accreditation Commission (EAC) Accreditation Board for Engineering and Technology)
- The program was recently awarded with full accreditation
- Students, alumni, and cooperative education employers rate the program highly

Appendix I - University Mission

Wichita State University is committed to providing comprehensive educational opportunities in an urban setting. Through teaching, scholarship, and public service, the University seeks to equip both students and the larger community with the educational and cultural tools they need to thrive in a complex world, and to achieve both individual responsibility in their own lives and effective citizenship in the local, national, and global community.

High quality teaching and learning are fundamental goals in all undergraduate, graduate, and continuing education programs. Building on a strong tradition in the arts and sciences, the University offers programs in business, education, engineering, fine arts, and health professions, as well as in the liberal arts and sciences. Degree programs range from the associate to the doctoral level and encompass 75 fields of study; non-degree programs are designed to meet the specialized educational and training needs of individuals and organizations in south central Kansas.

Scholarship, including research, creative activity, and artistic performance, is designed to advance the University's goals of providing high quality instruction, making original contributions to knowledge and human understanding, and serving as an agent of community service. This activity is a basic expectation of all faculty members at Wichita State University.

Public and community service activities seek to foster the cultural, economic, and social development of a diverse metropolitan community and of the state of Kansas. The University's service constituency includes artistic and cultural agencies, business and industry, and community educational, governmental, health, and labor organizations.

Wichita State University pursues its mission utilizing the human diversity of Wichita, the state's largest metropolitan community, and its many cultural, economic, and social resources. The University faculty and professional staff are committed to the highest ideals of teaching, scholarship, and public service, as the University strives to be a comprehensive, metropolitan university of national stature.

Appendix II - College of Engineering Mission

The College of Engineering at Wichita State University is committed to:

- Prepare graduates who will engage effectively and responsibly in the practice of the engineering profession in a global economy and in pursuing advanced engineering education.
- Conduct applied and basic research to support and contribute to the social and economic well being of citizens and organizations in the Wichita metropolitan area, the state of Kansas and beyond.
- Cultivate the spirit of entrepreneurship and the connection between engineering and business that encourages technology commercialization.
- Improve continuously the engineering pedagogical methods employed in delivering its academic programs.
- Foster and value diversity of ideas and people through early student recruitment, outreach programs, and the recruitment and development of faculty role models.
- Encourage scholarship in all its dimensions.
- Evolve thoughtfully in response to the needs of industry and the changing world.