1-15-2015

Mechanical and Materials Engineering Academic Program Review, 2014

College of Engineering & Computer Science, Wright State University

College: College of Engineering and Computer Science

Department: Department of Mechanical and Materials Engineering

Academic Programs Reviewed:

Program 1. Mechanical Engineering Bachelors of Science Degree
Program 2. Materials Science and Engineering Bachelors of Science Degree
Program 3. Mechanical Engineering Master's Degree
Program 4. Materials Science and Engineering Master's Degree
Program 5. Renewable and Clean Energy Engineering Master's Degree
Program 6. Aerospace Engineering Master's Degree

Program Review Committee:

1. Dr. George Huang, Chair, Department of Mechanical and Materials Engineering
2. Dr. James A. Menart, Professor and Director of Renewable and Clean Energy Program
3. Dr. Sharmila Mukhopadhyay, Professor
4. Dr. Hong Huang, Associate Professor
6. Dr. Dan Young, Associate Professor
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8. Heather Casto, Academic Programming Director

Submitted: January 15, 2015

Department Chair: Dr. George Huang

Dean: Dr. Nathan Klingbeil

Program 1. Mechanical Engineering Bachelors of Science Degree

Enrollment and Graduate History

Table MME1: Mechanical Engineering Bachelors of Science degree yearly enrollment and gradation numbers.

	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	439	484	563	664	749
Graduates	66	47	65	98	79

Program description

The Bachelors of Science in Mechanical Engineering (BSME) program at Wright State University has been in existence since 1986 and prepares its undergraduates for careers in thermal, manufacturing, and mechanical design areas. Graduates of the BSME program will: 1) be employed in the engineering profession or purse graduate studies; 2) successfully compete in a globally integrated environment; and 3) be engaged in life-long learning through continuing education and other avenues in a rapidly changing technical environment.

Alignment with university mission, strategic plan

The BSME program education objectives (PEOs) are meant to fulfill the university‘s mission in that they are meant to “transform the lives of our students and the communities we serve.” We are doing this by training our undergraduate Mechanical Engineering students so that they can “be employed in the engineering profession or pursing graduate studies” and so that they can “successfully compete in a globally integrated environment”. To make sure the goal of “transforming the lives of our students and the communities we serve” continues throughout the lives of our students we want to instill in our students the desire to “be engaged in life-long learning through continuing education and other avenues in a rapidly changing technical environment.”

To align with the university strategic plan, the BSME program has continuously enhanced the program’s quality and distinctiveness by assessing both the program and student outcomes, modifying curriculum and offering new courses, recruiting new faculty, providing development opportunities for existing faculty, collaborating and outreaching with other institutions, both in education and research, just to name a few.

Program distinctiveness

This program, housed in the Mechanical and Materials Engineering Department, is the second largest undergraduate program in the Wright State College of Engineering and Computer Science (CECS) and is the largest engineering program in the CECS. The BSME program first received ABET accreditation in 1988 from the Engineering Accreditation Commission (EAC) branch of ABET, and has continuously been ABET accredited since. This program is a high quality undergraduate Mechanical Engineering program that provides a great deal of value and quality to its students. This program provides three tracks from which its students can choose, a Design track, a Thermal-Fluids track, and a Manufacturing track. These tracks cater to the technological needs of the region. In addition to three tracks, a large

number of technical elective courses, covering a number of technical topics, are provided. Students are required to take three technical elective courses as part of their BSME program.

Recognitions of quality of the program

The quality of the program has been recognized by:

1. continuous increaseing enrollment,
2. students from different parts of the world who have or are enrolling in the program,
3. faculty members who have attained national/international prominence in research, scholarship which is exemplified by publications and grants,
4. exit interviews from graduating students which are positive and the majority of the program's students consider the BSME program at Wright State to be excellent,
5. an external advisory board that is satisfied with the continuous improvement of the program, and
6. employers who continuously hire graduates from the Wright State BSME program and who are impressed with the students' capabilities and skills.

Program learning outcomes

The BSME program uses the standard a-k learning outcomes as listed by ABET:

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 multidisciplinary 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, and
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

These outcomes are essential by the very nature of engineering. During the past 5 years we have been trying to foster increased obtainment of all eleven a-k outcomes.

Description of learning outcomes assessment program

The learning outcomes of the BSME program are assessed in the following five ways:

1. Course material collection
2. Senior design evaluations
3. Exit interviews
4. Alumni surveys
5. Employer surveys

A wide range of constituencies and techniques are used to assess the BSME program.

Summary of assessment findings for past five years

A summary of the survey data is given below. The numbering below corresponds to the numbering in the previous section.

1. Course material collection results have been mapped onto the course coverage of the a–k outcomes. In essence this mapping indicates that i) the students rate our coverage of these outcomes well and ii) outcomes a, b, c, e, g, and k are rated significantly higher than d, f, h, i, j, and k.
2. Senior Design Evaluations from faculty advisors and industrial advisors show that most of the a-k outcomes are in the 3 to 5 range; however, there are a few low ratings for outcomes h, i, and j. These are based on the number of references in the student's final report. Improvement is needed on h, i, and j.
3. Exit interview comments on the BSME program are generally very positive and the students feel they have received a solid education. Many students are pleased with the BSME education that they have received at Wright State University and, if given the opportunity, would make the same choice again. Students do, however, often have suggestions for improvement and the occasional complaint. The complaints usually reference specific courses or faculty, some university services, and the Math Department.
4. Alumni surveys results are favorable and similar to our exit interview survey results. All ratings in the alumni survey are above 3.5 and many are above 4.0 out of a total of 5.0.
5. Employer survey results are also favorable. All ratings in the employer survey are above 3.5 out of 5.0.

Major curricular changes since last review (or past five years)

The BSME faculty have been continuously enhancing the BSME to ensure academic quality and program distinctiveness. Below are a list of a few selected changes in the past 5 years:

1. The program educational outcomes have been changed in 2011 to better align with the university mission.
2. Curriculum has been continuously enhanced by modifying the existing course content, improving teaching facilities, adding new courses, improving students' computational and experimental skills, and increasigng knowledge of modern engineering technologies and tools.
3. A new manufacturing track has been added to the curriculum.
4. The student advising policy was changed to mandatory advising of students by the Assistant Chair, resulting in better prerequisite fulfillment and students taking the proper classes at the proper time.
5. Five new faculty members have been hired.

In addition, major changes were made to the BSME program during our semester transition that occurred in the fall of 2012. Planning for the semester transition started occurring in 2010. The changes to the program that occurred are shown in Table MME2 below. The old quarter based program is shown in the left-hand column, and the new semester based program is shown on the right-hand side. Note that the hours on the quarter side are quarter credit hours and the hours on the semester side are

semester credit hours. A number of improvements to the program were made during this semester transition.

Table MME2: Changes in Mechanical Engineering Bachelors of Science Degree program when transition from quarters to semesters occurred in 2012.

College	**CECS**
Department	**Mechanical and Materials Engineering**
Degree (A.A. B.S., B.F.A., etc.) & Title	**BS**
Concentration, Track, Option, Specialization	**Mechanical Engineering**

Quarter System Program	**Hours**	**Semester System Program**	**Hours**
I. General Education		**I. Wright State Core**	
Area 1: MTH 229, MTH 230	18	**Communications:** ENG 1100(3), EGR 3350(3)- Technical Communication for	
Area 2:	8	Engineers and Scientists	6
Area 3:	8	**Mathematics**: MTH 2300(4)	4
Area 4:	12	**Global Traditions**: 6 hours	6
Area 5: PHY 240/200, 242/202, 244/204	16	**Arts/Humanities**: 3 hours	3
Area 6: EGR 101	5	**Social Science**: 6 hours	6
	67	**Natural Science**: PHY 2400(4)/PHY 2400L(1),	
		PHY 2410(4)/PHY 2410L(1)	10
		Additional Core Courses: EGR 1010(4), CHM 1210(3)/1210L(2), MTH	
		2310 (4)	13
			48
II. Department Courses		**II. Department Courses**	
ME 102, 199, 202, 212, 213	19	ME 1020, 2020, 1030(2), 2120, 3310	14
ME 313, 314, 315, 316, 317, 318, 360, 370, 371	35	ME 2210, 3120, 3350, 2700, 3600	15
		ME 3360, 3210, 4140	9
ME 408, 410 412, 414, 415, 460, 490, 491	31	Choose one track	
		Design: ME 4150, ME 4210, ME 4120	
2 of 3 from ME 495, 496, 497	4	Fluid Thermal: ME 3320, ME 4010, ME 4340	
	89		
		Senior Design, Choose one sequence:	9
		a) EGR 4910, 4920	
		b) ME 4910, 4920	
		Senior Lab (pick 1 from approved list)	6
			2
			55
III. CECS Courses		**III. CECS Courses**	
EE 301/302, 413/414	9	EE 2010(3)/EE 2010L(1)	4
	---		4
	9		
IV. Other		**IV. Other**	
CHM 121/5	5	MTH 2320(4), MTH 2350(4)	8
MTH 231, 232, 235	15		
STT 363	3		

	23		
V. Electives		**V. Electives**	
At least 3 courses from an approved list	10	2 from an approved list	6
Total	198	**Total**	121

Graduate placement data, employer satisfaction

Placement of students who graduate from the BSME program is very good. Many students find employment before they graduate, while most all students find employment shortly after graduation. Many of our students are employed in the Dayton region. A number of local employers continue to hire Wright State students. This is an indication that these employers are pleased with the quality of Wright State's BSME students. Some examples of students who have graduated from the BSME program are shown in Table MME3. This is only a small sample of the employment of our students, most of our students obtain gainful engineering employment.

If program has professional accreditation, attach most recent review findings and recommendations

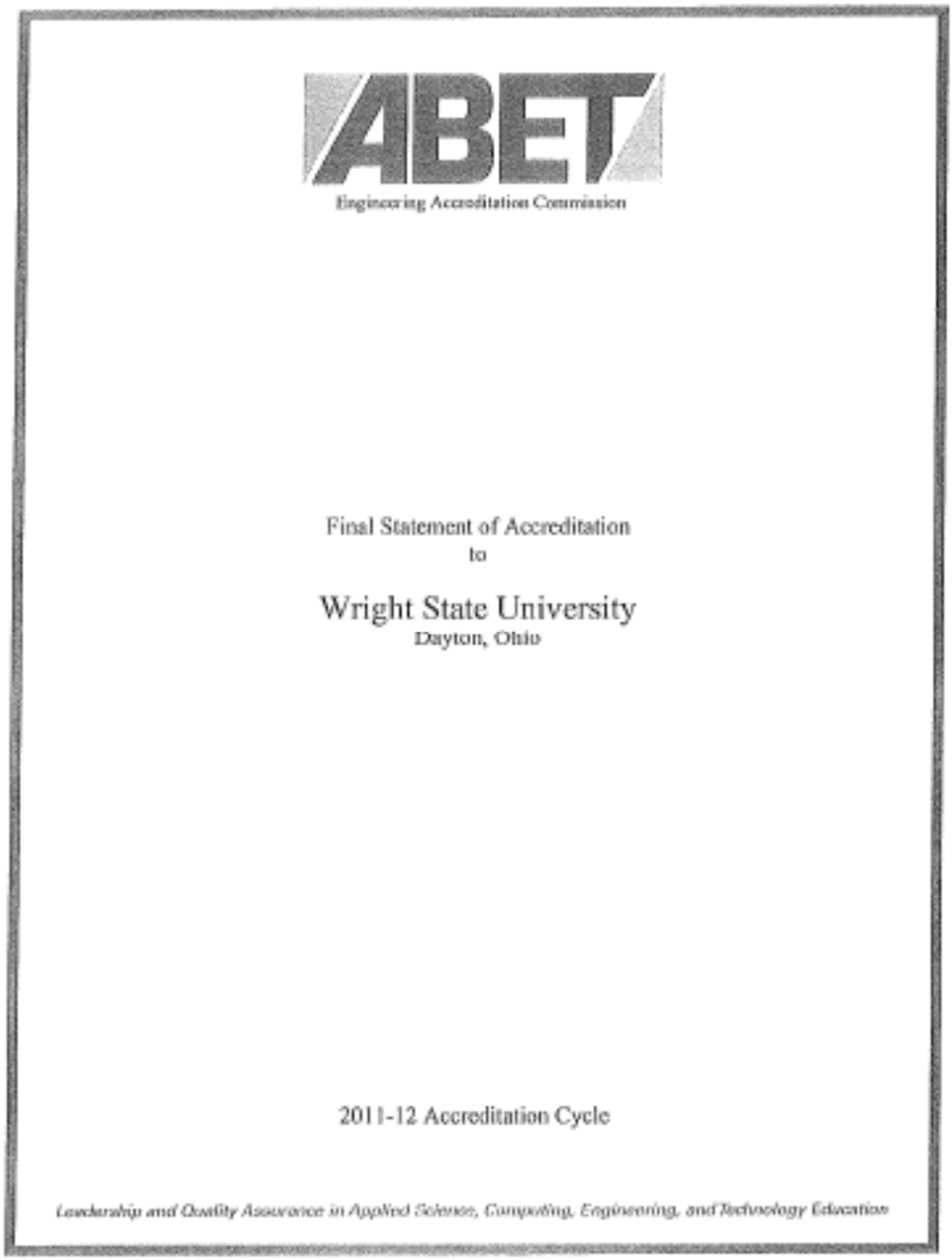
The BSME program first received ABET accreditation in 1988 from the Engineering Accreditation Commission (EAC) branch of ABET, and has continuously been ABET accredited ever since. The last ABET accreditation was in 2011-2012. The BSME program at Wright State University received a 6 year accreditation, the longest and highest accreditation given by ABET. The most recent accreditation report is shown in Figure MME1, which is five pages long.

Table MME3: Small sampling of BSME graduates who obtained employment.

FIRST NAME	LAST NAME	TITLE	COMPANY	SALARY RANGE
			Company	
Karjada	Aithala		Caterpillar, Inc.	40K
Caleb	Barnes	Aerospace Research Engineer	Wright Patt Air Force Base	60K
Joseph	Beck	Aerospace Engineer	Wright Patt Air Force Base	
Asela	Wadumesthrige		Tenneco Automotive	75K
Aaron	Blake	Program Manager	UES, Inc	
Aron	Brezina	Certification Engineer	Belcan Technologies	
Girish	Byrappa	Quality engineer	American Metal Technologies	
Alex	Byrd	Teaching Assistant	Wright State University	62K
Jace	Carter	Structural Analyst	Rolls-Royce	
Michael	Corbett	Senior Engineer	Bihrel Applied Research	75K
Jeffery	Cousineau	OPW-Engineered Systems	OPW-Engineer	
Jaderic	Dawson		Wright Patt Air Force Base	54K
Heather	Doak	Research Scientist	Mound Laser & Photonics Center, Inc.	
Scott	Eastborn		The Spaceship Co.	70K
Benjamin	Florkey	Materials Engineer II	Tri-Tech Associates, Inc	42K
Samuel	Freund		Currently looking for position	
Awsantha	Ganesan		American Metal Technologies	40K
Zach	Gaston	Senior Engineer	GoHypersonic, Inc.	77K
Dan	Gorsky	Senior Aerospace engineer	Caterpillar, Inc.	62K
Charles	Hall	Certification Engineer	Boeing	
Jantzen	Hinton	Structures Engineer	Goodrich AWB	
Shih Kang	Huang	Research Assistant of MAV Dynamic Air Flow	Wright State University	
Parshanth	Kumaraswamy	Mechanical Design Engineer	F Tech R&D North American	
Jamie	Larios-Barbosa		United States Air Force	
Hao	Li	PhD Candidate	Wright State University	
Zhe	Lin	Mechanical Engineer	WCR Heat Exchangers	
David	Loel	Senior Engineer	APR Consultants	60K
(Tony) Shup	Mao	Technical & Production Engineer	Stego Saws, Inc	
Josh	Mark	F135 Lead Engineer	United States Air Force	

Zaheer Ali	Mashraque	Project Lead	Moriroku Technology North America	
Joshua	Moore	Operations Manager	United States Air Force	
Vidadhara	Nagendra	Stress Analysis Engineer (level 2)	Chrysler Group	
Brian	Nicholson	Mechanical Engineer	Air Force Research Laboratory	
Erik	Pakulski	Mechanical Engineer		
Steve	Palluconi	Research Engineer	Innovative Scientific Solutions, Inc.	
Bryan	Penkal	Design Engineer	Emerson Process Management	77K
Melanie	Peterson	Graduate Student	University of Toledo	
Brad	Pollock	PhD Candidate	United States Air Force	
Huiying	Ren	Post-Master Research Associate	Pacific Northwest National Laboratory	
David	Roe	System Engineer	Meggitt Aircraft Braking System	
Todd	Smith	Research Engineer	Air Force Research Laboratory	
Shreyas Vathul	Subramanian	Graduate Research Assistant	Purdue University	
Chanchal	Thakur	Manufacturing Engineer	American Metal Technologies	
Michael	Thomas	Project Engineer II	Stole Machinery	
John	Thompson	Senior Engineer	Emerson Climate Technologies	
Randy	Tobe	Engineer/Technologist	GE Aviation	
John	Van Oss	Dynamics Engineer	UTC Aerospace Systems	
Anup Gopal	Vappala	Senior Software Engineer	Accenture Services Private Limited	
Ryan	Vogel	Mechanical Engineer	United States Air Force	70K
Zachary	Votaw	Graduate Research Assistant	Wright State University	
Zhixin	Wang	Research Assistant	Wright State University	
Jessica	Webb	Research Engineer	Innovative Scientific Solutions, Inc.	
Masound	Zarepoor	Graduate Research Assistant	Old Dominion University	
Dongning	Zhao	Mechanical Engineer	Super ATV	45K
Fang (Frida)	Zong	Mechanical Engineer	Circuits and Cables, Inc.	

Figure MME1: Most recent ABET accreditation findings and recommendations for the Mechanical Engineering Bachelors of Science Degree. This figure continues for five pages.



ABET

Engineering Accreditation Commission

Final Statement of Accreditation
to

Wright State University
Dayton, Ohio

2011-12 Accreditation Cycle

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

Continue Figure MME1: Most recent ABET accreditation findings and recommendations for the Mechanical Engineering Bachelors of Science Degree.

Mechanical Engineering
Program

Introduction

The mechanical engineering program is a traditional program that prepares its undergraduates for careers in the thermal, manufacturing, and mechanical systems areas. The program is administered by the Mechanical and Materials Engineering Department. The program has approximately 400 undergraduate students, 19 tenured or tenure-track faculty members and four full-time-equivalent adjunct faculty positions. The program had 38 graduates in the most recent academic year.

Program Strengths

1. The program faculty members are very active and committed to the instruction of their students. Several faculty members have won university and national teaching awards. The faculty members support each other's efforts in teaching and scholarship, and express satisfaction with their colleagues and departmental administration.

2. The program is well-equipped, with new machining facilities and several state-of-the-art laboratories. These facilities permit the students to fabricate parts for the design projects and research projects.

3. Student design projects are of high quality; many of these projects were entered in national design competitions, such as those sponsored by SAE and ASME, and received recognition.

Program Weaknesses

1. Criterion 4. Continuous Improvement This criterion requires the program to regularly use appropriate, documented processes for assessing and evaluating the extent to which both the program educational objectives and the student outcomes are being attained. The results of these evaluations must be systematically utilized as input for the continuous improvement of the program. The program has an assessment process for both program educational objectives and for student outcomes. However, these assessment processes rely primarily on

Continue Figure MME1: Most recent ABET accreditation findings and recommendations for the Mechanical Engineering Bachelors of Science Degree.

surveys of students and alumni and do not provide information that is useful for continuous improvement. Although actions have been taken to improve the curriculum, very few of these actions were the direct result of the assessment process. Because the assessment and evaluation processes that are in place do not provide adequate information to inform the continuous improvement of the program, the program lacks strength of compliance with this criterion.

- Due-process response: The EAC acknowledges receipt of documentation related to continuous improvements in the program. Additional data from student outcome assessment has been used to stimulate improvements to the program. The program now has in place a process that will continue to assess outcomes and will use that process to provide input for improvements in the program. In addition, as the assessment process for the program educational objectives proceeds the program expects to incorporate that assessment for continuous program improvement. At this time the review process has generated a single set of results, and it will be important for the program to demonstrate continued compliance with this criterion.

- The weakness is now cited as a concern.

Program Concern

1. Criterion 5. Curriculum This criterion requires that faculty ensure that the program curriculum devotes adequate attention and time to each component of the program. Students reported in a group interview that the mathematics instruction they received at Wright State University was exceptionally poor. The occurrence of student complaints about the low quality math instruction was acknowledged by program faculty members in interviews. Mathematics instruction at Wright State University is purportedly so poor that approximately 55 to 60 out of approximately 120 students said they took the calculus sequence at a nearby community college instead of at Wright State University. The mathematics department has a new chairman who appears willing to work to improve the math instruction problem. Unless there is adequate quality of instruction in fundamental topics in mathematics that are prerequisite to more advanced engineering topics, there is the potential that future compliance with this criterion could be jeopardized.

Continue Figure MME1: Most recent ABET accreditation findings and recommendations for the Mechanical Engineering Bachelors of Science Degree.

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Continue Figure MME1: Most recent ABET accreditation findings and recommendations for the Mechanical Engineering Bachelors of Science Degree.

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- Due-process response: The EAC acknowledges receipt of documentation related to the poor mathematics instruction. Faculty members of the program met with the new department chairman of the mathematics department. The chairman of the mathematics department is now working with the college of engineering and science to make sure the top instructors are assigned to mathematic courses designated for engineering students.

- The concern is resolved.

Program 2. Materials Science and Engineering
Bachelors of Science Degree

Enrollment and Graduate History

Table MME4: Material Science and Engineering Bachelors of Science Degree yearly enrollment and gradation numbers.

	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	32	41	47	42	47
Graduates	2	6	9	3	5

Program description

The Bachelors Materials Science and Engineering (BMSE) program at Wright State University is a comprehensive degree that covers all the major areas of the field. Graduates from this program will possess the necessary skills to successfully enter the engineering profession or to pursue graduate study, and will appreciate the benefits of lifelong learning. They will possess a solid foundation in mathematics, basic and engineering sciences, laboratory techniques and their application to the field of materials. They will demonstrate a breadth of understanding in the relationships among processing, microstructure, properties, and performance of different material systems. Finally, Materials Science and Engineering Bachelor Degree graduates will demonstrate strong communication skills and the ability to work in collaborative groups in a professional and ethical fashion.

Alignment with university mission, strategic plan

The BMSE program at Wright State University is in strong alignment with all five points of the WSU Strategic Plan (2013-2018). For example Strategic Point 1 in the Wright State strategic plan is satisfied by the BMSE program's ABET accreditation since 1979, predating the College of Engineering and Computer Science. As another example Strategic Point 2 in the Wright State strategic plan is satisfied by the BMSE program successfully placing graduates into local and national engineering careers since this time.

Program distinctiveness

The Wright State BMSE undergraduate program is the only full BMSE undergraduate program in the greater Dayton Area. The program enjoys a uniquely close, collaborative relationship with Wright Patterson Air Force Base, which both benefits graduates of the program and can serve as a draw for students.

Recognitions of quality of the program

The BMSE program at Wright State University first received ABET accreditation in 1979, predating the College of Engineering and Computer Science. The program has continuously maintained accreditation since that date. Every accreditation cycle since 1979 resulted in an award of the maximum number of accreditation years (6 years).

Program learning outcomes

The BMSE program has adopted the ABET Student Learning Outcomes (SO) listed below:

(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 multidisciplinary 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, and
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Description of learning outcomes assessment program

The BMSE program utilizes four processes to evaluate student outcomes, 1) direct quantitative assessment of student work and prerequisite quiz performance in class, 2) exit interviews, 3) alumni surveys and 4) employer surveys. The Fundamentals of Engineering exam, which is often used to assess attainment of student objectives, is not germane to the BMSE program since none of the students took the exam prior to graduation. A range of viewpoints and techniques are being used in this assessment procedure, enhancing the credibility of the results.

Summary of assessment findings for past five years

Direct Assessment of Student Outcomes: Direct assessment of student outcomes is performed on a 2-year cycle. This assessment is meant to be statistically significant and quantitative, and covers all (a) through (k) student outcomes. Student success in each assessment is defined as 70% of students performing at a "satisfactory level" or better. Over the last academic year, the following student outcomes were assessed and are shown in Table MME5 below.

Table MME5: Material Science and Engineering Bachelors of Science Degree student outcome attainments in the direct assessment of student outcomes. Results show the percentage of students who met the student outcome.

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Overall Student Attainment	58%	100%	n/a	n/a	49%	n/a	100%	n/a	n/a	n/a	94%

Note that each attainment level represents the average of multiple assessment actions. The missing student outcomes will be assessed in the upcoming academic year in order to form a complete student outcome assessment. As multiple data sets accumulate, the sets will be used to identify changes in student success as a function of time, in addition to providing average student success rates.

Exit interviews: Upon graduation, seniors are interviewed to obtain their impressions about the BMSE program. They assess their preparation level in student outcomes (a) through (k), in addition to other areas. While this assessment is qualitative, the program has found this data to be highly predictive of changes needed in the program. Historically, BMSE students rate their level of preparation above 4.0 (out of 5) for 10 out of the 11 student outcomes. Student outcome (a) is historically rated at a level of 3.90.

Alumni Surveys: After 3-5 years in the workforce, graduates of the BSME program are surveyed again in order to assess if their impressions about their Wright State experience has been changed by their first years of employment. The most recent alumni survey results are shown in Table MME6 below.

Table MME6: Material Science and Engineering Bachelors of Science Degree alumni survey student outcome results. Results are on a 1 to 5 scale where 1 is poor and 5 is excellent.

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Importance to Graduates	4.0	4.3	3.3	4.8	4.0	4.4	4.6	2.8	4.1	3.4	4.1
Attainment at Wright State	4.3	4.1	4.0	3.8	4.0	3.5	4.1	2.9	3.8	3.1	4.3

Employer Surveys: Employers are also surveyed to assess the preparation level of Wright State BSME graduates. The most recent survey data is shown Table MME7 below.

Table MME7: Material Science and Engineering Bachelors of Science Degree employer survey of student outcomes. Results are on a 1 to 5 scale where 1 is poor and 5 is excellent.

Student Outcomes	a	b	c	d	e	f	g	h	i	j	k
Average Employer Evaluation	4.0	3.5	3.0	4.5	3.5	4.5	3.5	3.0	3.8	4.0	3.2

Major curricular changes since last review (or past five years)

A few of the curricular changes that have taken place in the past five years are given in Table MME8. The boxes in this table describe the action taken, the basis for the action, the date, the program outcomes addressed, and the result of the changes. Only a few of the changes are listed in these boxes. Many more changes were made in order to continually improve the BSME program. Major changes to the Materials Science and Engineering Bachelor's Degree program occurred during the semester transition in the fall of 2012. These changes can be seen in Table MME9. The old quarter based program is shown in the left-hand column, and the new semester based program is shown on the right-hand side column. Note that the hours on the quarter side are quarter credit hours and the hours on the semester side are semester credit hours.

Table MME8: Sampling of changes made to the Material Science and Engineering Bachelors of Science Degree program.

Action Taken: Creation of a new programming course – ME 102: Engineering Programming With Matlab and replaced EGR 153 - FORTRAN
Basis for Action: Students entering college very rarely have experience with command based interfacing with computers, having experienced only use of a GUI. The leap to a compiled language, such as FORTRAN, is steeper for today's students than 20 years ago. As a result Matlab was introduced into the curriculum as the conduit for teaching basic programming skills. ME 102 is a formal course in engineering programming with a primary focus on Matlab, but with an introduction to basic scripting

via Python and Unix for two weeks. Students learn programming logic, data structures, object oriented programming, and some basic numerical methods in this course. Exit interview data also revealed that the students in the department felt that it would have been beneficial to have Matlab programming.
Date: Winter 2009
Outcomes: (a), (k)
Results: Positive student feedback from exit interviews

Action Taken: Addition of numerous technical elective classes in renewable and clean energy
Basis for Action: Alternative sources of energy have become very important.
Date: Winter 2009
Results: Positive student feedback from exit interviews

Action Taken: Addition of a New technical elective course – ME 469: Computational Materials Science
Basis for Action: Computational techniques in BMSE are becoming important. Faculty with expertise in atomic/molecular scale simulation joined the department
Date: Winter 2009
Outcomes: (a), (k)
Results:

Action Taken: Increased ME 102: Engineering Programming With Matlab from 3 to 4 credit hours
Basis for Action: Faculty/student concerns with the limited time available to cover required content
Date: Spring 2009
Outcomes: (a), (k)
Results: Required content now being covered

Action Taken: Removal of EGR 190 – Engineering Fundamentals from curriculum
Basis for Action: This course evolved from an attempt in the late 1990s to engage freshman students in engineering projects. With the development of other freshman courses, such as EGR 101 and ME 199, this course was deemed to be unnecessary and eliminated from the curriculum. Exit interview feedback about this course was extremely poor.
Date: Fall 2009
Results: Reduction in number of credits required in the program

Action Taken: Improvement of lecture content in ME 490/491/492/493 – Engineering Design and Materials Engineering Design
Basis for Action: Students requested more industry related topics
Date: Winter 2010
Outcomes: (h), (i), (j)
Results: Positive student feedback from exit interviews

Table MME9: Changes in Material Science and Engineering Bachelors of Science degree program when the transition from quarters to semesters occurred in 2012.

College	**CECS**
Department	**Mechanical and Materials Engineering**
Degree (A.A. B.S., B.F.A., etc.) & Title	**BS**
Concentration, Track, Option, Specialization	**Materials Science and Engineering**

Quarter System Program	
	Hours
I. General Education	
Area 1: MTH 229, MTH 230, Eng 101, Eng 102	18
Area 2:	8
Area 3:	8
Area 4:	12
Area 5: PHY 240/200, 242/202, 244/204	16
Area 6 EGR 101	5
	67
II. Department Courses	
ME 199, 102, 202, 212, 213	19
ME 313, 314, 315, 370, 371, 375, 376	26
ME 496, 497, 470, 472, 479, 477, 480, 483, 492, 493	35
Processing	8
	88
III. CECS Courses	
EE 301/302	5
	5
IV. Other	
CHM 121	5
MTH 231, 232, 235	15
	20
V. Electives	
MRE 14 credit from approved list	14
	14
Total	**194**

Semester System Program	
	Hours
I. Wright State Core	
Communications: ENG 1100(3), EGR 3350(3)- Technical Communication for Engineers and Scientists	6
Mathematics: MTH 2300(4)	4
Global Traditions: 6 hours	6
Arts/Humanities: 3 hours	3
Social Science: 6 hours	6
Natural Science: PHY 2400(4)/PHY 2400L(1), PHY 2410(4)/PHY 2410L (1)	10
Additional Core Courses: EGR 1010(4), CHM 1210(3)/1210L(2), MTH 2310 (4)	13
	48
II. Department Courses	
ME 1020, 1030(2)	5
ME 2120, 3120, 2700, 2020	12
ME 3600, 3610 (2), 3750, 3760	11
ME 4700, 4720, 4730, 4740, 4750 (4), 4770	19
Senior Design, Choose one sequence: a) EGR 4910, 4920 b) ME 4910, 4920	6
	53
III. Materials Related Electives 2 from approved list	**6**
IV. Technical Elective 1 from approved list	**3**
V. CECS Courses EE 2010(3)/EE 2010L(1)	**4**
IV. Other MTH 2320(4), 2350(4)	**8**
Total	**122**

Graduate placement data, employer satisfaction

Graduate Placement: The undergrad BMSE program tracks the employment of recent graduates, although this information is voluntarily provided by graduating seniors and only a fraction of students provide this information. Historically, roughly 30% of graduating seniors indicate that they have immediate employment upon graduation, 20% of graduating seniors indicate that they are attending graduate school, and 50% do not respond to a request for an exit interview. A sampling of the employment obtained by some of our graduating seniors is given in Table MME10.

Employer Satisfaction: The employers of the graduates of the Mechanical and Materials Engineering (MME) Department were contacted between March and June 2011 to fill out a survey regarding the graduates. This survey included questions regarding the performance of the graduates in their career. The survey questions do not directly ask about the program's educational objectives, but can be related to the program's education objectives as indicated in the table below. Two employers participated in the survey and the results are shown in Table MME11. The results appear to indicate the attainment of the program educational objectives (PEO), but due to the small sample size it is difficult to make definite conclusions.

Professional Accreditation

In the most recent 2012 ABET accreditation cycle of the BMSE program, the final result was an award of a 6-year accreditation. This is the best outcome possible in an ABET accreditation reiew. The results of this accreditation process are shown in Figure MME2. Figure MME2 runs for five pages.

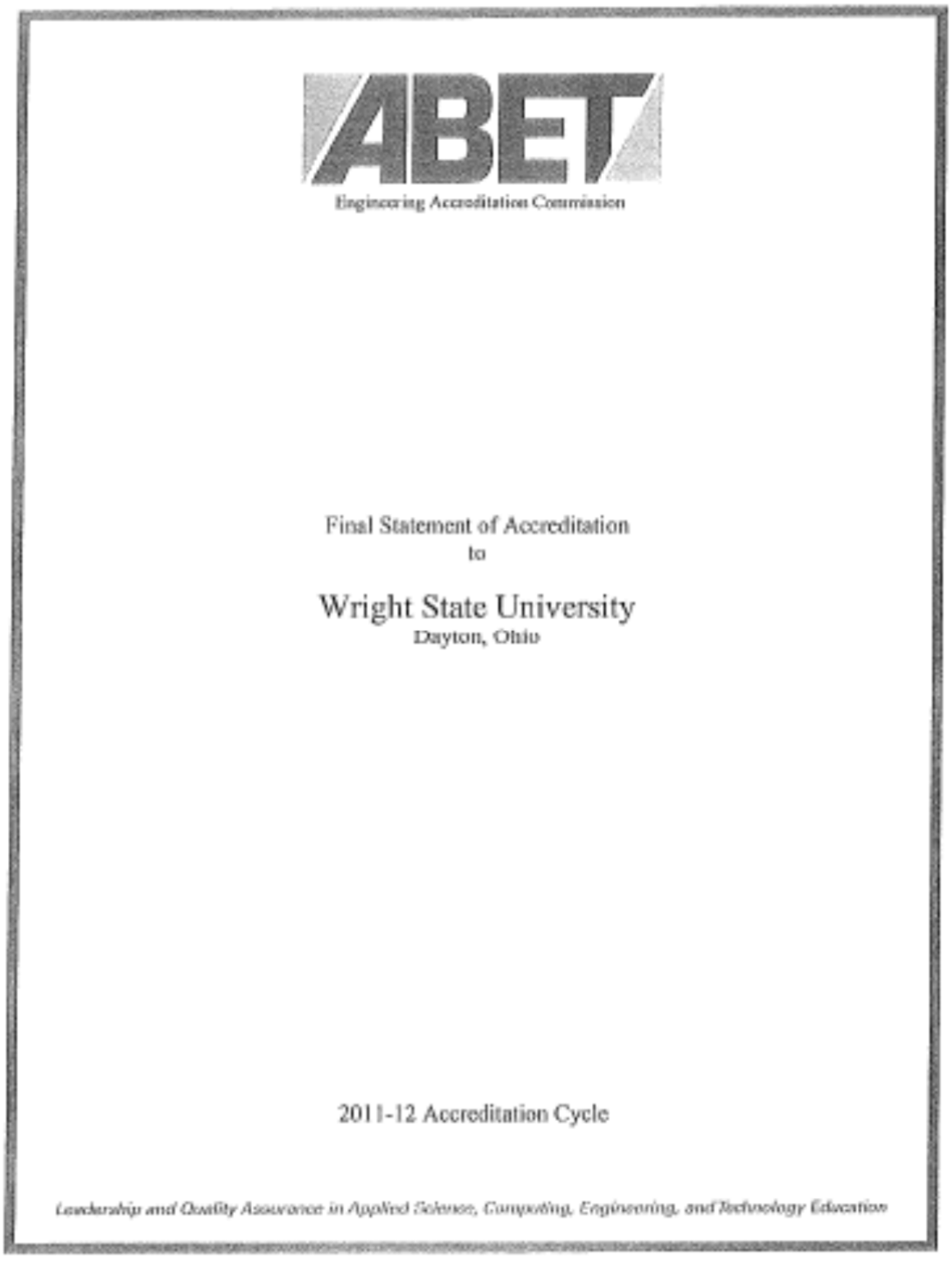
Table MME10: Sampling of BMSE graduates who obtained employment.

Quarter	Student	Employer	Salary
Winter 09	Gerald Malott	Applied Science Inc.	$37,500
Spring 09	Emily Smith	Wright Patterson Air Force Base	$60,000
Spring 09	David Beeler	Mound Laser and Photonics Center	$52,500
Winter 2011	Cory Knick	Grad School	
Spring 2011	Gregory Lewis	Trutec Industries	
Spring 2011	Kevin McReynolds	Grad School	
Spring 2011	Bradley Joseph	Nucor Steel Decatur	$58,000
Summer 2011	Casey Strope	Grad School	
Winter 2012	Jacob Crafton	MI Tech Metals	$53,000
Winter 2012	Craig Sheppard	Trutec Industries	$53,000
Spring 2012	Sara Knox	Grad School	
Spring 2012	Lisa Dewart	Trutec Industries	$48,000
Spring 2013	Taylor Hines	Wright Patterson Air Force Base	$59,000

Table MME11: Material Science and Engineering Bachelors of Science degree employer assessment of program outcomes. Results are on a 1 to 5 scale where 1 is poor and 5 is excellent.

	PEO Relation	Average Employer Response
MME graduate(s) can appropriately apply acquired knowledge.	2 and 3	4.0
MME graduate(s) works well with other people.	4	4.5
MME graduate(s) can effectively communicate ideas and technical information.	4	4.0
MME graduate(s) continues to learn and improve.	1	4.5
MME graduate(s) with advanced degree(s) contributes to the development of advanced concepts and leading edge technologies.	1	4.0
MME graduate(s) will have successful career(s) in industry, government, or academia.	1	4.0

Figure MME2: Most recent ABET accreditation findings and recommendations for the Materials Science and Engineering Bachelors of Science Degree. This figure continues for five pages.



ABET

Engineering Accreditation Commission

Final Statement of Accreditation
to

Wright State University
Dayton, Ohio

2011-12 Accreditation Cycle

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

Continue Figure MME2: Most recent ABET accreditation findings and recommendations for the Materials Science and Engineering Bachelors of Science Degree.

Materials Science and Engineering
Program

Introduction

The materials science and engineering program is one of the two undergraduate programs administered by the Mechanical and Materials Engineering Department. The material science and engineering program has seven faculty members, 44 undergraduate students and 22 graduate students. The program graduated six students in the most recent academic year and expects to graduate 10 students during the current academic year.

Program Strengths

1. The program provides exemplary advising services to students, which is critical to keep students on track for graduation as the university converts to a semester system. The Assistant to the Chair of the department serves as the undergraduate academic advisor, provides individualized guidance to transfer students, evaluates student performance, monitors student progress, advises students regarding curricular and career matters, and enforces procedures to ensure that students who graduate meet all graduation requirements.

2. The program faculty members have been instrumental in creating a welcoming and strong learning environment for students. Faculty members are accomplished and productive, balancing high quality instruction with cutting-edge research. Students are enthusiastic about, and appreciative of, the "hands-on" learning environment in the program.

3. The program is one of only three materials programs in Ohio and is strategically located adjacent to one of the largest materials science labs in the world at Wright Patterson Air Force Base. The program provides a path for student employment in advanced materials, a technology area identified as a key competitive opportunity by the Ohio Third Frontier Commission.

Continue Figure MME2: Most recent ABET accreditation findings and recommendations for the Materials Science and Engineering Bachelors of Science Degree.

Program Weaknesses

1. Criterion 2. Program Educational Objectives This criterion requires that a program have published program educational objectives that are consistent with the mission of the institution, the needs of the program's constituencies, and these criteria. It further requires that there be a documented and effective process, involving program constituencies, for the periodic review and revision of these program educational objectives. The program has a new set of educational objectives that were developed by the faculty and an accreditation consultant. There is a documented process for review and revision of the objectives, but it has not been fully implemented. The program lacks strength of compliance with this criterion.

   - Due-process response: The EAC acknowledges receipt of documentation related to the program educational objectives including a new process for review and revision of the program educational objectives. New program educational objectives have been generated by constituencies of the program. The new program educational objectives are more closely aligned with the definitions in the engineering criteria. The appointment of an assessment director at the college level and an assessment manager at the program level should help insure that the periodic process for review and revision remains active. At this time the review process has generated a single set of results, and it will be important for the program to demonstrate continued compliance with this criterion.

   - The weakness is now cited as a concern.

2. Criterion 4. Continuous Improvement This criterion requires the program to regularly use appropriate, documented processes for assessing and evaluating the extent to which both the program educational objectives and the student outcomes are being attained. The results of these evaluations must be systematically utilized as input for the continuous improvement of the program. The program has implemented a continuous improvement process using the results of assessment and evaluation of the extent to which program educational objectives and student outcomes are attained. However, the available data are mostly qualitative in nature, primarily gleaned from student exit surveys and alumni surveys. At the time of the visit the quantitative data gathered was not statistically valid due to the small number of

Continue Figure MME2: Most recent ABET accreditation findings and recommendations for the Materials Science and Engineering Bachelors of Science Degree.

students and alumni, and is of limited usefulness. Because the assessment and evaluation processes that are in place do not provide adequate information to inform the continuous improvement of the program, the program lacks strength of compliance with this criterion.

- Due-process response: The EAC acknowledges receipt of documentation related to continuous improvements in the program. Additional data from student outcome assessment has been used to stimulate improvements to the program. The program now has in place a process that will continue to assess student outcomes and will use that process to provide input for improvements in the program. In addition, as the assessment process for the attainment of program educational objectives proceeds the program expects to incorporate that assessment for continuous program improvement. At this time the review process has generated a single set of results, and it will be important for the program to demonstrate continued compliance with this criterion..

- The weakness is now cited as a concern..

Program Concern

1. Criterion 7. Facilities: This criterion requires that modern tools, equipment, computing resources, and laboratories appropriate to the program be available to enable students to attain program outcomes. The laboratories currently meet the needs of the program. However, the potential exists for the situation to change such that this criterion may not be satisfied due to lack of funding for replacement equipment. In particular, new teaching scanning and transmission electron microscopes, a corrosion lab, polymer and composite processing equipment, and laboratory supplies are needed to ensure future compliance with this criterion.

   - Due-process response: The EAC acknowledges receipt of documentation related to the program's laboratories. Several sources of funding from the state are available and sufficient lab supplies are available through an engineering technology fee. The dean has approved the acquisition of a scanning electron microscope for use by undergraduate students of the program.

Continue Figure MME2: Most recent ABET accreditation findings and recommendations for the Materials Science and Engineering Bachelors of Science Degree.

- The concern is resolved.

Program Observations

1. The majority of the major design projects in the MSE Program are high-quality. However, a consistent report format and perhaps faculty training is needed to ensure that the design experience is consistently excellent for all students.

2. An aggressive and targeted recruiting program is needed to publicize the opportunities that the MSE Program provides in order to increase enrollment.

3. Not all engineering undergraduates are currently required to take the "Introduction to Materials Science" course. In other universities, this course has been used as an effective career advisement tool to inform students about careers in materials science.

Program 3. Mechanical Engineering Master's Degree

Enrollment and Graduate History

Table MME12: Mechanical Engineering Master's Degree yearly enrollment and gradation numbers.

	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	55	55	47	53	50
Graduates	19	25	23	14	29

Program description

The Mechanical Engineering Master's Degree program is designed to produce, prepare and engage high quality mechanical engineers for work in government agencies and industry, for global competition in engineering research and development, for advanced studies, and for life-long learning in a rapidly changing technical environment. This program contains two track options for students to choose from: Design or Thermofluids. The Mechanical Design track includes advanced structural studies, advanced dynamic studies including vibrations, advanced design optimization techniques, and advanced computational methods. The Thermofluids track includes advanced thermodynamics, advanced fluid dynamics, advanced heat transfer, energy studies, and advanced computational techniques. Both thesis and non-thesis options are available to students.

Alignment with university mission, strategic plan

The Mechanical Engineering Master's Degree program is aligned with Wright State's Mission Statement and Strategic Plan which deals with solid foundations, innovative programs, scholarly research, community service, driving economic revitalization, and empowering students, faculty and staff. This program strives to provide a solid foundation for student success, thereby producing students who can continue on to develop and research the products and processes of the future; thus making the Miami Valley region more competitive in a global environment. A basic principle of this program is to encourage and instill in students the idea of life-long learning by obtaining advanced engineering certificates, attending workshops and conferences, publishing papers, etc. Additionally, this program embraces and supports the different backgrounds and cultures of our region, the state, and those of our students, faculty, and staff. In the Mechanical Engineering Master's Degree program research is not limited to the laboratory facilities on campus. Several industrial companies, laboratories, and Wright-Patterson Air Force Base are involved in joint research efforts with the university and have unique facilities that are available for faculty and graduate research. This collaboration is good for Wright State and for the surrounding region.

The faculty in the Mechanical Engineering program continuously monitor the progress of their students through exams, homework, and projects. Student work is carefully assessed and grades are given. Our diverse faculty and the diverse staff are available and willing to help our students to a successful completion of their degree. The faculty and staff reach out to incoming students by e-mail and web sites. Questions of incoming students are answered by the Chair of the Department, department faculty, the staff in the Mechanical and Materials Engineering Department, or the different

university offices, including the International Gateway office. At the present time the Mechanical Engineering Master's Degree program does not offer courses online.

Program distinctiveness

The Mechanical Engineering Master's Degree program is special in a number of ways. Some ways in which this program is special are:

1. this program provides evening classes to allow part time study towards a Mechanical Engineering Master's Degree,
2. both thesis and non-thesis options are available to students,
3. this program maintains a close working relationship with Wright Patterson Air Force Base and local industry,
4. the faculty and staff strongly encourage cultural diversity, and
5. an option exists for obtaining joint international master's degrees in Mechanical Engineering.

Recognitions of quality of the program

Some indications of the quality of the Mechanical Engineering Master's Degree program are:

1. many students from different parts of the world have or are enrolled,
2. large amounts of research funding has been obtained by faculty from both local and national granting agencies,
3. graduating students continuously provide positive feedback on the program through exit interviews,
4. there is strong support of this program from the Department's External Advisory Board, and
5. students who graduate from the program continuously get employment by local and distant industrial and governmental organizations.

Program learning outcomes

The learning outcomes of the Mechanical Engineering Master's Degree program are:

1. students must demonstrate an advanced understanding of the basic principles of mechanical engineering,
2. students must demonstrate engineering competency in one of two concentration areas: Design or Thermofluids,
3. students must recognize the need for life-long learning,
4. students must demonstrate their ability to communicate engineering ideas and techniques, and
5. students must demonstrate a mathematical competency above that of an undergraduate engineering student.

Description of learning outcomes assessment program

The learning outcomes of the Mechanical Engineering Master's Degree program are assessed by the following means.

1. Students must take and pass at least 9 credits of 7000 level classes in Mechanical Engineering. 7000 level classes at Wright State University are strictly graduate level

courses and are only taken by graduate students or a select few undergraduate students with special permission. Passing is determined by a rigorous regiment of faculty graded exams, projects, homework, etc.

2. Mechanical Engineering graduate students who take 6000 level courses, which are co-listed as undergraduate 4000 level courses, must complete an extra project or extra course work above that required of the undergraduate students. These projects are critically evaluated by the faculty member teaching the course.
3. Mechanical Engineering graduate students are required to take and pass at least 18 credit hours at the 7000 level. As mentioned above, 9 of these credits must be in Mechanical Engineering, the remaining 9 credits can be in Mechanical Engineering, other engineering fields, or computer science. Passing is determined by a rigorous regiment of faculty graded exams, projects, homework, etc.
4. Students must successfully complete three courses from one of the degree concentrations: Design or Thermofluids. The course choices for each of these concentrations are:
    a. <u>Design</u>
        i. ME 7100 - Advance Mechanics of Solids
        ii. 2 courses from the following:
            1. ME 7060 - Structural Reliability
            2. ME 7080 - Multidisciplinary Structural Optimization
            3. ME 7120 - Finite Element Method Applications
            4. ME 7160 - Nonlinear Dynamics & Vibration
            5. ME 7210 - Computational Methods in Structural Dynamics
            6. ME 7690 - Vibration Testing & Machine Health Monitoring
    b. <u>Thermofluids</u>
        i. 3 courses from the following:
            1. ME 7300 - Advanced Fluid Dynamics
            2. ME 7330 - Convective Heat & Mass Transfer
            3. ME 7340 - Advanced Computational Fluid Dynamics
            4. ME 7500 - Advanced Thermodynamics
            5. ME 7520 - Hydrogen Energy
            6. ME 7550 – Photovoltaics

    Successful completion of three of these courses is determined by a rigorous regiment of faculty graded exams, projects, homework, etc.
5. In class projects and thesis projects instill in students the need for life-long learning.
6. Students either write a thesis or complete substitute coursework. Each of these options are critically evaluated by faculty members.
7. Students must take and pass one graduate level math course as part of the Mechanical Engineering Master's Degree program. Passing is determined by a rigorous regiment of faculty graded exams and homework.
8. We perform exit interviews of our graduates. Verbal and written information is collected on different aspects of the graduate programs in the Mechanical and Materials Engineering Department. Results are presented in the next section of this report.
9. The External Advisory Board provides feedback on the performance of the Department of Mechanical and Materials Engineering and of the programs housed

in that department. This provides information on the rigor and relevancy of the program.

10. We try to track where our graduates find employment. Results are presented in the "Graduate placement data, employer satisfaction" section of this report.

Summary of assessment findings for past five years

The findings of the assessment program for the Mechanical Engineering Program are listed below. The numbers used below match the numbering used in the questions above that describe the assessment tools. The findings are:

1. All students who graduate pass at least 9 credits of 7000 level classes in Mechanical Engineering. Students who do not pass these courses do not graduate.
2. Most Mechanical Engineering graduate students who take 6000 level courses, which are co-listed as undergraduate 4000 level courses, complete an extra project or extra course work above that required of the undergraduate students. Grades on these projects range from low to high.
3. All Mechanical Engineering graduate students take and pass at least 18 credits hours at the 7000 level.
    a. All Mechanical Engineering graduate students successfully complete three courses from one of the degree concentrations: Design or Thermofluids.
4. All Mechanical Engineering graduate students are exposed to in class projects or thesis projects that instill in them the need for life-long learning. All students recognize that their educations do not cover everything they will need in the Mechanical Engineering profession. They also recognize that technology is changing and they must keep abreast of these changes.
5. All Mechanical Engineering graduate students either write a thesis or complete substitute coursework. These must receive a passing evaluation or grade from faculty members in order for the student to graduate.
6. All Mechanical Engineering graduate students take and pass one graduate level math course as part of the Mechanical Engineering Master's Degree program. This graduate math course is critically evaluated by graded exams and homework.
7. Below are results from our exit interviews. These data are for the whole Mechanical and Materials Engineering Department which include the Mechanical, Materials, and Renewable and Clean Energy students. Since students from the Mechanical Engineering Master's Degree are the majority of students that take the survey, the results best represent this program. The most recent student comments to the exit interview in abbreviated from are shown below.
    a. Students comments on good and bad aspects of graduate programs
        - Most positive experiences
            - Research projects
            - Useful skills learned
            - Interactions with industry
            - Real problem solving
            - Cross-registration using DAGSI & SOCHE
            - Small classes
            - Went deeper into the subject

        - Teaching quality
        - Level of professionalism with faculty and staff
        - Research work at AFRL
        - High level project courses
        - Good Thesis Advising
        - Assistantship experience
        - Presenting at conferences
    - Most negative experiences
        - Not easy
        - Cooperative ability
        - Design track courses
        - FEM courses
        - Math courses
        - Lack of flexibility
        - New energy courses for faculty
        - Too few classes offered
        - Not as strong (MT)
        - Need to cater to industry, not just Air Force
        - Advisor too busy
        - Need more materials equip & in-depth courses in Materials Science and Engineering
        - Energy job market not good
        - Need new student orientation
        - Undergraduate education elsewhere not good prep
        - Scheduling challenges for working students

b. Students comments on facilities
    - Positive comments
        - Machine shop
        - Good labs
        - Good computer labs
        - Great student network
        - Get help easily – helpful staff
        - Flexible hours
        - Small classes
        - Good software
    - Negative comments
        - Space
        - Air conditioner in open lab
        - Need supercomputer
        - Machines in the lab not working
        - Need distance learning classes
        - Open computer labs are dirty
        - Teaching assistants
        - Not enough peers
        - Little experimental equipment

c. Overall student impressions
   - Great
   - Need more opportunities to get jobs
   - Need to increase reputation
   - Faculty are very good
   - Prepared me for satisfying and enjoyable career
   - Ability to take University of Dayton and AFIT courses
   - Some Wright State drop outs go to the University of Dayton
   - Good Professors
   - Good students
   - Culture is shifting, keep going
   - Getting better and better – keep growing!
   - Networking
   - Courses are direct and focused for research
   - Satisfied, good experience
   - An excellent program
   - Other buildings more artsy/modern (this comment was made prior to our remodeling work)
   - More divisions between engineering fields would allow more focused approach

8. Formal and informal responses from the External Advisory Board indicate that the Mechanical Engineering Master's Degree program is delivering good graduates to the region and that graduates are relevant and well trained.
9. Employment results are presented in the "Graduate placement data, employer satisfaction" section.

Major curricular changes since last review (or past five years)

In 2012, the university converted from quarters to semesters. This conversion resulted in a complete review of the Mechanical Engineering Master's Degree program requirements and course offerings. Specific changes can be found in Table MME13 for the Design track and Table MME14 for the Thermofluids track.

Graduate placement data, employer satisfaction

Graduates from the past five years were surveyed regarding their current employment status. Fifty-five graduates responded and are employed by forty companies/institutions. The average salary is $61,500 for those who responded. A sample of employment information for the Mechanical Engineering Master's Degree program is shown in Table MME15.

If program has professional accreditation, attach most recent review findings and recommendations

This program does not require professional accreditation and does not have a professional accreditation.

Table MME13: Changes in Mechanical Engineering Master's Degree program for the Design track when the transition from quarters to semesters occurred in 2012.

College			**College of Engineering and Computer Science**	
Department			**Department of Mechanical and Materials Engineering**	
Degree (A.A. B.S., B.F.A., etc.) & Title			**Master of Science in Mechanical Engineering**	
Concentration, Track, Option, Specialization			**Mechanical Engineering: Design**	
Quarter System Program			**Semester System Program**	
	Hours			**Hours**
I. Core Courses Design - ME 710 – Computational Methods in Structural Dynamics - ME 712 – Finite Element Method Applications - ME 720 – Advanced Mechanics of Solids *Sub-total*	 4.0 4.0 4.0 *12.0*		**I. Core Courses** Design - ME 7100 – Advanced Mechanics of Solids Must choose two courses from the list below. - ME 7060 – Structural Reliability - ME 7080 – Multidisciplinary Structural Optimization - ME 7120 – Finite Element Method Applications - ME 7160 – Nonlinear Dynamics and Vibration - ME 7210 – Computational Methods in Structural Dynamics - ME 7690 – Vibration Testing and Machine Health Monitoring *Sub-total*	 3.0 3.0 3.0 3.0 3.0 3.0 3.0 *9.0*
II. Math courses - MTH 504 – Advanced Engineering Mathematics I - MTH 505 – Advanced Engineering Mathematics II *Sub-total*	 3.0 3.0 *6.0*		**II. Math course** - MTH 5040 – Advanced Engineering Mathematics *Sub-total*	 3.0 *3.0*
III. Elective courses Elective courses at the graduate level. *Sub-total*	 15.0 *15.0*		**III. Elective courses** Elective courses at the graduate level. *Sub-total*	 9.0 *9.0*
IV. Thesis or Non-Thesis Option Thesis Option - ME 899 – Master's Thesis Non-Thesis Option - Additional 700 level courses Students who elect to do the non-thesis option must replace thesis credits with graduate level courses. *Sub-total*	 12.0 12.0 *12.0*		**IV. Thesis or Non Thesis Option** Thesis Option - ME 79XX –Master's Thesis Non-Thesis Option - Additional 7000 level courses Students who elect to do the non-thesis option must replace thesis credits with additional graduate courses at the 7000 level, with an option to take an independent project of up to 3 credits. *Sub-total*	 9.0 9.0 *9.0*
Total	45.0		**Total**	30.0
- A maximum of 15 credit hours of 600 level elective courses will be accepted towards the degree requirements.			- A maximum of 9 credit hours of 6000 level elective courses will be accepted towards the degree requirements. 30.0	

Table MME14: Changes in Mechanical Engineering Master's Degree program for the Thermofluids track when the transition from quarters to semesters occurred in 2012.

College	**College of Engineering and Computer Science**
Department	**Department of Mechanical and Materials Engineering**
Degree (A.A. B.S., B.F.A., etc.) & Title	**Master of Science in Mechanical Engineering**
Concentration, Track, Option, Specialization	**Mechanical Engineering: Thermal-Fluids**

Quarter System Program		**Semester System Program**	
	Hours		**Hours**
II. Core Courses Thermofluids - ME 734 – Advanced Computational Fluid Dynamics - ME 736 – Convective Heat and Mass Transfer - ME 744 – Advanced Thermodynamics *Sub-total*	4.0 4.0 4.0 *12.0*	**I. Core Courses** Must choose three courses from the list below. Thermofluids - ME 7300 – Advanced Fluid Dynamics - ME 7330 – Convective Heat and Mass Transfer - ME 7340 – Advanced Computational Fluid Dynamics - ME 7500 – Advanced Thermodynamics - ME 7520 – Hydrogen Energy - ME 7550 – Photovoltaics *Sub-total*	3.0 3.0 3.0 3.0 3.0 3.0 *9.0*
II. Math courses - MTH 504 – Advanced Engineering Mathematics I - MTH 505 – Advanced Engineering Mathematics II *Sub-total*	3.0 3.0 *6.0*	**III. Math course** - MTH 5040 – Advanced Engineering Mathematics *Sub-total*	3.0 *3.0*
IV. Elective courses Elective courses at the graduate level. *Sub-total*	15.0 *15.0*	**IV. Elective courses** Elective courses at the graduate level. *Sub-total*	9.0 *9.0*
V. Thesis or Non-Thesis Option Thesis Option - ME 899 – Master's Thesis Non-Thesis Option - Additional 700 level courses Students who elect to do the non-thesis option must replace thesis credits with graduate level courses. *Sub-total*	12.0 12.0 *12.0*	**V. Thesis or Non Thesis Option** Thesis Option - ME 79XX –Master's Thesis Non-Thesis Option - Additional 7000 level courses Students who elect to do the non-thesis option must replace thesis credits with additional graduate courses at the 7000 level, with an option to take an independent project of up to 3 credits. *Sub-total*	9.0 9.0 *9.0*
Total	45.0	**Total**	30.0
- A maximum of 15 credit hours of 600 level elective courses will be accepted towards the degree requirements. 45.0		- A maximum of 9 credit hours of 6000 level elective courses will be accepted towards the degree requirements. 30.0	

Table MME15: Sample of Mechanical Engineering Master's degree student employment data.

FIRST NAME	LAST NAME	TITLE	COMPANY	SALARY RANGE
Karjada	Aithala		Caterpillar, Inc.	40K
Caleb	Barnes	Aerospace Research Engineer	Wright Patt Air Force Base	60K
Joseph	Beck	Aerospace Engineer	Wright Patt Air Force Base	
Asela	Wadumesthrige		Tenneco Automotive	75K
Aaron	Blake	Program Manager	UES, Inc	
Aron	Brezina	Certification Engineer	Belcan Technologies	
Girish	Byrappa	Quality engineer	American Metal Technologies	
Alex	Byrd	Teaching Assistant	Wright State University	62K
Jace	Carter	Structural Analyst	Rolls-Royce	
Michael	Corbett	Senior Engineer	Bihrel Applied Research	75K
Jeffery	Cousineau	OPW-Engineered Systems	OPW-Engineer	
Jaderic	Dawson		Wright Patt Air Force Base	54K
Heather	Doak	Research Scientist	Mound Laser & Photonics Center, Inc.	
Scott	Eastborn		The Spaceship Co.	70K
Benjamin	Florkey	Materials Engineer II	Tri-Tech Associates, Inc	42K
Samuel	Freund		Currently looking for position	
Awsantha	Ganesan		American Metal Technologies	40K
Zach	Gaston	Senior Engineer	GoHypersonic, Inc.	77K
Dan	Gorsky	Senior Aerospace engineer	Caterpillar, Inc.	62K
Charles	Hall	Certification Engineer	Boeing	
Jantzen	Hinton	Structures Engineer	Goodrich AWB	
Shih Kang	Huang	Research Assistant of MAV Dynamic Air Flow	Wright State University	
Parshanth	Kumaraswamy	Mechanical Design Engineer	F Tech R&D North American	
Jamie	Larios-Barbosa		United States Air Force	
Hao	Li	PhD Candidate	Wright State University	
Zhe	Lin	Mechanical Engineer	WCR Heat Exchangers	
David	Loel	Senior Engineer	APR Consultants	60K
(Tony) Shup	Mao	Technical & Production Engineer	Stego Saws, Inc	
Josh	Mark	F135 Lead Engineer	United States Air Force	
Zaheer Ali	Mashraque	Project Lead	Moriroku Technology North America	
Joshua	Moore	Operations Manager	United States Air Force	
Vidadhara	Nagendra	Stress Analysis Engineer (level 2)	Chrysler Group	
Brian	Nicholson	Mechanical Engineer	Air Force Research Laboratory	
Erik	Pakulski	Mechanical Engineer		
Steve	Palluconi	Research Engineer	Innovative Scientific Solutions, Inc.	
Bryan	Penkal	Design Engineer	Emerson Process	77K

			Management	
Melanie	Peterson	Graduate Student	University of Toledo	
Brad	Pollock	PhD Candidate	United States Air Force	
Huiying	Ren	Post-Master Research Associate	Pacific Northwest National Laboratory	
David	Roe	System Engineer	Meggitt Aircraft Braking System	
Todd	Smith	Research Engineer	Air Force Research Laboratory	
Shreyas Vathul	Subramanian	Graduate Research Assistant	Purdue University	
Chanchal	Thakur	Manufacturing Engineer	American Metal Technologies	
Michael	Thomas	Project Engineer II	Stole Machinery	
John	Thompson	Senior Engineer	Emerson Climate Technologies	
Randy	Tobe	Engineer/Technologist	GE Aviation	
John	Van Oss	Dynamics Engineer	UTC Aerospace Systems	
Anup Gopal	Vappala	Senior Software Engineer	Accenture Services Private Limited	
Ryan	Vogel	Mechanical Engineer	United States Air Force	70K
Zachary	Votaw	Graduate Research Assistant	Wright State University	
Zhixin	Wang	Research Assistant	Wright State University	
Jessica	Webb	Research Engineer	Innovative Scientific Solutions, Inc.	
Masound	Zarepoor	Graduate Research Assistant	Old Dominion University	
Dongning	Zhao	Mechanical Engineer	Super ATV	45K
Fang (Frida)	Zong	Mechanical Engineer	Circuits and Cables, Inc.	

Program 4. Materials Science and Engineering Master's Degree

Enrollment and Graduate History

Table MME16: Materials Science and Engineering Master's degree yearly enrollment and gradation numbers.

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	11	21	19	11	9
Graduates	4	6	6	3	4

Program description

The Materials Science and Engineering Master's Degree program is broad in scope, emphasizing the interdisciplinary nature of the field of materials science and engineering. The program is built around processing, structure, properties, and performance of advanced materials relevant to numerous areas of application, such as energy, biomedical, aerospace, environmental, and manufacturing. Students are required to take three of six core courses. In addition, students take at least one advanced math course and several graduate level elective courses. There are two options: 1) a thesis option which involves original, creative research under the supervision of a faculty member, and 2) a non-thesis option which involves taking three additional graduate courses in lieu of thesis work. The intent of the program is to train the next generation of materials scientists and engineers to become active learners, researchers, and meaningful contributors in this field.

Alignment with university mission, strategic plan

The Materials Science and Engineering Master's Degree Program is designed to transform the students it teaches from undergraduate degree recipients in Engineering and Science into materials experts who are truly capable of bridging the gap between science and engineering to enable discovery, modification, and adaptation of materials for the greater benefit of society. The aim is to build a solid foundation in our students so that they become capable of handling challenging problems and excelling in future professional careers. This aligns with Wright State's Mission Statement to develop solid foundations in its students, deliver innovative programs, perform scholarly research, perform community service, deliver driving economic revitalization, and empower students, faculty and staff.

Program distinctiveness

This program is distinctive because it offers the following advantages for its students:

1. High level of cross-disciplinary collaboration: Faculty in this program come from a variety of Science and Engineering backgrounds (Physics, Chemistry, Metallurgical Engineering, Civil Engineering etc.) and actively collaborate with experts in the fields of Mechanical, Thermal, Structural, Biomedical, Optical, Chemical and Environmental Engineering.
2. High levels of cross-institutional exposure for students: Through co-op employment, co-advising, collaborative funding, and student sharing arrangements, our students are routinely engaged with multiple external organizations including

the Air Force Research Laboratory (AFRL), Environmental Protection Agency (EPA), aerospace, consumer products companies and chemical/metallurgical companies, as well as several national and international universities.

3. In addition to the rich diversity of faculty background mentioned earlier, this program boasts a large number of senior level scientists from AFRL and other organizations that serve as adjunct faculty.
4. Students have very easy access to a large variety of cutting edge research facilities related to materials fabrication, characterization and property evaluation. This includes facilities obtained by faculty members, as well as creative facility sharing arrangements with nearby federal laboratories that have close and sustained collaboration with the Materials Science and Engineering program faculty.

Recognitions of quality of the program

The uniqueness and quality of this program have been recognized by:

1. the media coverage received by students, faculty and alumni of this program,
2. the large number of archival publications coauthored by students in this program,
3. competitive grants received by the faculty in this program,
4. faculty in this program that are invited by leading publishers to author books,
5. faculty in this program serving on editorial boards of leading journals, assuming leadership roles and being elected as fellows in national and international professional societies, and
6. alumni from this program placed in leadership roles and receiving awards.

Program learning outcomes

The learning outcomes of the Materials Science and Engineering Master's program are:

1. Critical thinking and problem solving: Students will be able to think critically, creatively and have the ability to identify and solve problems in Materials Science and Engineering.
2. Knowledge and scholarship: Students will be able to pursue scholarship or creative endeavors, and conduct some degree of independent research.
3. Professional Development: Students will be able to demonstrate attributes of professional development consistent with expectations within this discipline.
4. Communication: Students will be able to effectively communicate scientific and engineering ideas and developments.
5. Math knowledge: Students must demonstrate a mathematical competency above that of an undergraduate engineering student.

Description of learning outcomes assessment program

The learning outcomes of the Materials Science and Engineering Master's Degree program are assessed by the following means.

1. Students must take and pass at least 9 credits of 7000 level classes in Materials Science and Engineering. 7000 level classes at Wright State University are strictly graduate level courses and are only taken by graduate students, or a select few undergraduate students with special permission. Passing is determined by a rigorous regiment of faculty graded exams, projects, homework, etc.

2. Materials Science and Engineering graduate students who take 6000 level courses, which are co-listed as undergraduate 4000 level courses, must complete an extra project or extra course work above that required of the undergraduate students. These projects are critically evaluated by the faculty member teaching the course.
3. Materials Science and Engineering graduate students are required to take and pass at least 18 credit hours at the 7000 level. As mentioned above, 9 of these credits must be in the core Materials Science and Engineering requirements; the remaining 9 credits can be in Materials Science and Engineering, other engineering fields, or computer science. Passing is determined by a rigorous regiment of faculty graded exams, projects, homework, etc.
4. Thesis projects, in class projects, and other research experiences provide students with abilities to pursue scholarship, creative endeavors, and independent research.
5. Many students present their research at local, national, or international conferences.
6. Students either write a thesis, do research reports, or do project reports.
7. Students must take and pass one graduate level math course as part of the Material Science and Engineering Master's Degree program. Passing is determined by a rigorous regiment of faculty graded exams and homework.
8. We perform exit interviews of our graduates. Verbal and written information is collected on different aspects of the graduate programs in the Mechanical and Materials Engineering Department. Results are presented in the next section.
9. The External Advisory Board for the department provides feedback on the performance of the Department of Mechanical and Materials Engineering and of the programs housed in that department. This provides information on the rigor and relevancy of the programs and whether our students are obtaining the proper knowledge, whether our students are critical thinkers, and whether our students can perform in a research setting.
10. We try to track where our graduates find employment. Results are presented in the "Graduate placement data, employer satisfaction" section.

Summary of assessment findings for past five years

The findings of the assessment program for the Materials Science and Engineering Program are listed below. The numbers used below match the numbering used in the questions above that describe the assessment tools. The findings are:

1. All Materials Science and Engineering Master's students who graduate take and pass at least 9 credits of 7000 level classes in Materials Science and Engineering. 7000 level classes at Wright State University are strictly graduate level courses and are only taken by graduate students or a select few undergraduate students with special permission. Passing is determined by a rigorous regiment of faculty graded exams, projects, homework, etc.
2. Most Materials Science and Engineering graduate students take 6000 levels courses and complete an extra project or extra course work above that required of the undergraduate students. The results of evaluation of this work range from poor to very good.

3. All Materials Science and Engineering Masters students who gradaute take and pass at least 18 credit hours at the 7000 level. Passing is determined by a rigorous regiment of faculty graded exams, projects, homework, etc.
4. Most of our students do thesis projects which are critically evaluated by a committee of three faculty members. For those students who do not do a thesis project, they develop scholarship and creative skills though class projects and other research experiences provided by Wright State. The evaluation of our theses and theses defense is considered high quality.
5. A large number of students get to present their work at local, national, and international conferences. This is indicates acceptance of the quality of work done in the Materials Science and Engineering Master's Degree program. There are two engineering conferences in Dayton each year. One of these conferences is at Wright State University and the other is at a local hotel. One conference is organized by the local ASME branch and the other is organized by the local AIAA branch. A majority of our Materials Science and Engineering Master's Degree students present at these two conferences.
6. All Materials Science and Engineering Master's Degree students either write a thesis or complete substitute coursework. These are critically evaluated by faculty members. The thesis and the thesis defense must receive a passing evaluation for the student to graduate.
7. All Materials Science and Engineering Master's Degree students who graduate take and pass one graduate level math course. In order to pass this course the student must perform at an acceptable level on graded tests and homework.
8. Below are results from our exit interviews. These data are for the whole Mechanical and Materials Engineering Department which includes the Mechanical, Materials, and Renewable and Clean Energy students. These results include Materials Science and Engineering Master's students, but are dominated by Mechanical Engineering Master's students. The most recent student comments to the exit interview in abbreviated from are shown below.
    d. Students comments on good and bad aspects of graduate programs
        - Most positive experiences
            - Research projects
            - Useful skills learned
            - Interactions with industry
            - Real problem solving
            - Cross-registration using DAGSI & SOCHE
            - Small classes
            - Went deeper into the subject
            - Teaching quality
            - Level of professionalism with faculty and staff
            - Research work at AFRL
            - High level project courses
            - Good Thesis Advising
            - Assistantship experience

        - Presenting at conferences
    - Most negative experiences
        - Not easy
        - Cooperative ability
        - Design track courses
        - FEM courses
        - Math courses
        - Lack of flexibility
        - New energy courses for faculty
        - Too few classes offered
        - Materials Science and Engineering Master's Degree program not as strong
        - Need to cater to industry, not just Air Force
        - Advisor too busy
        - Need more materials equip & in-depth courses in Materials Science and Engineering
        - Energy job market not good
        - Need new student orientation
        - Undergraduate education elsewhere not good prep
        - Scheduling challenges for working students

e. Students comments on facilities
    - Positive comments
        - Machine shop
        - Good labs
        - Good computer labs
        - Great student network
        - Get help easily – helpful staff
        - Flexible hours
        - Small classes
        - Good software
    - Negative comments
        - Space
        - Air conditioner in open lab
        - Need supercomputer
        - Machines in the lab not working
        - Need distance learning classes
        - Open computer labs are dirty
        - Teaching assistants
        - Not enough peers
        - Little experimental equipment

f. Overall student impressions
    - Great
    - Need more opportunities to get jobs
    - Need to increase reputation
    - Faculty are very good

- Prepared me for satisfying and enjoyable career
- Ability to take University of Dayton and AFIT courses
- Some Wright State drop outs go to the University of Dayton
- Good Professors
- Good students
- Culture is shifting, keep going
- Getting better and better – keep growing!
- Networking
- Courses are direct and focused for research
- Satisfied, good experience
- An excellent program
- Other buildings more artsy/modern (this comment was made prior to our remodeling work)
- More divisions between engineering fields would allow more focused approach

9. Feedback from the Department of Mechanical and Materials External Advisory Board is generally positive on the Material Science and Engineering Master's Degree program. This advisory board has provided a number of helpful suggestions for improving this program.
10. We try to track where our graduates find employment. Results are presented in the "Graduate placement data, employer satisfaction" section.

Major curricular changes since last review (or past five years)

In 2012, Wright State University converted from quarters to semesters. This conversion resulted in a complete review of the Materials Science and Engineering Master's Degree program requirements and course offerings. Specific changes made can be found in Table MME17. This adjustment to our program has given students more flexibility in designing their program of study.

In the last five years the following new courses have been developed and added to the courses offered in the Materials Science and Engineering Master's Degree program:

1. ME 6680: Experimental Nanotechnology,
2. ME 6850: Nanoscale Science and Engineering,
3. ME 7730 Advanced Physical Properties, and
4. ME 7750 Advanced Engineering Materials.

Graduate placement data, employer satisfaction

Essentially all graduates from the Materials Science and Engineering Master's Degree program find employment. A sample of employment information for the Materials Science and Engineering Master's Degree program is shown in Table MME18.

If program has professional accreditation, attach most recent review findings and recommendations

This program does not require professional accreditation and does not have a professional accreditation.

Table MME17: Changes in Materials Science and Engineering Master's degree when the transition from quarters to semesters occurred in 2012.

College	**College of Engineering and Computer Science**
Department	**Department of Mechanical and Materials Engineering**
Degree (A.A. B.S., B.F.A., etc.) & Title	**Master of Science in Engineering**
Concentration, Track, Option, Specialization	**Materials Science and Engineering**

Quarter System Program	**Hours**
I. Core Courses	
Materials	
- ME 760 – Thermodynamics of Solids	4.0
- ME 762 – Transformation in Solids I	4.0
- ME 772 – Physical Polymer Science	4.0
- ME 783 – Ceramics for Advanced Applications	4.0
Sub-total	*16.0*
II. Math courses	
- MTH 504 – Advanced Engineering Mathematics I	3.0
- MTH 505 – Advanced Engineering Mathematics II	3.0
Sub-total	*6.0*
III. Elective courses	
Elective courses at the graduate level	11.0
Sub-total	*11.0*
IV. Thesis or Non-Thesis Option	
Thesis Option	
- ME 899 – Master's Thesis	12.0
Non-Thesis Option	
- Additional 700 level courses	12.0
Students who elect to do the non-thesis option must replace thesis credits with graduate level courses.	
Sub-total	*12.0*
Total	45.0
- A maximum of 15 credit hours of 600 level elective courses will be accepted towards the degree requirements.	

Semester System Program	**Hours**
I. Core Courses	
Must choose three courses from the list below.	
Materials	
- ME 7500 – Advanced Thermodynamics	3.0
- ME 7780 – Ceramics for Advanced Applications	3.0
- ME 7760 – Transformation of Solids I	3.0
- ME 7750 – Advanced Engineering Materials	3.0
- ME 7720 – Engineering Polymers II	3.0
- ME 7730 – Advanced Physical Properties	3.0
Sub-total	*9.0*
II. Math course	
- MTH 5040 – Advanced Engineering Mathematics	3.0
Sub-total	*3.0*
III. Elective courses	
Elective courses at the graduate level	9.0
Sub-total	*9.0*
IV. Thesis or Non Thesis Option	
Thesis Option	
- ME 79XX –Master's Thesis	9.0
Non-Thesis Option	
- Additional 7000 level courses	9.0
Students who elect to do the non-thesis option must replace thesis credits with additional graduate courses at the 7000 level, with an option to take an independent project of up to 3 credits.	
Sub-total	*9.0*
Total	30.0
- A maximum of 9 credit hours of 6000 level elective courses will be accepted towards the degree requirements.	

Table MME18: Sample of Materials Science and Engineering Master's Degree student employment data.

FIRST NAME	LAST NAME	TITLE	COMPANY	SALARY RANGE
Elizabeth	Maurer	Research Scientist Materials Characterization Specialist	AFRL	
Joshua	Shearer	Business Manager	Air Force Research Laboratory	
David	Beeler	Sovereign of Solutions, LLC	Dafinity Solutions, LLC	
Dewei	Guan	Mechanical Engineer	Enterex America	
John	Holtkamp	Alternative Energy	ESL Teacher	
Sarah	Payne	Quality engineer	Faurecia	
Cory	Knick	Research Engineer	General Technical Services	
Guanglin (Lucas)	Cheng	Material Engineer	Photographer	
Anil Kumar	Karumuri	EUV Lithography	SEMATECH	
Adam	Maleszewski	Sales Engineer	SLECO	
Casey	Holycross	Graduate Research Assistant	The Ohio State University	
Nicholas	Garvin	Propulsion engineer	UES, Inc	
Michael	Tyrchniewicz		USUI International Group	73K
Hema	Vijwani	PhD Candidate	Wright State University	
Zhuo	Yao	Research Assistant	Wright State University	

Program 5. Renewable and Clean Energy Engineering Master's Degree

Enrollment and Graduate History

Table MME19: Renewable and Clean Energy Engineering Master's degree yearly enrollment and gradation numbers.

	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	11	21	19	11	10
Graduates	1	5	5	4	6

Program description

The intent of the Renewable and Clean Energy Master's Degree Program is to train the next generation of renewable and clean energy engineers and to develop research in the area of renewable and clean energy. Many types of renewable and clean energy topics are covered in the program. The program is designed to instill the fundamentals of energy and energy conversion in the students through courses such as Advanced Thermodynamics, Energy Conversion, and Energy Materials. To instill specific details on specific renewable and clean energy topics, the students must take three classes from a list of 22 renewable and clean energy courses. Included in this program are courses on fuel cells, solar thermal energy, solar electric energy, wind power, hydrogen fuel, geothermal energy, hydropower, etc. The program has both thesis and non-thesis options. All non-thesis students must complete a 3 credit, independent study project course.

Alignment with university mission, strategic plan

The Renewable and Clean Energy Master's Degree Program is aligned with Wright State's Mission Statement and Strategic Plan which deals with solid foundations, innovative programs, scholarly research, community service, driving economic revitalization, and empowering students, faculty and staff. The Renewable and Clean Energy Master's Degree Program is designed to transform the students it teaches from engineers and scientist with undergraduate degrees in Mechanical Engineering, Electrical Engineering, Chemical Engineering, Biomedical Engineering, Civil Engineering, Physics, Mathematics, and other engineering and science disciplines, into engineers at the Master's level that can deal with the technical issues and problems present in the renewable and clean energy field. In the training of these students, we hope to grow the renewable and clean energy field into one that is more competitive. We aim to build a solid foundation in our students to handle many types of engineering problems in energy through a creative and high-quality program. In addition to developing the renewable and clean energy engineers for this up and coming industry, we want to further the advancement of renewable and clean energy through scholarly and creative research.

The faculty in the Renewable and Clean Energy Program continuously monitor the progress of their students through exams, homework, projects, mentoring, etc. Student work and progress is carefully assessed and grades and feedback are given. Our diverse faculty and the diverse staff of the Mechanical and Materials Engineering Department are available and willing to help our students to a successful completion of their degree. The faculty and staff reach out to incoming students by e-mail and web sites. Questions of incoming students are answered by Dr. Menart, the staff in the Mechanical and Materials Engineering Department, or the different university offices, including the International

Gateway office. At the present time the Renewable and Clean Energy Program does not offer its courses online, but the hope is to do this sometime in the next three years.

The faculty and the students of the Renewable and Clean Energy Program currently engage in research and academic scholarship at many levels. Research includes both funded and unfunded research. Students in the program do research at the Master's Thesis level, the course project level where the entire course is dedicated to a single research or design project, and at the class project level where a miniature project is given that amounts to 10 or 20% of the course grade. We have not commercialized any products from the program at this time, but we have responded to community partners through joint projects. It is hoped that commercial products will be developed in the future.

Since the Renewable and Clean Energy Program started in January 2009, Wright State University has injected resources into the program. Most of these resources were in the form of hiring two faculty members that could teach Renewable and Clean Energy classes. Additional, support was given to Dr. Menart, the Director of the Renewable and Clean Energy program, to teach a number of courses in this area. The Department, College, and University are committed to making this program a success and making its students a success. All the student resources of the University are available to the Renewable and Clean Energy students. We have special offices for disabled students and for international students. We also have career services, writing services, legal services, human services, health services, counselling and wellness services, and in general a number of student support services.

Program distinctiveness

The Renewable and Clean Energy Program is distinct because:

1. This is one of few Master's Degree programs across the country that focuses exclusively on Renewable and Clean Energy Engineering.
2. This program accepts undergraduate students from a number of engineering and science disciplines and trains them in the field of energy engineering. All entering students must meet some extensive math requirements and are required to have courses in Thermodynamics I, Thermodynamics II, Fluid Mechanics, Heat Transfer, and Material Science. The Thermodynamics I, Thermodynamics II, Fluid Mechanics, Heat Transfer, and Material Science requirements can be made up after the student has been accepted to the program. Many students need to take these 5 energy courses when they arrive at Wright State because the Renewable and Clean Energy program is attracting students from a number of engineering and science disciplines.
3. This program has a very large selection of Renewable and Clean Energy courses. There are 22 Renewable and Clean Energy courses from which the students can chose. Students are required to take at least three of these classes; however, many students elect to take many more of these courses. Twenty-two renewable and clean energy courses is one of the largest offering of renewable and clean energy engineering courses in the country. These 22 renewable and clean energy classes are:
    i. WSU/ME6530 –Energy Conversion
    ii. WSU/ME6540 –Solar Engineering
    iii. WSU/ME6560 –Wind Power
    iv. WSU/ME7550 –Photovoltaics
    v. WSU/ME7520 –Hydrogen Energy
    vi. UD/MEE573 –Renewable Energy Systems
    vii. UD/MEE/CME 590 –Biomass and Biofuels
    viii. UD/MEE590 –Geothermal Energy
    ix. UD/MEE 590 –Wind Energy Engineering
    x. CSU/ME6520 –Hydropower

xi. WSU/ME6240 –Vehicle Engineering
xii. UD/MEE569 –Energy Efficient Buildings
xiii. UD/MEE571 –Design of Thermal Systems
xiv. UD/MEE 572 –Design for Environment
xv. UD/MEE 578 –Energy Efficient Manufacturing
xvi. UD/MEE 590 –Energy Information Management
xvii. WSU/ME6570 –Energy Materials
xviii. WSU/ME6580 –Fuel Cell Science and Technology
xix. UD/MEE/CME524 –Fuel Cell Fundamentals and Technology
xx. UD/MEE/MAT507 –Energy Materials
xxi. AFIT/NENG620 –Nuclear Reactor Theory and Engineering
xxii. CSU/ME6590 –Environmental Advances in Coal Based Power Plants

4. We have a unique collaboration arrangement with the University of Dayton, Central State University, and the Air Force Institute of Technology, all three of which are within 30 minutes driving distance of Wright State.
5. The program requires all students to perform an in depth independent study of some renewable and clean energy problem. This is done through a Master's thesis project or through an independent study project course.
6. The program offers many classes in the evening to cater to working students.

Recognitions of quality of the program

The uniqueness and quality of this program have been recognized by:

1. The media coverage of the program at its inception. The Renewable and Clean Energy Master's Degree Program is one of the few programs of its kind in the country. There has been considerable interest in this program since its inception. Local, national, and international media outlets covered this program. While most of the international coverage was via internet outlets, local coverage included newspapers, radio and TV. A partial listing of the coverage is shown below: (note that some of these web sites may no longer be active)
   i. Ohio schools offering masters in **renewable energy**
   IBTimes Australia, Australia - 43 minutes ago
   ii. Ohio schools offering masters in **renewable energy**
   MSN Money - 28 minutes ago
   iii. Ohio schools offering masters in **renewable energy**
   Forbes, NY - 36 minutes ago
   iv. Ohio schools offering masters in **renewable energy**
   CNNMoney.com - 43 minutes ago
   v. Ohio schools offering masters in **renewable energy**
   13abc.com, OH - 1 hour ago
   vi. Schools offering masters in **renewable energy**
   Coshocton Tribune, OH - 1 hour ago
   vii. Some Ohio Universities Offer Green Degree
   kypost.com, KY - 1 hour ago
   viii. Some Ohio Universities Offer Green Degree
   WCPO, OH - 1 hour ago
   ix. Schools offer master's in **renewable energy**
   Chillicothe Gazette, OH - 1 hour ago

x. Ohio schools offering masters in **renewable energy**
Bucyrus Telegraph Forum, United States - 1 hour ago
xi. Ohio schools offering masters in **renewable energy**
Mansfield News Journal, OH - 2 hours ago
xii. Miracle on Main to begin at 5:30 pm
Zanesville Times Recorder, OH - 2 hours ago
xiii. Ohio Schools Offering Masters In **Renewable Energy**
WCPO, OH - 9 hours ago
xiv. Ohio Schools Offering Masters In **Renewable Energy**
kypost.com, KY - 10 hours ago
xv. Ohio schools offering masters in **renewable energy**
WKYC-TV, OH - 12 hours ago
xvi. Ohio schools offering green degrees
Huntington Herald Dispatch, WV - 13 hours ago
xvii. Ohio schools offering masters in **renewable energy**
Education Week News, MD - 13 hours ago
xviii. **Renewable energy** masters program in Ohio
Akron Beacon Journal, OH - 14 hours ago
xix. Ohio Schools Offering Masters In **Renewable Energy**
WHIOtv.com, OH - 16 hours ago
xx. Dayton-area schools offer master's degrees in **renewable energy**
Palladium-Item, IN - 17 hours ago
xxi. Ohio schools offering masters in **renewable energy**
WTTE, OH - 17 hours ago
xxii. **Ohio schools offering masters in renewable energy**
(Alliance Review © 12/03/2008)
xxiii. **Ohio schools offering masters in renewable energy**
(Ashland Times Gazette © 12/02/2008)
xxiv. **Ohio schools offering masters in renewable energy**
(Cambridge Daily Jeffersonian © 12/02/2008)
xxv. **Ohio schools offering masters in renewable energy**
(Cincinnati WXIX-TV FOX 19 © 12/02/2008) DAYTON, Ohio (AP)
xxvi. **Ohio schools offering masters in renewable energy**
(Cleveland Plain Dealer © 12/02/2008)
xxvii. **Ohio schools offering masters in renewable energy**
(Cleveland WKYC-TV FOX 8 © 12/02/2008
xxviii. **Ohio schools offering masters in renewable energy**
(Dayton Daily News © 12/02/2008)
xxix. **Ohio Schools Offering Masters In Renewable Energy**
(WHIOTV.com © 12/03/2008)
xxx. **Renewable energy masters program in Ohio**
(Akron Reporter © 12/02/2008)
xxxi. **Renewable energy masters program in Ohio**
(Dayton Daily News © 12/02/2008
xxxii. **Renewable energy masters program in Ohio**
(Springfield News Sun © 12/02/2008)
xxxiii. Area schools? to offer new master's degree
Xenia Gazette, OH - Nov 28, 2008

xxxiv. Colleges join state program to find workers in environmental jobs
Dayton Daily News, OH - Nov 26, 2008

xxxv. Dayton Daily News Article on Renewable and Clean Energy Engineering Master's Degree Program is shown below in Figure MME3.

A8 | THURSDAY, NOVEMBER 27, 2008 | DAYTON DAILY NEWS

A master's degree in energy is born

State's first program through four area colleges, universities is approved.

By Dave Larsen
Staff Writer

DAYTON — Dayton-area colleges and universities will partner to help fuel Ohio's renewable energy industry with qualified workers.

Ohio Board of Regents Chancellor Eric D. Fingerhut on Monday, Nov. 24, approved the state's first master's degree program in clean and renewable energy.

Wright State University, the University of Dayton, Central State University and the Air Force Institute of Technology will join forces to start the two-year program.

Courses will be taught by faculty from the institutions.

"This is another example of the world-class collaborations in the Miami Valley that will move Ohio's economy forward," Fingerhut said. "Students will graduate from this master's program with the leadership, management, research and technical skills needed to help grow one of the most critical industries of the 21st century — clean and renewable energy and advanced energy systems."

The four institutions hope to provide a future engineering work force for the more than 45 existing Ohio companies with a stake in renewable energy and energy efficiency, as well as graduates who might start businesses to create Ohio jobs.

"It is very important that we start educating our next generation of engineers in how to power our society, other than through the use of fossil fuels," said James Menart, professor of materials and mechanical engineering at Wright State.

He will direct the program with Kevin Hallinan, chairman of UD's mechanical and aerospace engineering department.

Students will receive a degree from UD or Wright State, depending on where they enroll. Central State and AFIT also will offer classes and instructors but will not grant degrees.

Anticipated program enrollment is about 20 at each institution. Students may be able to enroll in the program as early as January at Wright State and UD.

Contact this reporter at (937) 225-2419 or dlarsen@DaytonDailyNews.com.

Figure MME3: Article in Dayton Dailey News on the Renewable and Clean Energy Engineering Master's Degree program.

2. The students from different parts of the world and country who have or are enrolled in the program.
3. The grants that have been given to faculty in the program. Some of these are:
   i. Air Force Research Laboratory grant entitled "Center of Excellence for Advanced Power and Energy Conversion Research (CAPEC)" for $610,000 from 2007 to 2012.
   ii. DOE grant entitled "Finite Volume Based Computer Program for Ground Source Heat Pump Systems" for $232,596 from 2010 to 2011.
   iii. DOE grant entitled "Renewable and Clean Energy Education Initiative" for $177.767 from 2011 to 2012.
   iv. DEEDS grant entitled "Solar Irrigation System," for $4000 in 2011.
   v. DEEDS grant entitled "Solar Irrigation Instrumentation System," for $4000 in 2012.
   vi. ASHARAE grant entitled "Heat Powered Demonstration Chiller," for $1870 in 2012.
   vii. Air Force Research Laboratory and UES grant entitled "Nanostructured Architectures for Structural Batteries" for $27,300 from 2014 to 2015.
   viii. NSF grant entitled "NUE – WSU Nanoscience and Nanotechnology Laboratory Experience" for $199,957 from 2012 to 2013.

ix. Air Force Research Laboratory and DAGSI grant entitled “Fundamentals of Low Dimensional Carbon Films Grown by Sublimation of SiC” for $78,782 from 2011 to 2013.
x. Air Force Research Laboratory and DAGSI grant entitled “Micro-Solid Oxide Fuel Cell (SOFC) Design and Development” for $10,882 from 2011 to 2013.
xi. Ohio Space Grant Consortium grant entitled “Nano-Graphene Plateltes – a New Class of Anode Materials for High Power Density Lithium-ion Batteries” for $40,000 from 2009 –2012.
xii. NSF ADVANCE Program Leader Consortium grant entitled “Fabricating and Understanding Graphene-Based Nanostructured Composites for High Energy Density Li-ion Batteries”, for $5,166 in 2010.
xiii. Ohio Space Grant Consortium grant entitled “Bimetallic Catalyst/Nano-Ceria Composite Anode for Military Fuel Cells” for $10,000 from 2008 to 2009.
xiv. Ronald Houck II and IHE, LLC and Iron Hawk Enterprises contract entitled “Design of Biplane Wind Turbine Blade with Houck’s Concept” for $50,000 in 2015.
xv. NSF STTR Phase II grant entitled “Modeling ultrasound exfoliation of graphene nanoplatelets” for $150,100 from 2011 to 2013.

4. The requests for presentations about the Renewable and Clean Energy Master’s Degree program and about the activities that are occurring in the program. Some of these are:
   i. Menart, J., “Renewable and Clean Energy Program at Wright State” (2009), Department of Mechanical and Materials Engineering External Advisory Board Meeting, Dayton, OH, January 16.
   ii. Menart, J., “Renewable and Clean Energy Program at Wright State” (2009), The Mound, Dayton, OH, February 20.
   iii. Menart, J. and Hallinan, K., “Renewable and Clean Energy Master’s Degree Programs in Dayton, Ohio Area” (2009), UCEAO 3rd Annual Conference Panel Member, Columbus, OH, June 18.
   iv. Menart, J., “Renewable and Clean Energy Master’s Degree Programs in Dayton, Ohio” (2009), Wright State Renewable and Clean Energy Round Table Discussion, Dayton, OH, April 9.
   v. Menart, J., “Solar and Geothermal Energy for the Dayton Region,” (2009), City Wide Alternative Energy Committee, Dayton, OH, July 1.
   vi. Menart, J., (2010) “Renewable and Clean Energy Master’s Degree Program Update” (2010), Department of Mechanical and Materials Engineering External Advisory Board Meeting, Dayton, OH, February 26.
   vii. Menart, J., “Wright State’s Renewable and Clean Energy Program” (2010), Dayton Environmental Advisory Board, Dayton, OH, March 12.
   viii. Menart, J., “Thermodynamic Research and Software Development,” (2010), AOP Workshop, October 10, Delaware, Ohio.
   ix. Menart, J., “Wright State Solar Thermal System,” (2011), Green Energy Ohio Conference, Dayton, OH, February 11 -12, 2011.
   x. Menart, J., (2012), One hour lecture for Environmental Science and Society Class at Wright State University on Renewable Energy given on November 1, 2012.

xi. Menart, J., "Geothermal and Solar Initiatives at Wright State University," Society of American Military Engineers, Kittyhawk Post Industrial Day, May 9, 2013.
xii. Menart, J. (2013) "Wright State Renewable and Clean Energy Program," Wright State University/University Clean Energy Alliance of Ohio Focus Meeting, August 20, 2013.
xiii. Menart, J. (2013) "Geothermal and Solar Initiatives at Wright State University," Wright State University/University Clean Energy Alliance of Ohio Focus Meeting, August 20, 2013
xiv. Menart, J., (2013), One hour lecture for Environmental Science and Society Class at Wright State University on Renewable Energy given on November 4, 2013.

5. Student exit interviews on the program. These are given in the section "Summary of assessment findings for past five years".
6. Externally Advisory Board comments are favorable on the Renewable and Clean Energy Engineering Master's Degree program.

Program learning outcomes

The learning outcomes of the Renewable and Clean Energy Program are:

1. Students must demonstrate an advanced understanding of the basic principles of energy and energy conversion.
2. Students must demonstrate engineering competency in three renewable and clean energy areas.
3. Students must demonstrate competency in undertaking an in-depth research, design, analysis or experimental investigation of some engineering problem involving energy.
4. Students must demonstrate their a**b**ility to communicate engineering ideas and techniques.
5. Students must demonstrate a mathematical competency above that of an undergraduate engineering student.

Description of learning outcomes assessment program

The learning outcomes of the Renewable and Clean Energy Program are assessed by:

1. All students who get a degree in the program must have passed an advanced thermodynamics course and must have passed two classical thermodynamics courses, one fluid mechanics course, one heat transfer course, and one materials science course as part of their undergraduate degree or as part of their Renewable and Clean Energy Master's Degree prerequisites. Passing is determined by a rigorous regiment of graded exams, homework, projects, etc.
2. All students must take and pass three renewable and clean energy engineering courses. Passing is determined by a rigorous regiment of graded exams, homework, projects, etc.
3. All students must successfully complete a thesis project or an independent study project to show their ability to perform independent research or design and to demonstrate their ability to work on a major project. Successful completion is determined by a thesis committee of three faculty members and by constant observation by a faculty advisor for thesis work, and by the constant observation of a

faculty advisor and an extensive report evaluated by the faculty advisor for an independent study project.

4. All students must successfully write a thesis or a major independent study report to show their competency in written communications. Successful completion is determined by a thesis committee of three faculty members and by constant observation by a faculty advisor for thesis work, and by the constant observation of a faculty advisor and an extensive report evaluated by the faculty advisor for an independent study project.
5. All students must take and pass one graduate level math course as part of the Renewable and Clean Energy Program to demonstrate their ability to utilize mathematics at a more advanced level than undergraduate students. Passing is determined by a rigorous regiment of graded exams and homework.
6. We perform exit interviews of our graduates. Verbal and written information is collected on different aspects of the Renewable and Clean Energy Program. Results from these assessments are shown in the next section.
7. The External Advisory Board provides and evaluation of the performance of the Department of Mechanical and Materials Engineering and of the programs housed in that department. This evaluation provides information on the rigor and relevancy of the program.
8. We try to track where our graduates find employment. Some results are shown in the next section.

Summary of assessment findings for past five years

The findings of the assessment program for the Renewable and Clean Energy Program are listed below. The numbers used below match the numbering used in the questions above that describe the assessment tools. The findings are:

1. All students who get a degree in the Renewable and Clean Energy Engineering Program have successfully passed an advanced thermodynamics course as part of their Renewable and Clean Energy program requirements and have successfully passed two classical thermodynamics courses, one fluid mechanics course, one heat transfer course, and one materials science course at Wright State or as part of their undergraduate background. Passing these courses meant passing a rigorous regiment of graded exams, homework, projects, etc.
2. All students who get a degree in the Renewable and Clean Energy Engineering Program have successfully passed three renewable and clean energy courses. Passing these courses meant passing a rigorous regiment of graded exams, homework, projects, etc.
3. All students who get a degree in the Renewable and Clean Energy Program have successfully completed a thesis project or an independent study project. This proves the abilities of our students to perform independent research or design work and to work on a major project. The thesis work is critically evaluated by a thesis committee of three faculty members and by constant observation of a faculty advisor, and the independent study project is evaluated by the constant observation of a faculty advisor and an extensive report evaluated by the faculty advisor. Examples of these theses and independent study projects can be provided.
4. All students who get a degree in the Renewable and Clean Energy Program have successfully written a thesis or a major independent study project report to show their competency in written communications. These theses and independent study

reports have been critically evaluated by a faculty member. Examples of these theses and independent study projects can be provided.

5. All students who get a degree in the Renewable and Clean Energy Program have successfully passed one graduate level math course demonstrating their ability to handle mathematics at a level above the undergraduate level. Passing this course is determined by a rigorous regiment of graded exams and homework.
6. Below are results from our exit interviews. These statistics are for the whole Mechanical and Materials Engineering Department which include the Mechanical, Materials, and Renewable and Clean Energy Students. Data for just the Renewable and Clean Energy Students does not exist.
    g. Employment Statistics for Department - 32 graduates were interviewed
        - 6 went on to pursue their PhD
        - 17 got jobs
        - 8 were still looking
        - 1 continued in military
        - Average salary: $65k (range is $40-83k)
    h. Students comments on good and bad aspects of graduate programs
        - Most positive experiences
            - Research projects
            - Useful skills learned
            - Interactions with industry
            - Real problem solving
            - Cross-registration using DAGSI & SOCHE
            - Small classes
            - Went deeper into the subject
            - Teaching quality
            - Level of professionalism with faculty and staff
            - Research work at AFRL
            - High level project courses
            - Good Thesis Advising
            - Assistantship experience
            - Presenting at conferences
        - Most negative experiences
            - Not easy
            - Cooperative ability
            - Design track courses
            - FEM courses
            - Math courses
            - Lack of flexibility
            - New energy courses for faculty
            - Too few classes offered
            - Materials Science and Engineering Master's Degree program not as strong
            - Need to cater to industry, not just Air Force

- Advisor too busy
- Need more materials science equip & in-depth courses in Materials Science and Engineering Master's Degree program
- Energy job market not good
- Need new student orientation
- Undergraduate education elsewhere not good prep
- Scheduling challenges for working students

i. Students comments on facilities
   - Positive comments
     - Machine shop
     - Good labs
     - Good computer labs
     - Great student network
     - Get help easily – helpful staff
     - Flexible hours
     - Small classes
     - Good software
   - Negative comments
     - Space
     - Air conditioner in open lab
     - Need supercomputer
     - Machines in the lab not working
     - Need distance learning classes
     - Open computer labs are dirty
     - Teaching assistants
     - Not enough peers
     - Little experimental equipment

j. Overall student impressions
   - Great
   - Need more opportunities to get jobs
   - Need to increase reputation
   - Faculty are very good
   - Prepared me for satisfying and enjoyable career
   - Ability to take University of Dayton and AFIT courses
   - Some Wright State drop outs go to the University of Dayton
   - Good Professors
   - Good students
   - Culture is shifting, keep going
   - Getting better and better – keep growing!
   - Networking
   - Courses are direct and focused for research
   - Satisfied, good experience
   - An excellent program
   - Other buildings more artsy/modern (this comment was made prior to our remodel work)

- More divisions between engineering fields would allow more focused approach

7. Listed in Table MME20 is employment information on some of the Renewable and Clean Energy graduates. Regrettably only some of our students do the exit interview.

Major curricular changes since last review (or past five years)

The Renewable and Clean Energy Master's Degree Program was started in January 2009, and thus was not reviewed in the last HLC review cycle. The entire program can be considered to be new. Even though this is a new program we have taken steps to improve the Renewable and Clean Energy Engineering Master's Degree Program. The largest changes to the program since its start in 2009 have been:

1. We have added two new renewable and clean energy courses to the list of available options
    a. Geothermal Energy
    b. Vehicle Engineering
2. The Energy Materials course has been moved from a required course to a choice of 3 out of 22 classes in the Renewable and Clean Energy category.
3. The math requirement has been changed from any graduate math class to taking one of the two Advanced Engineering Mathematics courses, MTH 5040 or MTH 6040.
4. All courses have been changed from a quarter basis to a semester basis. At the present time students are taking required to take MTH 5040.

Table MME20: Renewable and Clean Energy Engineering Master's degree student employment data.

LAST NAME	FIRST NAME	TITLE	Company
Beisner	Russ	Safety Engineer	Norwood medical
Benjamin	Florkey		Tri-Tech
Chuang	Jason	Mechanical Engineer	Honda
Godar	Trenton	Research Engineer	University Of Dayton Research Institute
Gross	Paul	Research Engineer	Innovative Scientific Solutions, Inc.
Gustafson	Michael	Solar Engineer	Greenlight Renewable Energy Sources
Hassan	Ahmed	Process Development Engineer	Accenture Services Private Limited
Hayden	Scott	Performance Engineer	Energy Systems Group, EMIT, EI
Hill	Theresa	Materials Science Engineer	Air Force Research Laboratory
Hughes	Kyle	Mechanical Engineer	SHP Leading Design
Hughes	Kyle	Geothermal Engineer	Harbenger Group
Joe	Bozeman	Energy Engineer	Dept of Veterans Affairs
Kairamkonda	Shruthi	Product Development Engineer I	Sprint
McCoppin	Jared	PhD Engineering WSU	Wright State University
Mortezaee	Reza		MAPNA Group
Osborn	Tim	Research Engineer Additive Manufacturing	United States Air Force
Paul	Gross	Research Engineer	Third Millennium Metals
Tokarz	Joshua	Fuel Systems and Fire	Wright Patt Air Force Base

		Protection	

Graduate placement data, employer satisfaction

Students in the Renewable and Clean Energy Engineering Master's Degree program are getting jobs as shown in the Table MME20. Some of our students get employment in the energy field, some of our students get employment in general engineering fields, and some of our students go on for their Ph.D. While we have not tracked all of our students, essentially all of our students eventually find engineering employment or go to graduate school.

If program has professional accreditation, attach most recent review findings and recommendations

This program does not require professional accreditation and does not have a professional accreditation.

Program 6. Aerospace Engineering Master's Degree

Enrollment and Graduate History

The Aerospace Engineering Master's Degree Program is a newly approved program and does not have students yet. This program officially started in the fall of 2012.

Table MME21: Aerospace Engineering Master's degree yearly enrollment and gradation numbers.

	Fall 2013
Enrollment	0
Graduates	0

Program description

The Aerospace Engineering Master's Degree Program is designed to produce, prepare and engage high quality aerospace engineers for work in government agencies and industry, global competition in engineering research, and for advanced studies and life-long learning in the challenging aerospace environment. This graduate program is non-traditional in that it requires an interdisciplinary minor in an aerospace relevant area. Both thesis or non-thesis options are available to students.

Alignment with university mission, strategic plan

In the Aerospace Engineering Master's Degree Program research is not limited to the laboratory facilities on campus. Several industrial companies, laboratories, and Wright-Patterson Air Force Base are involved in joint research efforts with the university and have unique facilities that are available for faculty and graduate student research. This program strives to provide a solid foundation for student success in the aerospace industry. There are a great deal of aerospace companies and aerospace research labs in this region and the goal of this program is to supply capable engineers at the Master's level. A basic principle of this program is to encourage and instill the idea in students of life-long learning by obtaining advanced engineering certificates, attending workshops and conferences, publishing papers, etc. Additionally, this program embraces and supports the different backgrounds and cultures that our students, faculty, and staff contribute.

The faculty in the Aerospace Engineering Program continuously monitor the progress of their students through exams, homework, and projects. Student work is carefully assessed and grades are given. Our diverse faculty and the diverse staff of the Mechanical and Materials Engineering Department are available and willing to help our students to a successful completion of their degree. The faculty and staff reach out to incoming students by e-mail and web sites. Questions of incoming students are answered by the Chair of the Department, the staff in the Mechanical and Materials Engineering Department, or the different university offices, including the International Gateway office. At the present time the Aerospace Engineering program does not offer its courses online.

Program distinctiveness

The Aerospace Engineering Program is distinct because:

1. This program requires an interdisciplinary minor in an aerospace relevant area.
2. This program provides evening classes to allow part time study towards MS degrees.
3. Thesis and non-thesis options are available to students.

4. This program maintains close working relationships with Wright Patterson Air Force Base and local industry.
5. The entrance requirements for the program are higher than most Mater's Degree programs at Wright State University.

Recognitions of quality of the program

The Aerospace Engineering Program is too new of a program to have items to list in this section.

Program learning outcomes

The learning outcomes of the Aerospace Engineering Master's Degree program are:

1. Students must demonstrate a knowledge of fluid or structural systems related to the aerospace field.
2. Students must demonstrate competency in some type of numerical methods related to the aerospace field.
3. Students must demonstrate engineering competency in one sub-specialty. The sub-specialties to choose from are:
    a. Industrial and Human Systems
    b. Sensors and Signals
    c. Materials and Nanotechnology
    d. Controls and Robotics
    e. Computer Science
    f. Medical/Biological Systems
4. Students must recognize the need for life-long learning.
5. Students must demonstrate their ability to communicate engineering ideas and techniques.
6. Students must demonstrate a mathematical competency above that of an undergraduate engineering student.

Description of learning outcomes assessment program

The learning outcomes of the Aerospace Engineering Master's Degree program are assessed by:

1. Students must take and pass at least one of the following courses:
    a. Advanced Computational Fluid Dynamics (ME 7340)
    b. Multidisciplinary Structural Optimization (ME 7080)

   Passing is determined by a rigorous regiment of faculty graded exams, projects, homework, etc.
2. Students must take and pass at least one of the following courses:
    a. Advanced Computational Fluid Dynamics (ME 7340)
    b. Applications of Finite Element Methods (ME 7120)

   Students can also take the following course
    a. Finite Elements (ME 6120)

   Passing is determined by a rigorous regiment of faculty graded exams, projects, homework, etc.
3. Students must take and pass at least two graduate level courses in the following specialties
    a. Industrial and Human Systems
    b. Sensors and Signals
    c. Materials and Nanotechnology

d. Controls and Robotics
e. Computer Science
f. Medical/Biological Systems

Passing is determined by a rigorous regiment of faculty graded exams, projects, homework, etc.

4. In class projects and thesis projects instill in students the need for life-long learning.
5. Students either write a thesis or complete substitute coursework. Each of these options are critically evaluated by faculty members.
6. Students must take and pass one graduate level math course as part of the Aeorspace Engineering Master's Degree program. Passing is determined by a rigorous regiment of faculty graded exams and homework.

Summary of assessment findings for past five years

The Aerospace Master's Degree program is new and does not have assessment results.

Major curricular changes since last review (or past five years)

No changes have been made to this new program.

Graduate placement data, employer satisfaction

There have been no graduates from this program yet.

If program has professional accreditation, attach most recent review findings and recommendations

This program does not require professional accreditation and does not have a professional accreditation.

Departmental Summary

Faculty demographics

Table MME22: Department of Mechanical and Materials Engineering faculty, lecturers, and adjunct numbers.

	2008	2009	2010	2011	2012
Full	10.00	10.00	10.00	10.00	10.86
Associate	2.00	3.00	3.00	4.00	4.00
Assistant	5.00	5.00	5.00	4.00	3.00
Inst/Lect	0	0	0	0	0
Total	17.00	18.00	18.00	18.00	17.86

Adjunct	2.04	2.00	1.92	0.92	2.13

Staffing Summary

Table MME23: Department of Mechanical and Materials Engineering staff numbers.

	2008	2009	2010	2011	2012
Unclassified	2.77	2.73	2.00	2.00	2.00
Classified	3.00	3.00	3.00	3.00	3.00
Total	5.77	5.73	5.00	5.00	5.00

Graduate Assistant	0.00	0.51	1.34	4.17	4.28

Student/faculty ratio

Table MME24: Department of Mechanical and Materials Engineering student to faculty ratios.

	2008	2009	2010	2011	2012
Student FTE/Fac FTE	10.24	12.99	13.73	13.77	12.07

Average class size

Table MME25: Department of Mechanical and Materials Engineering average class sizes.

	2010	2011	2012
Lecture	20.66	9.04	20.74
Lab only	27.24	10.00	27.26
Lecture/Lab	29.74	17.14	28.28

Total of student data for all programs in unit

Table MME26: Department of Mechanical and Materials Engineering total and graduate student enrollments.

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Enrollment	548	612	690	781	867
Graduates	92	89	112	123	123

Total courses taught and credit hours generated for unit

Table MME27: Department of Mechanical and Materials Engineering credit hours taught.

	Fall 09	Fall 2010	Fall 2011	Fall 2012	Fall 2013
Undergraduate	6522	6636	6644	6857	8225
Graduate	1443	1755	1683	1328	1394
Total	7965	8391	8327	8185	9619

Course completions

Table MME28: Department of Mechanical and Materials Engineering course completion percentages.

	2008	2009	2010	2011	2012
Undergraduate	90.9%	90.8%	89.1%	88.7%	89.8%
Master's	88.6%	84.4%	98.4%	96.4%	97.5%

Expense per student and revenue to expense ratio

Table MME29: Department of Mechanical and Materials Engineering expenses per student and revenue to expense ratios.

	2008	2009	2010	2011	2012
Expense per student	$11,420	$10,617	$11,288	$11,691	$13,343
Rev/Expense	1.754	1.873	1.803	1.627	1.440

Research and External Funding

Table MME30: Department of Mechanical and Materials Engineering external funding.

	2008	2009	2010	2011	2012
External funding	$1,622,275	$2,972,863	$3,216,744	$3,381,389	$3,097,556

Future employment projections for discipline

Present and future employment statistics for the Mechanical Engineering Program and the Materials Science and Engineering Program are shown in Table MME31. The table shows state jobs and regional jobs in the year 2014 and projections of state and regional jobs in the year 2017. In the last column of the table, some average earnings per hour are listed.

The national importance of Materials Science and Engineering is strongly underscored by the launch of the Materials Genome Initiative (MGI) in 2011. This can be seen by visiting the web site: http://www.whitehouse.gov/blog/2011/06/24/materials-genome-initiative-renaissance-american-

manufacturing. This program stresses the need to revitalize American manufacturing. In order to do this it is essential for the entire knowledge community to unite towards "doubling the pace of advanced materials discovery, innovation, manufacturing, and commercialization." According to the Occupational Outlook Handbook from the United States Department of Labor, (http://www.bls.gov/oes/current/oes172131.htm), the 2013 median pay for Materials Engineers (Bachelor of Science minimum degree) was $89,930 per year. Industries with the highest levels of employment in this occupation are listed in Table MME32. According to employment prediction groups such as http://www.campusexplorer.com/, employment for Materials Engineers is "expected to grow at an average rate as job opportunities for engineers." This is poised to be significant over the next several years, when this country is revitalizing its emphasis on STEM fields that will enable local youths to compete for high-quality jobs. For Materials Science and Engineering, continuing education is a must to keep up with new technology, which indicates the need for graduate programs, which implies that follow-up graduate education will be needed, not just for recent college graduates, but also for working professionals. It therefore appears that there will be continuous impetus for growth, modernization, and continued innovation in Materials Science and Engineering, which will increase the need for higher education in this field.

Table MME31: Department of Mechanical and Materials Engineering current employment (2014) and future employment projections (2017) at the state and regional levels.

Program	State Jobs (2014)	State Jobs (2017)	State Growth in Jobs	Regional Jobs (2014)	Regional Jobs (2017)	Regional Growth in Jobs	Median Hours Earnings
Materials Engineering	19,236	19,367	0.70%	3,356	3,326	-0.90%	$40.35
Mechanical Engineering	30,413	30,300	-0.40%	5,465	5,351	-2.10%	$35.87

Table MME32: Annual mean salaries for Materials Science and Engineers in various industries.

Industry	**Employment**	**Annual mean wage**
Aerospace Product and Parts Manufacturing	4,160	$102,280
Architectural, Engineering, and Related Services	2,620	$81,960
Scientific Research and Development Services	2,270	$92,080
Semiconductor and Other Electronic Component Manufacturing	1,500	$88,380
Federal Executive Branch (OES Designation)	1,310	$111,050

For the Renewable and Clean Energy Engineering Master's Degree Program a number of reports show a bright employment future for our graduates. For example the graph shown in Figure MME4 and the comments below are obtained from the Pew Charitable Trust report entitled "The Clean Energy Economy". The Pew Charitable Trust reports, "The green education movement has been largely driven by increasing demands in the workforce. At a time when most sectors of the American economy are slowing, green industries are projected to see a major boom. The clean energy economy grew by 9.1%

between 1998 and 2007, compared to growth of just 3.7% in traditional jobs, and the future of the industry looks brighter still. The Obama administration has estimated that occupations in clean energy and sustainability will grow by an impressive 52% between 2000 and 2016. With other careers only expected to see a workforce increase of 14% in the same time period, the green sector is becoming increasingly attractive to students, mid-career changers and pretty much any type of job seeker." According to a report from the American Solar Energy Society, renewable energy and energy efficiency (RE&EE) fields will generate about 37 million jobs and $4,294 billion in annual revenue by 2030.

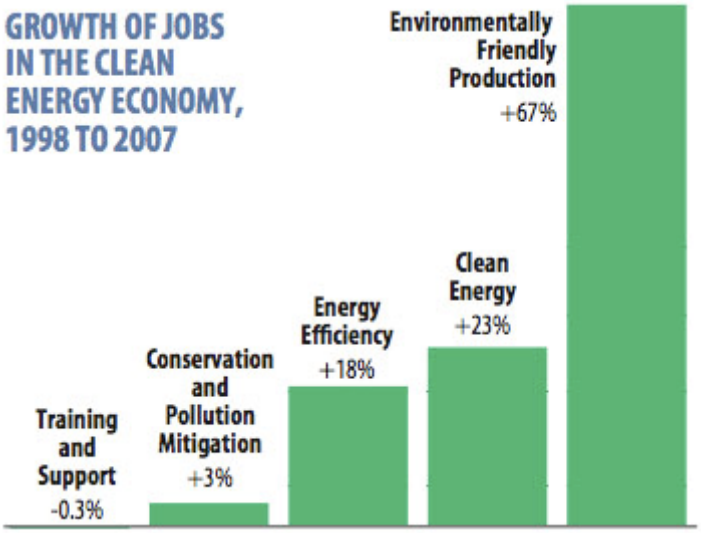


Figure MME4: Pew Charitable Trusts data on growth of clean energy jobs from 1998 to 2007.

Aerospace employment in the state of Ohio and in the Dayton area is generally high because Wright Patterson Air Force Base is located in Dayton. As of May 2013 the United States Bureau of Labor Statistics puts Aerospace Engineering employment in the state of Ohio at 4340 engineers and for the nation at 71,500 engineers. The United States Bureau of Labor Statistics also projects that Aerospace Engineering jobs will increase by 7% over the period from 2012 to 2022.

Description of how unit programs and curricula are "mission critical" to the core Wright State educational experience

Because of the technology rich area in which Wright State is located, a number of engineering disciplines need to be offered by Wright State. One of the primary missions of Wright State is to deliver an educated work force to the Dayton area, to the surrounding region, and to the state of Ohio. The Dayton region, as well as the state of Ohio, are manufacturing based, technologically advanced, and have a large amount of research being undertaken. This is epitomized by the Air Force Research Laboratory located on Wright Patterson Air Force Base. Wright Patterson Air Force Base is located just next door to Wright State University. A large number of our engineering graduates obtain employment at Wright Patterson Air Force Base. Because of Wright Patterson Air Force Base, a large number of high technology companies locate in the Dayton area. These companies expect Wright State to deliver a continuous supply of capable engineers. This cannot be done without having a large number of engineering disciplines available at Wright State University.

In the Department of Mechanical and Materials Engineering, four engineering disciplines are offered. These are Mechanical Engineering, Materials Science and Engineering, Renewable and Clean Energy Engineering, and Aerospace Engineering. All four of these disciplines are offered at the graduate level and Mechanical Engineering and Materials Science and Engineering are offered at the

undergraduate level. In the paragraphs that follow, a brief explanation of why these four engineering disciplines are an important part of Wright State's mission to the region and to the state is given.

The Wright State Mechanical Engineering programs at both the undergraduate and graduate levels are important because the region and the state need Mechanical Engineers. A large number of our Mechanical Engineering graduates find employment in the Dayton region. Without Wright State's supply of capable Mechanical Engineers, Southwestern Ohio, and all of Ohio, would suffer immense economic hardship. Mechanical Engineers perform so many types of important jobs in our community. They do research, they design machines, they design products, they design manufacturing processes to make these products, they route out inefficiencies in processes and equipment, they manage other workers, they manage industrial processes, they are business leaders and executives, and the list goes on and on. Mechanical Engineering is the most versatile of all the engineering disciplines. It is this versatility and the importance of the knowledge Mechanical Engineers obtain in school that make it one of the most employable engineering disciplines. Mechanical Engineering jobs are more numerous than all other engineering disciplines, except Civil Engineering. Mechanical Engineers are not only important in their own right, they also generate jobs in other manufacturing disciplines. Mechanical Engineers are involved at many levels of new product development. New products generate jobs and wealth for a community. Proof of the large need for Mechanical Engineers in our region is the huge interest in the new branch campus Mechanical Engineering program started in Celina, Ohio which is about 1 hour northwest of the Wright State Main campus. This branch Mechanical Engineering program was driven by industry in the Celina area. This program has grown from 11 students in 2009 to 129 students in 2014. This indicates there is a strong demand for Mechanical Engineering education in this region of Ohio.

The Wright State Materials Science and Engineering programs at both the undergraduate and graduate levels are also important to fulfill a regional and local need. This is most keenly shown by the location of the Air Force Research Laboratory's Materials and Manufacturing Directorate located in Dayton, Ohio on Wright Patterson Air Force Base. This directorate performs large amounts of materials research and hires many of our graduates. In addition, many of our current Materials Science and Engineering students work as Co-ops in the Air Force Research Laboratory's Materials and Manufacturing Directorate. Because of the Air Force Research Laboratory's Materials and Manufacturing Directorate being located in Dayton, Ohio and because of the large manufacturing and technology base in the area, many Materials Engineers are required.

In addition to this local need, there is a general need for Materials Science and Engineering graduates. Materials are a basic part of everything made; and thus knowledge of materials is required for every physical product we produce. Since engineers tend to make things, all engineers require some materials knowledge. This is especially true for Mechanical Engineers. There is a very nice complimentary relationship between a Materials Science and Engineering program and a Mechanical Engineering program. This is one of the reasons we have these two programs housed in the same department at Wright State University. Many courses required by Mechanical Engineering students are taught by our Materials Science and Engineering faculty. This relationship has served us well for decades. There will always be a need for good Material Scientists and Engineers and Wright State needs to supply some of these people.

The Ohio Board of Regents has identified advanced materials as one of the key enabling technologies for the region. One of their recent announcements clearly states that: "Dominance in iron and steel, polymers, and various chemicals has positioned the state to make scientific and technological breakthroughs in new, advanced materials that are revolutionizing many industrial and consumer

products. Advanced materials are the platforms for continued innovation in many of Ohio's rapidly growing industrial sectors." This statement can be found on the web site [https://www.ohiohighered.org/coe/enabling-technologies]. Of all the states in the country it must be noted that Ohio ranks 5th in employed Materials Scientists and Engineers [see http://www.bls.gov/oes/current/oes172131.htm]. Therefore, it makes perfect sense to nurture and strategically grow the Materials Science and Engineering Program at Wright State University, and keep it up-to-date so as to provide the best professional advantage to our students.

The Renewable and Clean Energy Engineering program at Wright State is a relatively new graduate program. This program had its first students in 2009. This is a program that will allow Wright State to have future growth in its graduate programs and to hopefully help a new industry to form in the Dayton region. This particular graduate program probably has more of an immediate need nationally than locally. There are a number of solar, wind, geothermal, fuel cell, biofuel, and other renewable companies springing up around the country. A need to supply engineers specifically trained in these technologies exists. While the present demand for Renewable and Clean Energy Engineers is relatively small, this could be a huge industry in the future. According to a report from the American Solar Energy Society, renewable energy and energy efficiency fields will generate 37 million jobs and $4,294 billion in annual revenue by 2030. It is so important that graduate programs be put in place to help make this prediction a reality, to respond to the present demand by renewable and clean energy companies, and to respond to the demand that will exists if this prediction comes true.

The industrial base in renewable energy is still relatively small compared to other industries; however, it is growing rapidly. According to the United States EIA's (Energy Information Administration's) report (see web site http://energy.gov/eere/water/articles/us-renewable-energy-generation-first-half-2013-eia) the following quote on the growth of renewable energy for electric power generation is obtained:

> "Renewable energy sources generated 14.2% of net U.S. electric power generation during the first six months of 2013, up from 13.6% the same time a year ago, according to data from the U.S. Energy Information Administration (EIA). Non-hydro renewable energy sources including solar, wind, and biomass energy, increased 12.1% in the first half of 2013 compared to the same period in 2012. In particular, solar thermal and photovoltaic energy increased 56.9% in 2013 compared to the first half of 2012, and wind power grew 15.3% during the same timeframe."

Renewable energy has grown substantially since the 1980's and it appears that there is plenty of room for it to continue to grow. The world's appetite for energy seems like it will do nothing but grow, and it would seem that a good portion of this energy growth must occur in renewable energies. Wright State's Renewable and Clean Energy Master's Degree program is positioning itself to provide the engineers to this expanding area that is critical to this country. Our numbers are currently small, but the program is relatively young.

The other trend in renewable energy that indicates it has a large growth potential is the cost of renewable energy is falling dramatically. The cost of solar PV (photovoltaic) has dropped by a factor of 100 since the 1970's and the cost of wind power has also dropped dramatically. While wind power does not have as much room to continue lowering costs, solar PV seems to have considerable room to lower its costs. At the present time, the levelized cost of wind power is competitive with fossil fuel generation of electrical power. Solar is still a factor of 2 to 3 times higher than fossil fuels, but it is cost competitive in a few states and should be cost competitive in many more in the next few years.

It is imperative that this country build programs that will aid in the development and growth of the renewable and clean energy field in the United States. In our opinion, this is critical to the economic competitiveness of this country. Wright State is doing this.

The Aerospace Engineering Graduate Program at Wright State is a relatively young program. This program is 2 years old. The reason for developing this program was to respond to the needs of the immediate region and the state of Ohio, in particular Wright Patterson Air Force Base and the Aerospace industry that has grown up around Wright Patterson Air Force Base. Ohio has a large number of industries that cater to the aerospace field. A second reason for starting this program was the large interest in unmanned air vehicles. This could be an explosive industry in the relatively near future. Unmanned air vehicles have potential applications in the military, agriculture, movie making, search and rescue operations, inspecting power lines, wildlife tracking, communications, surveying, and delivering commercial goods. The commercial goods delivery function could be especially large given the interest by such major online retailers like Amazon. Wright State is trying to position itself to be a part of this development.

Faculty accomplishments and recognitions

There are 17 full-time faculty members in the Department of Mechanical and Materials Engineering who all hold Ph.D. degrees. In addition to these 17 full-time faculty, the Dean of the College of Engineering and Computer Science, the Vice President of Student Affairs, and the Chair of the Department are considered to be faculty members in the department. These three faculty members all hold management positions and thus do not teach full loads of classes. The Dean of the College and the Vice President of Student Affairs will teach courses in the department on occasion, but their full time duties are managerial. The Chair of the Department teaches at least one class a semester. A photograph of most of the faculty in the department is shown in Figure MME5 below.

All 20 of the Department of Mechanical and Materials Engineering faculty members have Ph.D. degrees. Seventeen of these Ph.D. degrees are in Mechanical Engineering or Materials Engineering. Of the remaining three, one has a Ph.D. in Physics, one has a Ph.D. degree in Chemical Engineering, and one has a Ph.D. degree in Aerospace Engineering.

The list of accomplishments of these 20 faculty members is impressive. First and foremost this is an excellent group of teachers. We have some of the best teachers in the college and the university. Some of our teachers have even received teaching awards outside the university. All faculty members perform additional activities, above and beyond teaching, that strengthen the department. These activities include research, publishing scholarly books and papers, serving on committees for the department, the college, the university, the local area, the state, or the nation, being reviewers or editors for national journals, producing patents, helping industry solve problems, developing new teaching techniques and materials, etc. The list is large and cannot be completely covered in this document. For this reason a brief overview of the accomplishments of our faculty will be given. Four general areas will be covered: 1. teaching 2. research 3. service, and 4. awards.

In the area of teaching, the Department of Mechanical and Materials Engineering faculty are consistently rated high. Every semester each course is rated by the students in a number of areas. The average faculty scores for the courses taught by the faculty member that semester are averaged and the faculty member is given a single number on their performance. This rating system runs from 1 to 5 where 1 means very poor and 5 means excellent. The faculty in the Department of Mechanical and Materials Engineering consistently have averages above 4. Only a few faculty members receive numbers

below 4 in any given semester. This data is collected every semester and presented to the faculty members at their yearly faculty retreat. A sample of these results for the 2013 Fall semester and the 2014 spring semester are shown in Figures MME6 and MME7 below. The outstanding teaching of the departmental faculty is also verified by senior exit interviews. The results of the exit interviews from the 2010 – 2011 academic year are shown in Table MME33 below.

Figure MME5: Photo of the Department of Mechanical and Materials Engineering faculty at their annual retreat.

The excellence of the Department of Mechanical and Materials Engineering in research is evidenced by the research funding received and the papers published. The amount of research funding obtained as a function of year is shown in Figure MME8 and the average number of journal publications per faculty member is shown in Figure MME9. The research expenditures have retreated in the past three years, but we are confident this trend will reverse itself shortly. The years from 2009 to 2012 were very good years for the department. It should also be mentioned that the research expenditures for 2014 do not include the entire year. Only those expenditures put on the books by the time this plot was made are included for this year. The journal publications per faculty are shown in Figure MME9. On average each faculty member is producing 1.5 journal publications. This number does not include conference paper publications, which are significant. Faculty have also written books or chapters in books.

Each faculty member of the Department of Mechanical and Materials Engineering serves on a number of committees at the department, college and university levels. In general the tenured faculty are expected to serve on more committees than the untenured faculty. Committee assignments to untenured faculty are intentionally kept small so that they have time to develop their teaching and research programs. In addition to committees at Wright State University, many of our faculty perform service for the local community and the nation. This is evidence by the number of faculty reviewing articles for reputable journals in their fields, the number of faculty on editorial boards, the number of faculty reviewing books, the number of faculty reviewing research proposals for national organizations such as NSF, the number of faculty serving as session or conference chairs at national conferences, the number of faculty who have served as conference organizers, the number of faculty who have served on national technical committees, the number of faculty who have received fellowship positions at national labs, the number of faculty who have given invited talks, the number of faculty that are members of

national technical organizations, and the number of faculty who are associate or fellows of national technical organizations. The list of service work done by the Department of Mechanical and Materials Engineering faculty is truly extensive.

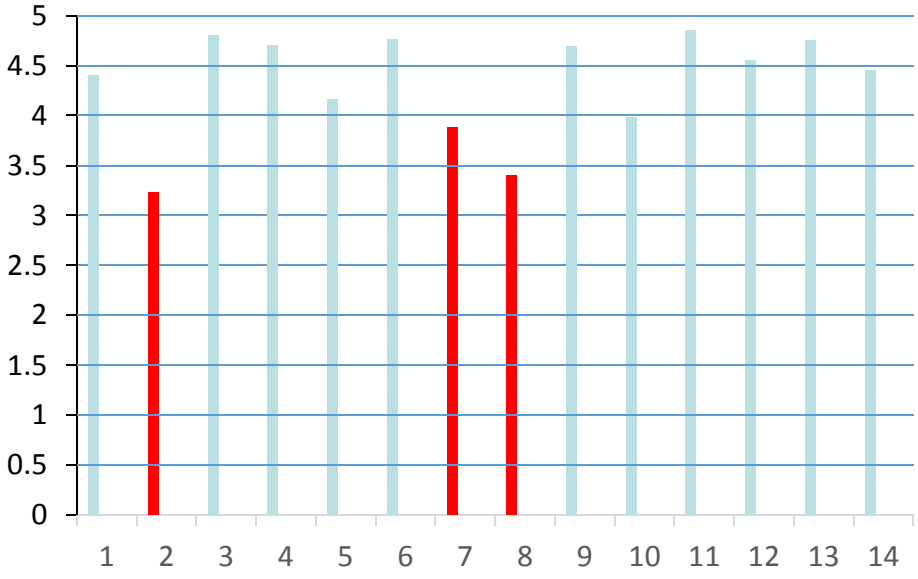


Figure MME6: Student evaluation numbers for the Department of Mechanical and Materials Engineering faculty for the Fall semester of 2013. Each number on the horizontal axis represents one faculty member and the numbers on the vertical axis are that faculty member's average evaluation. The average of all the faculty for this semester is 4.32 where is 1.0 is very poor and 5 is excellent.

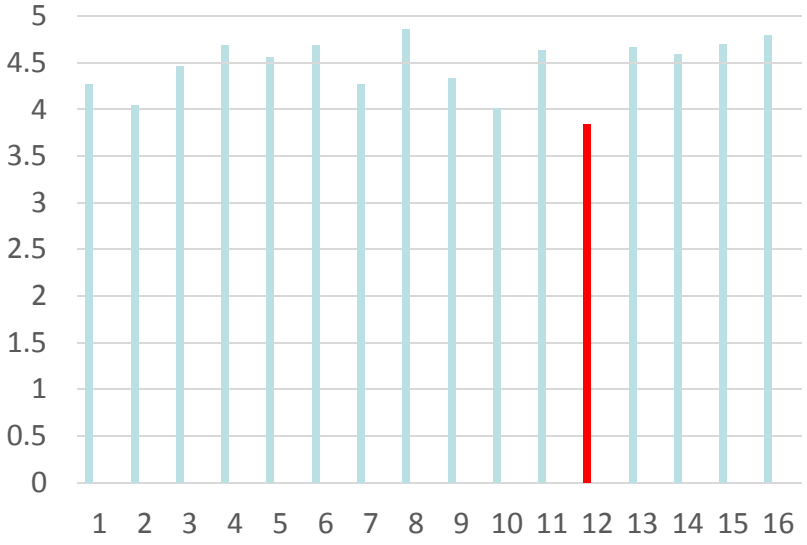


Figure MME7: Student evaluation numbers for the Department of Mechanical and Materials Engineering faculty for the Spring semester of 2014. Each number on the horizontal axis represents one faculty member and the numbers on the vertical axis are that faculty member's average evaluation. The average of all the faculty for this semester is 4.46 where is 1.0 is very poor and 5 is excellent.

Table MME33: Exit interview student evaluation numbers for the Department of Mechanical and Materials Engineering faculty for the academic year 2010 – 2011. Questions asked are in the first column and responses for each of the 15 faculty members evaluated are in the remaining columns. The first row gives the number of the faculty member. The average of each faculty member is shown in the last row where 1.0 is very poor and 5 is excellent. The average for all faculty members is 4.00.

Professors	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Number of courses taken by the professor	27	50	33	13	3	31	53	44	53	20	46	32	32	34	40
Teaching ability	3.95	2.93	3.38	3.92	3.67	3.84	4.96	2	4.93	3.29	3.77	4.35	4.35	4	3.85
Worked well with students	3.75	3.39	3.88	3.77	3.67	4.16	4.96	3.14	4.68	3.18	4.23	4.29	4.29	3.87	3.92
Ability to tailor course material to the students' level of understanding	3.75	3.14	3.42	3.85	3.67	4.21	4.83	2.45	4.54	3.41	4.12	4.18	4.18	4.17	3.65
Preparation	4.15	4.07	3.67	4.38	3.67	4.53	4.96	2.45	4.86	3.88	4.08	4.12	4.12	4.43	3.42
Organization	4.05	3.89	3.71	4.23	3	4.63	4.92	2.18	4.86	3.76	4.04	4.18	4.18	4.35	3.42
Knowledge of Material	4.75	4.43	4.46	4.77	4.67	4.53	5	3.68	4.96	4.41	4.38	4.88	4.88	4.7	4.27
Did this professor increase your motivation for the subject area taught	3.21	2.77	2.95	3	3.67	3.5	4.63	2.25	4.48	2.94	3.46	3.8	3.8	3.55	3.79
Discipline	4.3	3.86	3.96	4.15	4	4	4.71	2.29	4.71	3.65	3.85	4.53	4.53	4.43	3.96
Showed confidence	4.75	4	4.04	4.31	4	4	4.92	3.76	4.82	3.94	4.19	4.47	4.47	4.48	4.04
Overall Average	**4.07**	**3.61**	**3.72**	**4.04**	**3.78**	**4.15**	**4.88**	**2.69**	**4.76**	**3.61**	**4.01**	**4.31**	**4.31**	**4.22**	**3.81**

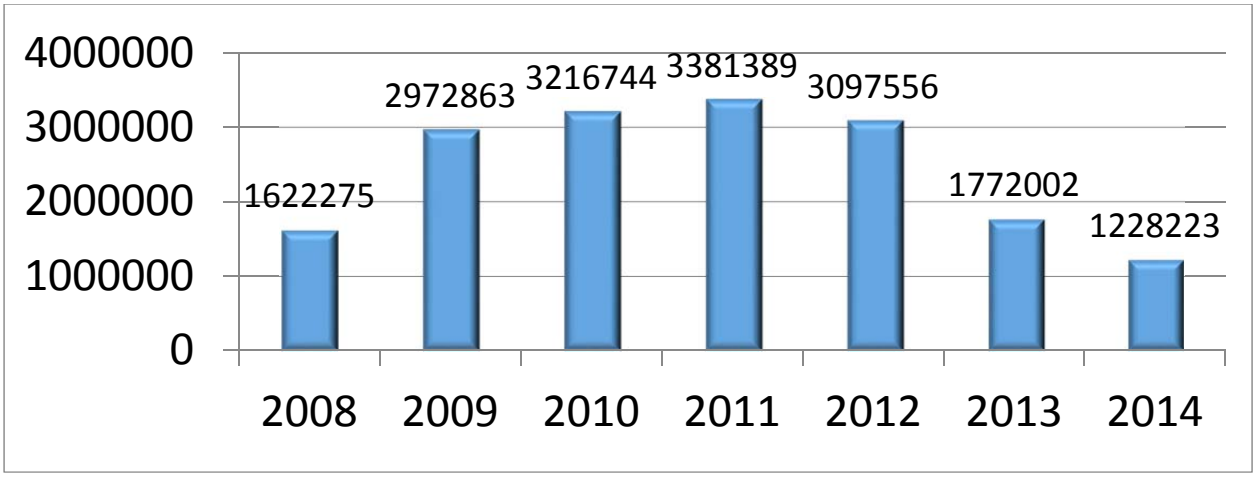


Figure MME8: Department of Mechanical and Materials Engineering research expenditures in dollars as a function of year.

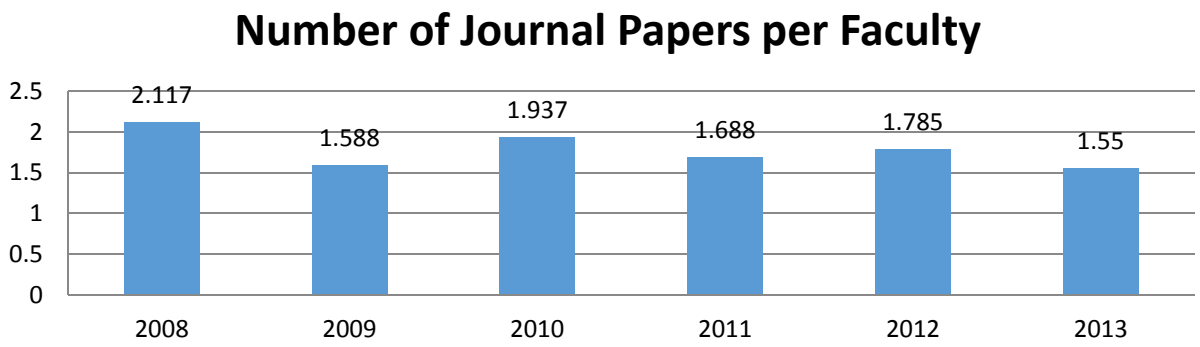


Figure MME9: Department of Mechanical and Materials Engineering journal publications per faculty.

The awards received by the Department of Mechanical and Materials Engineering faculty are numerous. A list of some of these awards and honors is given below:

1. Best paper award from the 33rd AIAA Dayton-Cincinnati Aerospace Science Symposium,
2. Outstanding student paper from the National AIAA Plasma Dynamics and Lasers Conference,
3. Excellence in Teaching Award from the Wright State College of Engineering and Computer Science,
4. Abe M. Zarem Award for Distinguished Achievement in Astronautics for student and advisor,
5. Trustee's Award for Faculty Excellence from Wright State University,
6. National Science and Technology award from the Chinese Academy of Science,
7. WOTRO Research Fellowship from the Dutch Organization for Scientific Research,
8. Dayton's Affiliate of Societies Council Outstanding Engineers & Scientists Award in the category of Education,
9. Silver Award from the Royal Aeronautical Society,
10. Ackroyd Stuart prize from the Royal Aeronautical Society,
11. Student Section Outstanding faculty Award from ASME,
12. Co-winner of the Gordon Bell Prize,
13. Co-winner of the Software of the Year Award from NASA,
14. Group Achievement Award from NASA,
15. President's Award for Excellence from Wright State University,
16. Senior Vice-President for Curriculum and Instruction Award from Wright State University,
17. Excellence in Teaching Award from the Wright State College of Engineering and Computer Science,
18. Robert J. Kegerreis Distinguished Professor of Teaching Award from Wright State University,
19. Ohio Professor of the Year from the Carnegie Foundation for the Advancement of Teaching and Council for Advancement and Support of Education,
20. Best Paper Award from ASEE North Central Section Conference,
21. Best Zone Paper Award from the American Society of Engineering Education,

22. Outstanding Teaching Award from the American Society of Engineering Education North Central Section,
23. Teeter Educational Award from Society of Automotive Engineers,
24. Spirit Award from NASA Moon-buggy Competition,
25. Third Place Award from Battery Powered Leaf Vacuum American Society of Mechanical Engineers Design Competition,
26. First Place Award from Utility Vehicle Duration American Society of Mechanical Engineers Competition,
27. Second Place Award from Multi-rider Vehicle American Society of Mechanical Engineers Competition,
28. Second Place Award from Utility Vehicle Overall American Society of Mechanical Engineers Competition,
29. First Place Award from Multi -rider and Utility Vehicle Design American Society of Mechanical Engineers Competition,
30. First Place Award from Utility Vehicle Endurance American Society of Mechanical Engineers Competition,
31. Second Place Award from Utility Vehicle Design and Endurance American Society of Mechanical Engineers Competition,
32. First Place Award from Multi -rider and Utility Vehicle Design American Society of Mechanical Engineers Competition,
33. Featured as “Nanotechnology Thought Leader” in AzoNano,
34. Featured as “Innovator” in Dayton Business Journal
35. Outstanding Scientist from the Wright State College of Engineering and Computer Science,
36. Faculty Service Award from the Wright State College of Engineering and Computer Science,
37. Faculty Service Award from the Wright State College of Engineering and Computer Science,
38. Outstanding Faculty Award from the Wright State College of Engineering and Computer Science,
39. Best paper award from the 32nd AIAA Dayton-Cincinnati Aerospace Science Symposium,
40. Excellence in Research Award from the Wright State College of Engineering and Computer Science,
41. Faculty Excellence and Innovation Award from Southwest Council of Higher Education,
42. Excellence in Teaching Award from the Wright State College of Engineering and Computer Science,
43. Trustee’s Award for Faculty Excellence from Wright State University,
44. Best Presentation Award from 38th American Institute of Aeronautics and Astronautics Dayton-Cincinnati Aerospace Science Symposium,
45. Best Presentation Award from 8th American Society of Mechanical Engineers Dayton Engineering Science Symposium,

46. Best Presentation Award from 7th American Society of Mechanical Engineers Dayton Engineering Science Symposium,
47. Best Presentation Award from 9th American Society of Mechanical Engineers Dayton Engineering Science Symposium,
48. Third Place Design Award from the Society of Automotive Engineers Aero Design Competition: Regular Class Airplane,
49. First Place Award from the ION Autonomous Lawnmower Competition,
50. First Place Award from the Society of Automotive Engineers Aero Design Competition: Micro Class Airplane,
51. First Place Award from the Society of Automotive Engineers Aero Design Competition: Micro Class Airplane,
52. Outstanding Engineers & Scientists Award from Affiliate Societies Council,
53. Outstanding Faculty Award from the Wright State College of Engineering and Computer Science,
54. Outstanding Teaching Award from the Wright State College of Engineering and Computer Science,
55. Dow Outstanding New Educator Award from American Society of Engineering Education, and
56. Ralph R. Teetor Educational Award from the Society of Automotive Engineeers.

Programs and areas of recognized excellence with supporting evidence

The Mechanical and Materials Engineering program is the largest engineering program at Wright State University by total student population. As discussed in many of the sections above this is a department that excels at teaching, research and service. There are a number of areas of recognized excellence in this department.

One of the areas of recognized excellence is in the area of computer modeling of physical phenomena. A number of computer programs representing a number of physical phenomena have been written by the faculty in this department. Some of these programs are: GEO2D, GEO3D, Solar_PVHFC, low density plasma code, radiation heat transfer in front of a high speed vehicle code, multiple chemical reactions code, PIC ion engine discharge chamber code, blood flow through arteries code, etc. These programs have been funded by national agencies and a couple are available on the Department of Energy's websites. Computer programing of complex physical phenomena has been a hallmark of the Department of Mechanical and Materials Engineering.

The Department of Mechanical and Materials Engineering has also done some excellent research in the area of graphene. The computer modeling has been ground breaking and has been recognized by a number of citations to papers written by our faculty.

Another area of recognized excellence is the micro-air-vehicles laboratory that has been built in the Department of Mechanical Engineering. A number of micro-air-vehicles have been designed and built in this laboratory.

A graduate program housed in the Department of Mechanical and Materials engineering that is one of the few of its kind in the nation is the Renewable and Clean Energy Master's Degree Program. There has been considerable interest in this program since its inception. This is evidenced by the media coverage of this program at its inception. Local, national, and international media outlets covered this program. A list of these have been given in the "Recognitions of quality of the program" section of the

Renewable and Clean Energy Program report. While most of the international coverage was via internet outlets, local coverage included newspapers, radio and TV. Another reason why the Renewable and Clean Energy Program should be considered a premier graduate program is because it has one of the largest course offerings in Renewable and Clean Energy Engineering. We offer 22 renewable and clean energy engineering courses. Lastly, this program has been recognized by the number of invited talks that have been given about the program and the activities occurring in the program. These are listed in the "Recognitions of quality of the program" section of the Renewable and Clean Energy Program report.

Capacity for growth of programs

The capacity for growth of the programs in the Department of Mechanical and Materials Engineering can be estimated from the student number plots shown in Figures MME10 through MME12. Figure MME10 shows the growth of the undergraduate Mechanical Engineering students from 2006 to 2014, Figure MME11 shows the growth of the undergraduate Materials Science and Engineering students from 2006 to 2014, and Figure MME12 shows the growth of the graduate students in the department from 2006 to 2014 for each program. The undergraduate programs are showing steady positive growth over this time period, while the graduate programs are showing oscillating to steady growth, except in the 2013 to 2014 comparisons. The growth rate from 2013 to 2014 for each of the programs is:

Undergraduate Mechanical Engineering Program is 8%,
Undergraduate Materials Science and Engineering program is 15%,
Graduate Mechanical Engineering program is 64%,
Graduate Materials Science and Engineering program is 78%, and
Graduate Renewable and Clean Energy program is 50%.

We feel that in the future our graduate programs will grow faster than our undergraduate programs. We hope that we can maintain steady growth in our undergraduate programs as well.

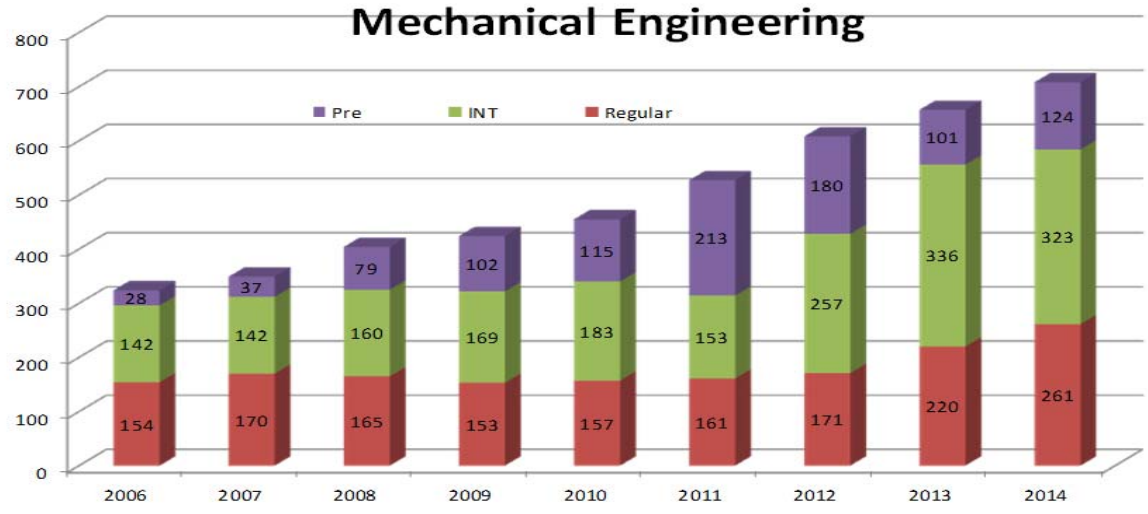


Figure MME10: Yearly student growth of undergraduate Mechanical Engineering program. The vertical axis is the number of students and the horizontal axis is the year.

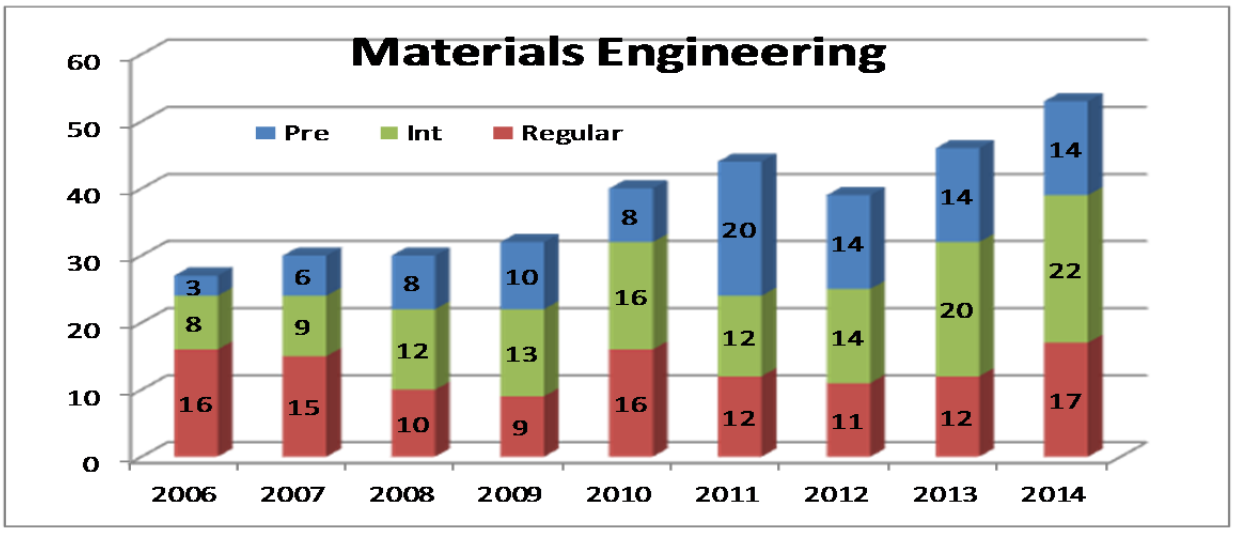


Figure MME11: Yearly student growth of undergraduate Materials Science and Engineering program. The vertical axis is the number of students and the horizontal axis is the year.

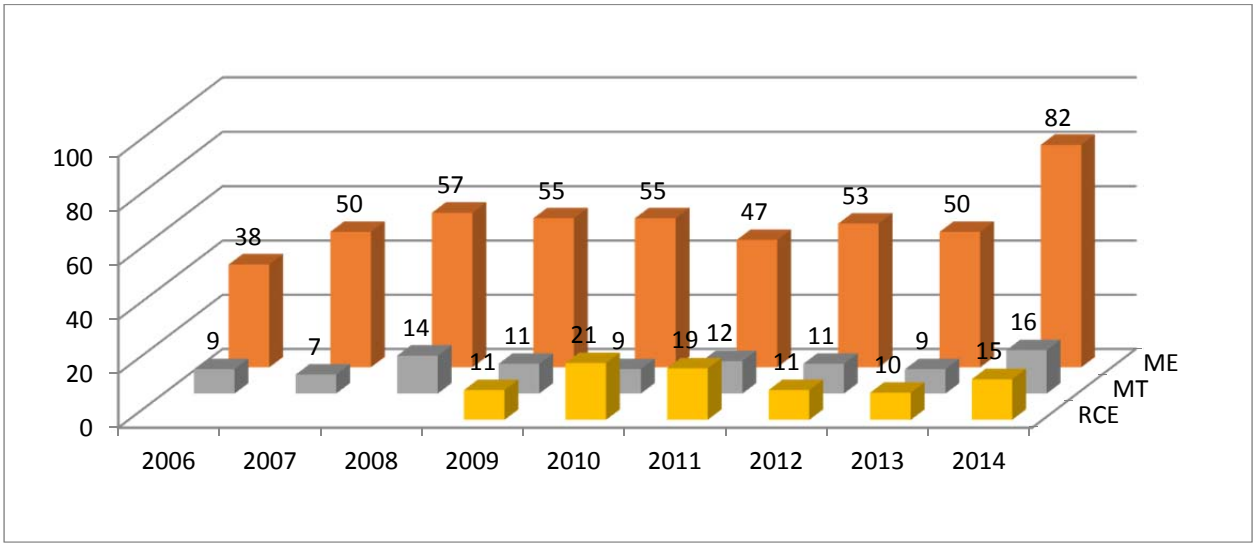


Figure MME12: Yearly student growth of graduate programs in the Department of Mechanical and Materials Engineering. The vertical axis is the number of students, the horizontal axis is the year, the orange columns are for the graduate Mechanical Engineering Program, the gray columns are for the graduate Materials Science and Engineering program, and the yellow columns are for the graduate Renewable and Clean Energy program.

New program opportunities

The Department of Mechanical and Materials Engineering does not have plans to start new programs in the near future. Of course we will always be looking for ways to better serve our surrounding community, and if this requires new programs be developed, we will do it.

Proposals to enhance programs

To enhance our undergraduate programs we are currently working on ways to implement recitation sessions for some of our more key and difficult undergraduate classes. We have implemented recitation sessions for our Statics, Dynamics, Solid Mechanics, and Thermodynamics I courses; however, the students are not attending these session in large numbers. In particular, the poor students are not attending these recitation sessions very much. We are looking for ways to get our weaker students into these recitation sessions.

Also to enhance our undergraduate programs we are looking for ways to increase the ethical standards of our students and to maintain an environment of academic integrity. We have instituted a number of policies in this area and will continue to look for better ways to maintain high ethical standards in our department.

Lastly, in regards to our undergraduate programs we are always looking for ways to improve our curriculum, improve our pedagogy, and to make our department staff a better resource for our students. We do not have a formal process ongoing in this area, but informally faculty members are recommending new courses and the Undergraduate Curriculum committee is reviewing recommendations. The big formal change in our undergraduate curriculum occurred in the academic years 2010 to 2012. This was the time of our semester transition. The actual transition occurred in the academic year 2012-2013, but the planning started two years before this.

To enhance our graduate programs we are currently involved in a graduate curriculum review. We are looking at all our graduate courses to see where changes should be made. We always look for ways to improve our graduate curriculum, but at the present time we have a formal process with a committee of four faculty members. This process is above the formal graduate curriculum process that occurred during the semester transition period, academic years 2010 to 2012. We are carrying out this formal process because a number of new faculty have joined the department and some old faculty have left. We want to have some of our graduate courses match our faculty's research expertise. A few changes have already been made to our graduate curriculum and this process will continue into next year.

In the future the Department of Mechanical and Materials Engineering needs to increase the amount of research work being performed, the amount of funding for research work being obtained, and the number of graduate students employed as research assistants. There are a number of ways to do this, and these will have to be investigated.