

## **SCHOOL OF MECHANICAL AND AEROSPACE ENGINEERING**

### **Mission**

Emphasizing the practice of engineering and the needs of Oklahoma, The School of Mechanical and Aerospace Engineering provides excellent education grounded in engineering fundamentals and advanced studies, contributes nationally recognized basic and applied research, and provides limited, focused customer-driven outreach.

### **Vision**

The School of Mechanical and Aerospace Engineering will be nationally recognized as among the best for its research, with strengths in manufacturing, nanotechnology, control systems, indoor environmental systems, web handling, specialized materials, and aerodynamics. Its educational programs will be programs of choice for Oklahoma and the surrounding region, and its outreach will specialized and limited, to be the best available, as determined by its clients.

### **Core Values**

**Excellence** – We seek excellence in all our endeavors, and we are committed to continuous improvement.

**Integrity** – We are committed to the principles of truth and honesty, and we will be equitable, ethical, and professional

**Service** – We believe that serving others is a noble and worthy endeavor.

**Intellectual Freedom** – We believe in ethical and scholarly questioning in an environment that respects the rights of all to freely pursue knowledge.

**Diversity** – We respect others and value diversity of opinion, freedom of expression, and other ethnic and cultural backgrounds.

**Stewardship of Resources** – We are dedicated to the efficient use of resources. We accept the responsibility of the public's trust and are accountable for our actions.

## **Strategic Goals, Critical Success Factors, Objectives, and Strategies (A.1\*)**

**Goal 1. Academic Excellence in Instruction - The School of Mechanical and Aerospace Engineering will support the mission for instruction of OSU and CEAT by providing a first class education to students that is grounded in engineering fundamentals by preparing:**

- **engineers who are competitive nation-wide and internationally for employment opportunities and who will become respected achievers within their chosen discipline;**
- **engineers who are well prepared for the pursuit of advanced studies at any university;**
- **and preparing engineers for a lifetime of continuing development that is demanded by disciplines involved with rapidly progressing technology.**

### **Critical Success Factors: (B.1)**

- Graduates of our undergraduate programs entering the workforce have starting salary averages equal to or above the average for other schools in our peer group, adjusted for regional salary variations.
- The percentage of acceptance of graduates of our undergraduate programs into graduate schools that are ranked equal to or above our own is equal to or greater than the percentage average of our Desired Peer Group.
- Recruit, retain, and graduate high quality B.S.M.E. students per AY in Stillwater and in Tulsa such that we average 3.4 BSME graduates per AY per faculty FTE at both locations, to move toward parity with the mean of our Desired Peer Group.
- Competitively recruit new faculty and retain sufficient faculty of excellent quality by raising starting offers and existing salaries by 23 to 31%.
- Expand the amount of support funding provided by the University by 28% to provide a learning environment for the students that will establish parity and be competitive with the mean of our Desired Peer Group.

### ***Objectives:***

***Objective 1.1: Actively recruit, retain, and graduate students of high quality, in numbers commensurate with our faculty resources to achieving a ratio of 3.4 BSME/BSAE graduates per faculty FTE per AY. (B.2, B.5).***

\* A parenthetical expression such as (A.1) refers to numbered explanatory notes, justifications, and benchmarking studies in either Appendix A or Appendix B to this Strategic Plan, available on [www.mae.okstate.edu](http://www.mae.okstate.edu), such that (A.1) refers to numbered note 1 in Appendix A, etc. A parenthetical expression such as (A.T1) refers to Table 1 in Appendix A.

Strategies:

- Require a minimum GPA of 2.5 in select course areas including Math, Basic Sciences, and Engineering Sciences in order to qualify for consideration for MAE professional School.
- For those students who qualify, select students into MAE professional School in Stillwater, and separately in Tulsa, on a best qualified basis as determined by the grade point average in relevant courses taken and completed at OSU, and professional potential. The selection process terminates when the maximum of 3.4 graduates per faculty FTE per year is reached.
- Require a grade of “C” or better in all MAE 3XXX and 4XXX courses. (B.3).

**Objective 1.2: Actively recruit new and retain sufficient faculty of excellent quality by offering compensation that is competitive among our “Desired Peer Group” (19-31% higher than present. (A.T1, B.5)**

Strategies:

- Recruit new faculty from institutions ranked in or above our Desired Peer Group to enhance the image of our programs and ultimately raise the ranking of our programs.
- Offer compensation and benefits competitive with our “Desired Peer Group” to recruit new and retain existing faculty, including incentives for quality undergraduate instruction. (B.4)).
- Streamline the undergraduate curriculum to reduce classes taught per faculty member. (B.6).

**Objective 1.3: Expand the amount of support funding provided by the University by 28% to provide a learning environment for the students that will establish parity with the learning environments of our Desired Peer Group (A.T2, B.2)**

Strategies:

- Use the expansion in support to hire additional teaching assistants, support staff, provide state-of-the-art instructional aids in the classroom, and replace and maintain equipment and instrumentation in undergraduate laboratories. (B.7).

**Goal 2. Academic Excellence in Instruction - Graduates of MAE undergraduate programs will achieve our Program Educational Objectives as required by ABET which are: (1) to educate engineers who can identify, formulate and provide effective solutions to real-life, complex problems; (2) to prepare engineers for successful careers by providing them with an appropriate background in mathematics, humanities, the sciences and engineering, and to instill in them a recognition of the need for lifelong learning and of the need to remain current in their chosen disciplines; (3) to educate engineers who can realize successful designs through proper use of classical and modern engineering tools while incorporating engineering standards and realistic constraints; (4) to prepare engineers to contribute successfully within teams and to communicate their ideas and solutions effectively.**

**Critical Success Factors:**

- Our BSME and BSAE Programs meet or exceed a level of quality eligible for attaining full term accreditation by the Accreditation Board for Engineering and Technology.
- All of our BSME and BSAE graduates meet our Program Educational Objectives as required by ABET.
- All of our BSME and BSAE graduates use and apply mathematics to meet our existing math metrics.

**Objectives:**

**Objective 2.1: Use monitoring and improvement to obtain and retain full term accreditation by the Accreditation Board for Engineering and Technology for our BSME and BSAE programs. (B.8)**

Strategies:

- Continue yearly measurement and monitoring of our Program Educational Objectives and Program Outcomes, with the results used to improve our curriculum per ABET's continuous quality improvement program.
- Use senior exit surveys, alumni surveys conducted by OSU assessment and MAE, and employer surveys to monitor the ability of our BS graduates to achieve our Program Educational Objectives.
- Review the results of these measurements every two years with MAE's Industrial Advisory Board and our Student Advisory Board to determine if (1) change needs to occur within our curricula such that our students will be better prepared to achieve the Program Educational Objectives and (2) to revise the Program Educational Objectives when needed to better serve our constituents' needs.

**Objective 2.2: To monitor the ability of our student body to achieve our Program Educational Objectives as required by ABET to ensure the continual improvement of our curricula and the capabilities of our graduates.**

Strategies:

- Use senior exit surveys, alumni surveys conducted by OSU assessment and MAE, and employer surveys to monitor the ability of our BS graduates to achieve our Program Educational Objectives.
- We will review the results of these measurements every two years with MAE's Industrial Advisory Board and our Student Advisory Board to determine if (1) change needs to occur within our curricula such that our students will be better prepared to achieve the Program Educational Objectives and (2) to revise the Program Educational Objectives when needed to better serve our constituents' needs.

***Objective 2.3: Monitor and improve the capability of our students to use and apply mathematics with existing metrics.***

Strategies:

- Use the Fundamentals of Engineering Exam to compare the ability of our students to use mathematics to the abilities of mechanical and aerospace engineering students from universities throughout the nation. (B.9).
- Encourage and support relevant university administrators to become proactive in taking steps in mathematics education to positively address undergraduate retention and improve mathematics learning. (B.10).

**Goal 3. Academic Excellence in Instruction - Improved visibility and national ranking of the BSME and BSAE programs. (B.11).**

**Critical Success Factors:**

- Annually, the top 15% of our undergraduates enroll in graduate study, both at OSU and at other institutions.
- At least 15% of MAE faculty are members of committees or are officers at the national or international level of their professional organizations (ASME, AIAA, ASHRAE, etc.).
- All MAE Faculty are members of their professional organizations (ASME, AIAA, ASHRAE, etc.) and attend at least one technical conference annually.
- At least 10% of MAE faculty members are Fellows or equivalent in their professional organizations.
- Taken as a group, the MAE faculty, in conjunction with others, hosts at least 1 national/international conference, workshop, or seminar per year at OSU.
- Biennially, at least one textbook, textbook edition, conference proceedings, monograph, textbook chapter, or other significant publication is authored or coauthored by MAE faculty.
- At least 20% of the senior class participates annually in prestigious, national and international design-build competitions.

**Objectives:**

**Objective 3.1: For our best undergraduates, raise the awareness and value of graduate study, encourage them to pursue graduate study, and make them aware of opportunities at OSU and at other universities.**

Strategies:

- Annually, discuss the value of and opportunities for graduate study with the top 25% of our seniors.
- Make our undergraduate students ambassadors of our undergraduate program wherever they pursue graduate school.
- Encourage OSU graduate students to make presentations at conferences and other venues where they are visible to Deans and senior faculty from other institutions.

**Objective 3.2: Have at least 15% of MAE faculty as members of committees or officers at the national or international level of their professional organizations (ASME, AIAA, ASHRAE, etc.) (B.12).**

**Objective 3.3: Encourage and support the involvement of all MAE Faculty in their professional organizations and help them attain the most prestigious level of membership (i.e. Fellows) in those organizations. (B. 13).**

Strategies:

- Use administrative encouragement and support of this activity to signal the faculty that this is important to our programs and our national rankings.

**Objective 3.4: Encourage and support the MAE faculty to host a total of 1 national/international conference per year at OSU in unique niche areas of MAE research to bring faculty from other institutions and visitors from corporations worldwide to witness the excellence of the facilities and programs of MAE and OSU. (B.14).**

Strategies:

- Use administrative encouragement and support of this activity to signal the faculty that this is important to our programs and our national rankings.

**Objective 3.5: Biennially, to have at least one textbook, textbook edition, conference proceeding, monograph, textbook chapter, or other significant publication authored or coauthored by MAE faculty. (B.15).**

Strategies:

- Use administrative encouragement and support of this activity to signal the faculty that this is important to our programs and our national rankings.

**Objective 3.6: Involve 20% of the undergraduate senior class in participation in prestigious, national and international design/build competitions. (B.16)**

Strategies:

- Encourage and support critical faculty advising, oversight, and instruction in design/build competitions. Have this as a factor in determining merit based salary increases and promotions.
- Provide and support critical shop and laboratory needs for design/build competitions. Target improvement of design/build competitions in allocation of laboratory equipment and shop resources
- Provide capstone design credit for design/build competitions.

**Goal 4. Academic Excellence in Research and Scholarly Activity - Improve the visibility and national ranking of the graduate Mechanical Engineering Degree programs. (A.T1, B.17)**

**Critical Success Factors:**

- Maintain a Ph.D. student to faculty ratio of at least 1.9, while maintaining a graduate to faculty ratio for B.S. and M.S. students of no more than 3.4 and 1.0, respectively (B.18)
- Have at least 4 new endowed faculty chairs or professorships (B.19).
- Have significant fellowship stipends for at least 5 Ph.D. students.
- Have a “Direct-to-PhD option” to help recruit high quality B.S. graduates directly into the PhD program.
- Attain salary parity with desired peer group institution M.E. departments.
- Attain annual funding per faculty parity with public Carnegie 1 Research M.E. departments.
- Attain parity in faculty AY salary requirements from extramural research with that of mean of desired peer group M.E. departments, providing increased funds for hiring high quality PhD students.
- Attain parity in graduate teaching assistant support with that of desired peer group mechanical engineering department mean.
- Average at least 1.5 peer reviewed archival journal publications per year per tenure track faculty member, assuming parity in state funding and faculty salaries.
- Beginning with FY 2005, average at least \$150K per year per tenure track faculty member in extramural research expenditures, increasing each year at cost of living increase or better, assuming parity in state funding and faculty salaries.

**Objectives:**

**Objective 4.1: Increase faculty size or decrease student numbers to the level necessary to maintain excellence in education while meeting research objectives, targeting graduate to faculty ratios of 3.4 and 1.0 for B.S. and M.S. graduates, respectively.**

Strategies:

- Use additional funds from strategic reallocation to create new faculty positions.
- Reduce caps on mechanical engineering undergraduate enrollment at both Stillwater and Tulsa.

**Objective 4.2: Competitively recruit high quality faculty candidates from respected institutions.**

Strategies:

- Attain salary parity with desired peer group institutions.



- Adjust workload to be more competitive with other universities (B.20).
- Reduce AY salary requirements to parity with expectations at desired peer group institutions.

***Objective 4.3: Increase enrollment and graduation rate of high quality PhD students, targeting a student to faculty ration of at least 1.9.***

Strategies:

- Increase fellowship funding to recruit high quality PhD students.
- Use research assistantships to recruit high quality PhD students.
- Increase teaching assistantship salaries and use these to augment research assistantship offers.
- Develop a “direct to PhD” program for outstanding BS graduates.
- Enhance reputation of program to attract better quality PhD students.

***Objective 4.4: Increase the quality of our M.S. students.***

Strategies:

- Be more selective in admitting only high quality M.S. graduate students.
- Use additional funds from strategic reallocation to increase teaching assistantship stipends to be competitive with desired peer group institutions.

***Objective 4.5: Retain existing productive faculty, and improve quality of output and peer reputation by providing competitive funding per faculty member.***

Strategies:

- Attain salary parity with desired peer group institutions.
- Adjust workload to be more competitive with desired peer group institutions.
- Reduce AY salary requirements to parity with expectations at other universities.

***Objective 4.6: Annually average at least 1.5 peer reviewed archival journal publications and at least 1.0 conference presentation per tenure track faculty member, assuming achieving parity in state support of salaries and departmental support.***

Strategies:

- Encourage and support faculty through administrative process.

***Objective 4.7: Beginning with FY 2005, average at least \$150K per year per tenure track faculty member in extramural research expenditures, increasing each year at cost of living increase percentage or better, assuming achieving parity in state support of salaries and departmental support.***

Strategies:

- Encourage and support faculty through administrative process.

**Goal 5. Student Success and Development - Monitor and improve the professional development of the student in the classroom**

**Critical Success Factors**

- Adequate student understanding of professional and ethical responsibility
- Adequate student communication skills.
- Adequate student knowledge of contemporary issues and how these issues may impact them in the job place.

***Objectives:***

***Objective 5.1: Monitor and improve the student's understanding of professional and ethical responsibility, communication skills, and their knowledge of contemporary issues.***

**Strategies:**

- We currently have a process in place for accreditation purposes by which we monitor each of our student's abilities in the areas of: professional and ethical responsibility, communication skills, and their knowledge of contemporary issues.
- As part of a continuous quality improve program with ABET, our accrediting agency, we will continuously monitor, make curriculum adjustments, and seek improvement in each area.

**Goal 6. Student Success and Development - Foster professional development of the student outside the classroom**

**Critical Success Factors**

- At least 65% of our professional school students join and become active in the professional society of their choice (ASME, AIAA, ASHRAE)
- At least 50% of our senior students take and pass the Fundamentals of Engineering Exam, the first step in becoming a licensed Professional Engineer.

**Objectives:**

**Objective 6.1: Encourage all students to join and be active in a professional society.**

Strategies:

- We currently have faculty advisors assigned to each student professional organization. Through those advisors we will monitor the membership and the participation of the students.
- We will encourage the student officers of the student professional organizations to organize technical seminars as well as social activities which will entice student membership.
- We will encourage the students to present a student paper within the professional society of their choice (e.g. ASME/AIAA Mini-Symposium)

**Objective 6.2: Encourage and monitor all students to take and help prepare them for the Fundamentals of Engineering Exam.**

Strategies:

- Faculty will encourage all students to take the Fundamentals of Engineering Exam and ultimately aspire to becoming Professional Engineers
- Faculty will help prepare the students for the by presenting review sessions for the exam.
- Faculty will review the results of the F.E. exams in the different subject areas and alter the review sessions as needed to better prepare the students who take the exam the following semester.

**Goal 7. Student Success and Development - Provide instructional facilities, equipment, resources, and support services to both faculty and students that characterize an excellent learning environment.**

**Critical Success Factors**

- Maintain annual per faculty funding of department at parity with public Carnegie 1 research institution mechanical engineering department mean. (B.24).

***Objectives:***

***Objective 7.1: Provide sufficient funds to create and maintain an excellent learning environment.***

**Strategies:**

- Use recently obtained baseline data on faculty output and input to demonstrate funding requirements to maintain excellence.
- Convey to Dean and Provost that increasing national prominence and ranking is not possible without this increase.

**Goal 8. Engagement and Outreach - Strengthen MAE's image by producing quality outreach and service programs which benefit OSU, the people of Oklahoma, and people worldwide.**

**Critical Success Factors:**

- Offering of at least 2 courses per year by 2-way compressed video or other distance learning media to persons at sites other than OSU-Tulsa.
- Provide university service as requested, balanced with other faculty workload requirements.
- Host at least 1 short course per year on a topic of interest to our constituents.
- Host at least 1 international conference, workshop, or seminar per year in niche research areas where MAE has expertise.

**Objectives:**

**Objective 8.1: Provide at least 2 courses per year by 2-way compressed video or other media for distance learners at such remote sites as those at Conoco/Phillips in Ponca City, Halliburton in Lawton, and OSU-Oklahoma City.**

Strategies:

- Encourage and support faculty to provide courses by 2-way video, rewarding them with overtime pay.

**Objective 8.2: Provide university service, as appropriate. (B.21).**

Strategies:

- Encourage and support faculty to be involved in university service.

**Objective 8.3: Host at least 1 short course per year on a topic of interest to our constituents. (B.22).**

Strategies:

- Encourage and support faculty to host short courses to improve program visibility, rewarding them with overtime pay.

**Objective 8.4: Host at least 1 international conference, seminar, or workshop per year in niche research areas where MAE has expertise. (B.23).**

Strategies:

- Encourage and support faculty to host international conferences to improve institution and program visibility.

**Goal 9. Engagement and Outreach - Promote partnerships with other universities, research institutions, state and national industries (B.25).**

**Critical Success Factors:**

- Continue high level of partnerships with state and national industries. (B.25)..
- Continue high level of partnerships with other universities and research institutions. (B.25).

**Objectives:**

**Objective 9.1: Initiate and continue collaborative research and other types of partnership with Oklahoma industries. (B.25)**

Strategies:

- Individual faculty members will continue to seek out new industrial partnerships.
- Continue participation in the OCAST Applied Research Program.

**Objective 9.2: Where advantageous, initiate and continue partnerships with non-Oklahoma firms and other universities.**

Strategies:

- Individual faculty members will continue participation in local and national society activities.

**Goal 10. Diversity - Maintain or increase diversity in the MAE faculty and student body**

**Critical Success Factors:**

- As a matter of principle, the MAE faculty believe that setting quantitative goals for diversity is inappropriate. (B.26).

***Objectives:***

***Objective 10.1:*** In faculty searches we will seek applicants who meet all the needs of the position defined. We will also seek applicants who would be sensitive to the needs of groups whom we deem are underrepresented in the student body.



**Goal 11. Human Resources - Encourage and promote professional development of faculty and staff.**

**Critical Success Factors:**

- Development of at least one new course every three years in emerging areas and modernization of existing courses and laboratories by incorporating advances in technology.
- Annually, have at least 5% of the faculty will be on developmental leave (sabbatical or other).
- Maintain a teaching load of 3 courses per academic year for faculty with active, extramurally funded research programs.
- 10% of the MAE faculty in responsible positions in professional organizations, such as ASME, AIAA, ASHRAE, and SME.
- Each faculty member annually participating in at least one conference or workshop.
- Each staff member annually participating in at least one seminar or short course per year aimed at improving job-related skills.

**Objectives:**

**Objective 11.1: Have each staff member attend annually seminars and activities dealing with improving and expanding their job skills.**

Strategies:

- Encourage staff to attend technical seminars that will help in carrying out administrative process efficiently and communicating with faculty and students effectively.
- Encourage staff to learn new computer software and sharpen skills in existing software in order to efficiently assist faculty in teaching and research.

**Objective 11.2: Encourage and support faculty to learn modern techniques and methods to enhance research and instructional capabilities. (B.27)**

Strategies:

- Encourage and support through administrative process.

**Objective 11.3: Encourage faculty to apply for sabbatical leave and other leave for professional development activities. (B.28).**

Strategies:

- Encourage and support through administrative process.
- Seek special private funding to assist with travel and COLAS.

**Objective 11.4: Encourage and support faculty to collaborate with other universities in research and teaching using regular visits to other universities. (B.29)**

Strategies:

- Encourage faculty to interact with other faculty at Big 12 schools, using funding from Big 12 scholarships, research grants, and private gifts.

**Objective 11.5: Encourage and support faculty to attend at least one professional conference per year, preferably delivering a paper.**

Strategies:

- Encourage and support faculty through administrative process.
- Funding should come primarily through grants and contracts for established faculty. However, private gifts should be used when grant/contract funding is not available.

**Objective 11.6: Encourage and support faculty participating in professional organizations in the form of officers and technical editors of journals in their disciplines. (B.30).**

Strategies:

- Encourage and support faculty through administrative process.
- Provide secretarial support for these activities, to the extent of available funding.
- Provide private funding for travel when grants and contract funding is not available.

**Objective 11.7: Reduce nominal teaching load from 4 courses to 3 courses per year. (B.31).**

Strategies:

- Engage the MAE Undergraduate Curriculum Committee and the MAE Aerospace Advisory Committee to come up with a plan to reduce the number of MAE courses offered, and implement.
- Engage the MAE Graduate Advisory Committee to come up with a plan to reduce the frequency of Graduate courses offered.
- Engage the MAE Graduate Advisory Committee to come up with a plan to reduce the number, but increase the quality, of graduate students admitted to MAE, concentrating on more Ph.D. and less M.S. students.

**Goal 12. Human Resources - Actively recruit and retain faculty members of excellent quality by offering competitive compensation and benefits that include incentives for quality instruction and research productivity, as well as opportunities for professional development.**

**Critical Success Factors:**

- Attain salary parity with desired peer group institutions.
- Increase annual per faculty funding of department to parity with mean of public Carnegie 1 Research Institution mechanical engineering departments. (in 2003 this would mean increasing from \$84K at OSU to \$116K).

**Objectives:**

**Objective 12.1: Retain existing productive faculty.**

Strategies:

- Attain salary parity with desired peer group institutions.
- As described above, reduce faculty workload to norms at desired peer group institutions.
- Institute substantial merit salary increase programs.

**Objective 12.2: Hire and retain new productive faculty.**

Strategies:

- Offer competitive salary, benefit, and start-up packages, on par with those of desired peer group institutions.
- Offer reduced teaching loads for the first 3 semesters, plus full support during the first two summers.
- As described above, reduce faculty workload to norms at desired peer group institutions.
- Offer attractive research lab space.