K-State 2025 Strategic Action and Alignment Plan
College or Major Unit: College of Engineering
Department: Mechanical and Nuclear Engineering

1. **What are your Department's mission and vision and how does your organization contribute to achieving the University's and your College's/Major Unit's vision for K-State 2025?**

Mechanical & Nuclear Engineering Mission Statement:

The mission of the Department of Mechanical and Nuclear Engineering is to (1) provide rigorous and challenging educational experiences at both the undergraduate and graduate levels to enable students to attain their full potential, (2) conduct scholarship that is of national and international repute to generate new knowledge and technology for the benefit of society, and (3) provide service through outreach programs to our profession, the state, and the nation.

Mechanical & Nuclear Engineering Vision Statement:

The Kansas State University Department of Mechanical and Nuclear Engineering shall be a highly ranked department providing quality education within a research environment that develops engineering leaders to benefit society.

2. **What are your Department's *key* strategic activities and outcomes?**

3. **Identify [in brackets] which of your Department's strategic outcomes are directly linked to your College's/Major Unit's outcomes.** ***(If your Department or similar unit is not in a College or Major Unit, skip this question.)***

Key Activities	Short Term (2013 - 2015) *Key Outcomes*	Intermediate (2016 - 2020) *Key Outcomes*	Long Term (2021 - 2025) *Key Outcomes*
What we plan to do…	***What we expect to happen…***	***What we expect to happen…***	***What we expect to happen…***
Theme 1: *Recruit and retain academically qualified students from both inside and outside Kansas who will succeed in their profession by producing new solutions to and knowledge about the challenges of tomorrow.*			
Action Items for Theme 1:	**Theme 1:**	**Theme 1:**	**Theme 1:**
(a) Undergraduate Students			
1. Improve undergraduate program quality by reducing undergraduate student-to-faculty ratio. Challenge is adding faculty in sufficient numbers to decrease the student-to-faculty ratio with expected increases in	**Reduce undergraduate student-to-faculty ratio to 30. [EN T2, 4]**	**Reduce undergraduate student-to-faculty ratio to 28. [EN T2, 4]**	**Reduce undergraduate student-to-faculty ratio to 25. [EN T2, 4]**

undergraduate enrollment. 2. Improve retention of students by supporting the COE programs directed at student success. Important is the retention of freshman students continuing into the sophomore year. Students staying in MNE or COE are considered as retained. While some students will leave engineering for good reasons, some need guidance at this juncture to determine best path. Retention is focused on capable students wishing to obtain BSME. 3. Develop and implement comprehensive advising programs for the MNE undergraduates. Providing program and career advice to students is an important activity for the faculty. 4. Improve undergraduate participation in professional societies, honor societies, and our competitive teams. 5. Develop brochures and web pages that emphasize the breadth of problems that MNE addresses and the competitive teams in which our students participate and to use our website to boast about what MNE students are accomplishing. 6. Improve the number of opportunities/positions for undergraduate research experiences in the department.	**Improve retention freshman students entering sophomore year to 66% (COE data). [EN T1,a2]** **Increase number of national recognitions and upper ½ placement of competitive teams to 2 and 3, respectively.** **Increase annual number of undergraduate students having supported research experience to 30. [EN T1, a8; EN T3, 9]**	**Improve retention freshman students entering sophomore year to 68% (COE data). [EN T1,a2]** **Increase number of national recognitions and upper ½ placement of competitive teams to 3 and 4, respectively.** **Increase annual number of undergraduate students having supported research experience to 36. [EN T1, a8; EN T3, 9]**	**Improve retention freshman students entering sophomore year to 70% (COE data). [EN T1,a2]** **Increase annual number of undergraduate students having supported research experience to 44. [EN T1, a8; EN T3, 9]**
(b) Graduate Students 1. Compete nationally for the highest quality graduate students (especially for PhD students) by developing funds to (1) recruit using support from COE and Graduate School, (2) supplement GRAs, and (3) support	**Increase number of nationally recruited PhD students to 2, annually. [EN T1, b1 and b5]**	**Increase number of nationally recruited PhD students to 5, annually. [EN T1, b1 and b5]**	**Increase number of nationally recruited PhD students to 8, annually. [EN T1, b1 and b5]**

GRAs before external funding becomes available. 2. Assist the COE and Graduate School obtaining support reducing and/or eliminating tuition. Tuition costs are limiting recruitment of top graduate students and adversely effecting funding level of research programs. 3. Use fund raising opportunities to create graduate fellowships in conjunction with the COE Development Office. 4. Develop integrated BS-MS programs to increase the number of top students entering the PhD program. 5. De-emphasize all-course work MS students and emphasize entering PhD students. MS students should produce a research thesis as an intermediate step towards a PhD degree. 6. Increase PhD production from department which relates to magnitude of research and scholarship in the department.	**Obtain one fully funded graduate student fellowship supporting PhD work.** **Increase PhD graduates produced per year to 8. [EN T1: b1, b2, b3, b4]**	**Increase number of funded graduate fellowships to 2.** **Increase PhD graduates produced per year to 10. [EN T1: b1, b2, b3, b4]**	**Increase number of funded graduate fellowships to 3.** **Increase PhD graduates produced per year to 12. [EN T1: b1, b2, b3, b4]**
	Theme 2:	**Theme 2:**	**Theme 2:**
Theme 2: *Maintain the Mechanical Engineering ABET accredited undergraduate program that produces graduates with excellent problem solving and communication skills and who are well prepared to succeed in their professions or graduate studies.* **Action Items for Theme 2:** 1. Recruit and retain outstanding faculty members with teaching and scholastic excellence and insure that evaluation and P&T standards are	**[EN T2, 1]**	**[EN T2, 1]**	**[EN T2, 1]**

maintained to ensure faculty members demonstrate excellence in all areas of responsibility, namely, instruction, research/scholarship, and service through-out their academic careers.			
2. Continue to evaluate and adapt the undergraduate curriculum to insure that it prepares our graduates to meet the ever changing needs of our constituents as well as to provide them the qualifications to enter top ranked graduate programs.	**Use ABET evaluation and improvement methodology to maintain the outstanding quality of our undergraduate curriculum.**	**Use ABET evaluation and improvement methodology to maintain the outstanding quality of our undergraduate curriculum. Secure "clean" ABET accreditation in 2018.**	**Use ABET evaluation and improvement methodology to maintain the outstanding quality of our undergraduate curriculum. Secure clean ABET accreditation in 2024.**
3. Provide students with comprehensive well-taught courses and laboratories based on the most current technology. Use student fees prudently to improve the technology in our courses and laboratories. Seek additional extramural funds to expand our laboratories to accommodate the anticipated increases in enrollment.	**Expenditures using student equipment fees and extramural funds for laboratory and classroom technological improvements, respectively to $100K and $20K, respectively. [EN T2, 2]**	**Expenditures using student equipment fees and extramural funds for laboratory and classroom technological improvements, respectively to $130K and $50K, respectively. [EN T2, 2]**	**Expenditures using student equipment fees and extramural funds for laboratory and classroom technological improvements, respectively to $160K and $75K, respectively. [EN T2, 2]**
4. Expand our use of KSOL and other technologies to improve efficiency and communication with students, especially in large undergraduate courses. GTA's will be needed to support the delivery of KSOL courses from the department.	**Increase DCE and department support for peer based learning. Have 3 DCE supported GTA positions by 2015.**	**Increase DCE and department support for peer based learning. Have 7 DCE supported GTA positions by 2020.**	**Increase DCE and department support for peer based learning. Have 11 DCE supported GTA positions by 2025.**
5. Increase the involvement of members of the faculty in prominent professional service activities including ABET accreditation visitors.	**Increase number of faculty holding professional service positions and making ABET visits to 14 and 1, respectively. [EN T3, 7]**	**Increase number of faculty holding professional service positions and making ABET visits to 21 and 2, respectively. [EN T3, 7]**	**Increase number of faculty holding professional service positions and making ABET visits to 27 and 2, respectively. [EN T3, 7]**
6. Improve the MNE curriculum offerings allowing undergraduate students to focus elective courses in a specific area or topic. Undergraduate options increase the appeal of the undergraduate program by providing targeted, high profile options. An example is the existing Nuclear Engineering option.	**Increase options in MNE curriculum by which undergraduate students may specialize to 2.**	**Increase options in MNE curriculum by which undergraduate students may specialize to 3.**	**Increase options in MNE curriculum by which undergraduate students may specialize to 4.**

Theme 3: *Provide MS and PhD programs in NE and ME that, based on advanced courses, leading to original, innovative and publishable research.*	**Theme 3:**	**Theme 3:**	**Theme 3:**
Action Items for Theme 3:			
1. Provide more “cutting edge” 800-900 level courses so advanced graduate students gain the knowledge required to contribute to the creation of new knowledge. Currently, our advanced graduate students must fill their programs of studies with many courses outside the department. Also, courses dropped and significantly revised as appropriate.	**Number of 800 and 900 level courses (excluding special topics, seminar, MS Thesis, and PhD Dissertation courses) in the MNE and NE graduate program to be increased to 35.**	**Number of 800 and 900 level courses (excluding special topics, seminar, MS Thesis, and PhD Dissertation courses) in the MNE and NE graduate program to be increased to 40.**	**Number of 800 and 900 level courses (excluding special topics, seminar, MS Thesis, and PhD Dissertation courses) in the MNE and NE graduate program to be increased to 45.**
2. Avoid having students enter all course-work MS programs. Emphasize the PhD programs and encourage the good MS students to bypass the MS programs.	**Increase annual number MS Theses and PhD Dissertations to 8 and 6, respectively.**	**Increase annual number MS Theses and PhD Dissertations to 12 and 8, respectively.**	**Increase annual number MS Theses and PhD Dissertations to 16 and 12, respectively.**
3. Encourage students to present and submit research papers to national conferences and reputable journals before they finish their research defense. Too often students leave for a job and fail to produce papers in a timely fashion.	**Increase annual number of publications and conferences papers to 17 with graduate students as coauthors.**	**Increase annual number of publications and conferences papers to 22 with graduate students as coauthors.**	**Increase annual number of publications and conferences papers to 30 with graduate students as coauthors.**
4. Involve graduate students in collaborative synergistic research programs that allow them to help each other and for the senior students to mentor the beginning students.			
5. Provide PhD students with excellent language and technical skills			

opportunities to train for teaching and engage in lecturing to give them classroom experience and the ability to be prepared for academic careers. Those interested in academic careers should also have programs of studies that give them breadth of knowledge as well as depth in their chosen area of study. Develop university level course for graduate students planning to pursue an academic career.			
Theme 4: *Establish nationally recognized, high-impact, focused research programs that are self-sustaining and produce graduates who will become research leaders.*			
Action Items for Theme 4:	**Theme 4:**	**Theme 4:**	**Theme 4:**
1. Establish focused, high-impact research programs by building on existing departmental strengths that have substantial potential for external funding.	**Increase number of publications in top-tier journals to 20 per year. [EN T3, 1]**	**Increase number of publications in top-tier journals to 25 per year. [EN T3, 1]**	**Increase number of publications in top-tier journals to 30 per year. [EN T3, 1]**
2. Encourage and reward faculty who work collaboratively and synergistically with others to create multi-investigator research programs. Also, encourage faculty to interact with research faculty at other institutions and to bring them to KSU for collaborative efforts.	**Increase department's annual research expenditures to $5 M. [EN T3, 1]**	**Increase department's annual research expenditures to $5.5 M. . [EN T3, 1]**	**Increase department's annual research expenditures to $6 M. . [EN T3, 1]**
3. Hire new faculty whose research expertise complements research areas in the department in conjunction with hiring needs for the undergraduate program.	**Increase number of research projects with collaboration outside MNE department to 3.**	**Increase number of research projects with collaboration outside MNE department to 5.**	**Increase number of research projects with collaboration outside MNE department to 8.**
4. Develop an ethos of research and scholarship that creates an environment in which all are eager to pursue new ideas and learn about new cutting edge discoveries.	**Reduce undergraduate student-to-faculty ratio to 30. [EN T3, 1 and 3]**	**Reduce undergraduate student-to-faculty ratio to 28. [EN T3, 1 and 3]**	**Reduce undergraduate student-to-faculty ratio to 25. [EN T3, 1 and 3]**
5. Reward highly productive research			

faculty and faculty who effectively mentor new and junior faculty in research. 6. Provide existing faculty with opportunities for research development by encouraging them to (1) take sabbaticals in order to develop new research skills, (2) attend short courses and other research development programs, and (3) make faculty visits/collaborations with researchers at other institutions. **Theme 5***: Create an MNE faculty with supporting resources and infrastructure that is nationally recognized for its excellence in instruction, research and scholarship.* **Action Items for Theme 5:**			
1. Promotion and tenure standards assisting development of faculty. P&T standards must be maintained to ensure faculty demonstrate excellence in all areas of responsibility, namely, instruction, research/scholarship, and service. 2. Increase faculty chairs, professorships, and UDP's. Secure resources to attract and hire, proactively, nationally prominent and experienced researchers who would make existing research programs even stronger. Attract them with high salaries (through endowed chairs), competitive startup packages, and other inducements. 3. Obtain supplements to faculty salary and other faculty support for retention of most research productive faculty. 4. Increase professional recognition of	**Theme 5:** **Increase number of faculty members with designated chairs, professorships, UDP's to 1. [EN T3, 7]** **Increase department awarded Professional Performance Awards to 1. [EN T3, 7]**	**Theme 5:** **Increase number of faculty members with designated chairs, professorships, UDP's to 2. [EN T3, 7]** **Increase department awarded Professional Performance Awards to 3. [EN T3, 7]**	**Theme 5:** **Increase number of faculty members with designated chairs, professorships, UDP's to 4. [EN T3, 7]** **Increase department awarded Professional Performance Awards to 5. [EN T3, 7]**

the faculty through Fellow awards, journal editors, etc. through nominations and other means by the department's faculty.	**Increase number of faculty Fellow designations to 3. [EN T3, 7]**	**Increase number of faculty Fellow designations to 5. [EN T3, 7]**	**Increase number of faculty Fellow designations to 8. [EN T3, 7]**
5. Utilize department and college publications and websites to communicate accomplishments and creativity of the faculty other than professional journal and conference papers.	**Increase number of articles put into publications and websites annually to 6.**	**Increase number of articles put into publications and websites annually to 10.**	**Increase number of articles put into publications and websites annually to 14.**

4a. What resources and/or opportunities <u>exist</u> for your Department to achieve its vision and outcomes?

Take advantage of University programs based on SRO to attract and retain high quality graduate students.

1. **Demand for mechanical and nuclear engineers remains high. Over 10 years, experiences 43% growth.**
2. **Demand for STEM-based graduates remains high.**
3. **Demand for distance education will increase.**
4. **With resurgence of the nuclear power industry, other engineering disciplines will seek to add nuclear science courses to curriculum.**
5. **Governments scholarships and fellowships can be used to subsidize graduate and undergraduate students – include NSF, DOE, NIST, NANT, Nuclear Navy and ANS.**
6. **UG student base may be used as source of graduate students.**
7. **Research funding from industry has remained constant.**

4b. What resources and/or opportunities are <u>needed</u> for your Department to achieve its vision and outcomes?

Increase the MNE Faculty number to 30 in the first 2 year period, 35 in the next 5 year period, and 40 in the last 5 year period.

1. **Need increased faculty for the rapidly increasing student body to reduce the present 33:1 student to faculty ratio down to 25:1.**
2. **Need proportional distribution of COE resources to properly reflect student enrollment.**
3. **Recruitment of high caliber undergraduate and graduate students.**

5. How do you propose to acquire the resources needed for your Department to accomplish its vision and outcomes?

By seeking Department funding proportional to undergraduate and graduate enrollment
By hiring additional faculty, the number of supported graduate students and the total number graduate students will increase
By hiring additional faculty, the SRO returned to the Department will increase funds for recruitment and support
Make use of the College provided funds [T1(b)5] for graduate student recruiting.

1. **Actively requesting necessary resources and faculty positions to achieve the targeted 25:1 student to faculty ratio.**
2. **Begin advanced acceptance plan to identify and accept only those undergraduates with appropriate educational background and academic success.**
3. **Actively recruit excellent graduate student candidates from the undergraduate pool and from other Midwest universities.**

6. How does your plan link to the K-State 2025 University Benchmark Metrics, Common Elements, and Thematic Goals, Outcomes, and Metrics? ***(See below)***

6. Departmental Links to K-State 2025 University Benchmark Metrics, Common Elements, and Thematic Goals, Outcomes, and Metrics

Links to Benchmark Metrics
B-1 - Total research and development expenditures B-4 - Number of faculty awards B-5 - Number of doctorates granted annually B-6 - Freshman-to-sophomore retention rate B-8 - Percent of undergraduate students involved in research

Links to Common Elements
CE-5 - Funding CE-8 - Technology

Links to University Thematic Goals, Outcomes, and Metrics			
Links to 2025 Thematic Goals and Metrics	**Links to Short Term Outcomes (2011 – 2015)**	**Links to Intermediate Outcomes (2016 – 2020)**	**Links to Long Term Outcomes (2021 – 2025)**
T1 - Research, Scholarly and Creative Activities, and Discovery (RSCAD) **Theme 1 Metrics:** T1-1 - # of interdisciplinary research projects, institutes, and centers T1-2 - Total sponsored extramural funding expenditures T1-4 - # of refereed scholarly publications per academic year and allocated faculty member	T1-C - Increased funding for investigator-based research, research centers, and graduate training grants T1-E - Competitive compensation and support available to GRAs, GTAs, and GAs	T1-K - Nationally and internationally recognized research centers T1-M - Increased participation by undergraduates in expanded opportunities in research	
T2 - Undergraduate Educational Experience (UEE) **Theme 2 Metrics:** T2-2 - # and % of undergraduate students completing an experiential learning experience	T2-C - Increased participation by undergraduates in expanded opportunities for meaningful research		T2-Q - Freshman to Sophomore retention ratios comparable to benchmark institutions
T3 - Graduate Scholarly Experience **Theme 3 Metrics:** T3-2 - Total funds awarded for graduate assistantships, endowed scholarships, and fellowships T3-6 - # of graduate terminal degrees awarded	T3-G - Broader spectrum and greater overall number of courses offered at the graduate, and especially at the PhD level	T3-K - Increased funding for graduate research and teaching T3-L - Increased number of nationally and internationally recognized award-winning graduate faculty T3-M - Increased number of Doctorates Awarded	

Links to University Thematic Goals, Outcomes, and Metrics			
Links to 2025 Thematic Goals and Metrics	**Links to Short Term Outcomes (2011 – 2015)**	**Links to Intermediate Outcomes (2016 – 2020)**	**Links to Long Term Outcomes (2021 – 2025)**
T5 - Faculty and Staff **Theme 5 Metrics:** T5-1 - # of national and international faculty awards T5-2 - # and % of faculty with endowed chairs, professorships, and fellowships T5-3 - Competitive compensation packages for faculty and staff	T5-A - Total compensation competitive with aspirant university and regional employers for faculty and staff in high priority areas	T5-E - Total compensation competitive with aspirant university and regional employers for all employees	
T6 - Facilities and Infrastructure			