

**Department of Mechanical Engineering  
University of Nevada, Las Vegas**

**Strategic Plan - 2006**

**October 12, 2006**

**Summary**

As the Department of Mechanical Engineering evolves, it faces new set of challenges. We have been experiencing simultaneous rise of the numbers of our undergraduate students, Ph.D. students, and research programs. Comparison with other mechanical engineering departments shows that our faculty members are successfully carrying significantly heavier research and teaching burdens than their counterparts in other schools. Additional resources (faculty, professional staff, and equipment) are needed to ensure that our research program continues while maintaining quality undergraduate education. These resources will also help develop out newly approved master programs in Aerospace Engineering, Biomedical Engineering, and Material and Nuclear Engineering.

**Department Mission Statement:**

*The Mechanical Engineering Department will provide a quality, state-of-the-art education in mechanical engineering to students for entry into positions in industry or graduate school while motivating faculty to attain excellence in research including the incorporation of education into their research programs.*

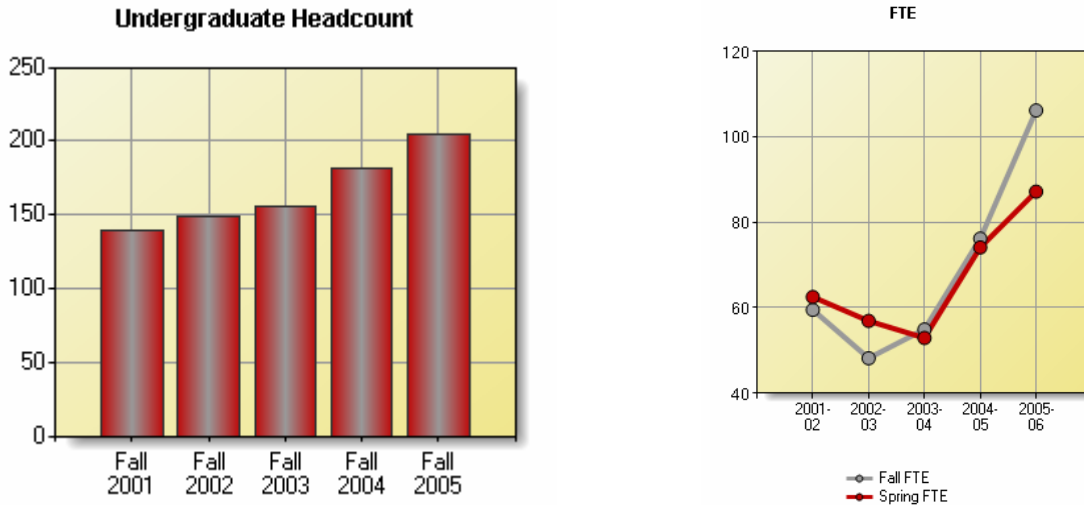
**Department Vision Statement:**

- Maintain the high quality of the B.S. in Mechanical Engineering Program
- Develop nationally-recognized multidisciplinary research programs that are built on our current strengths

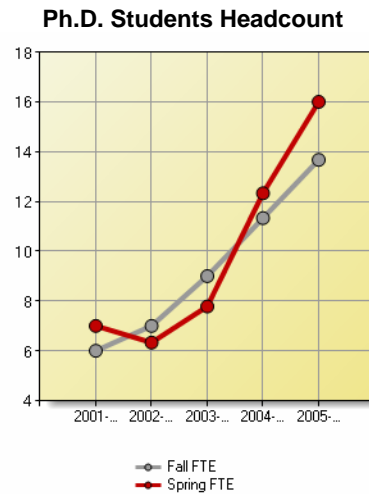
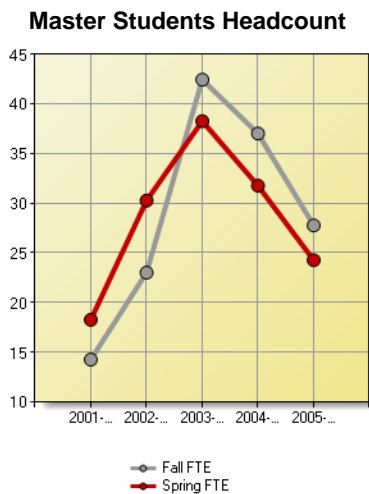
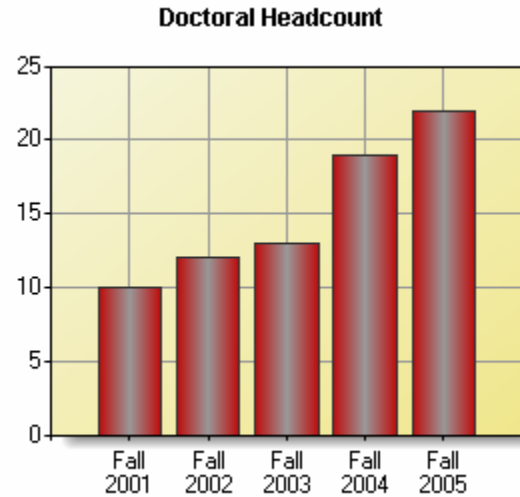
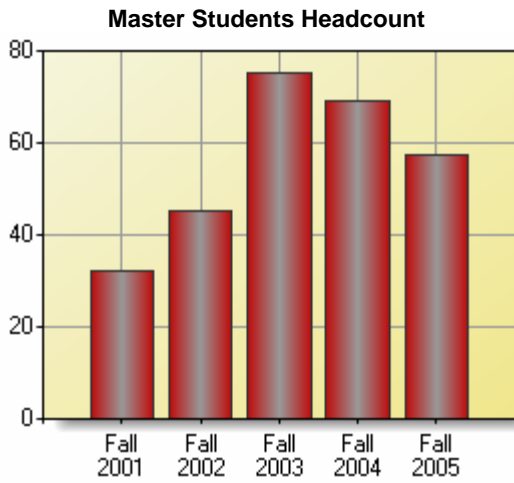
## Benchmark Status

We experienced a steady increase in the last five in our undergraduate and FTE enrollments. A major factor in this change is our success in communicating with local high schools through:

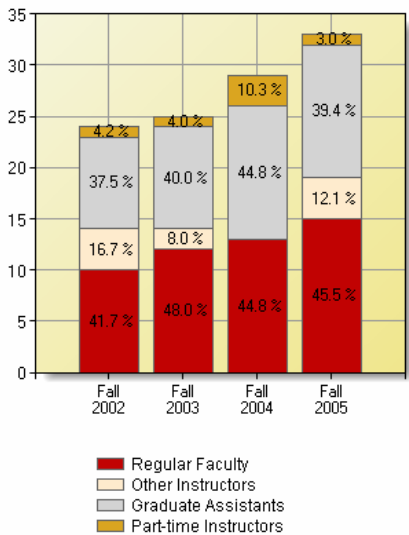
- Teaching ME 100 and ME 100L through Distance Learning to magnet schools (Advanced Technologies, Clark, Rancho) (Dr. Mauer)
- Continue mentoring students from schools who participate in the FIRST Competition



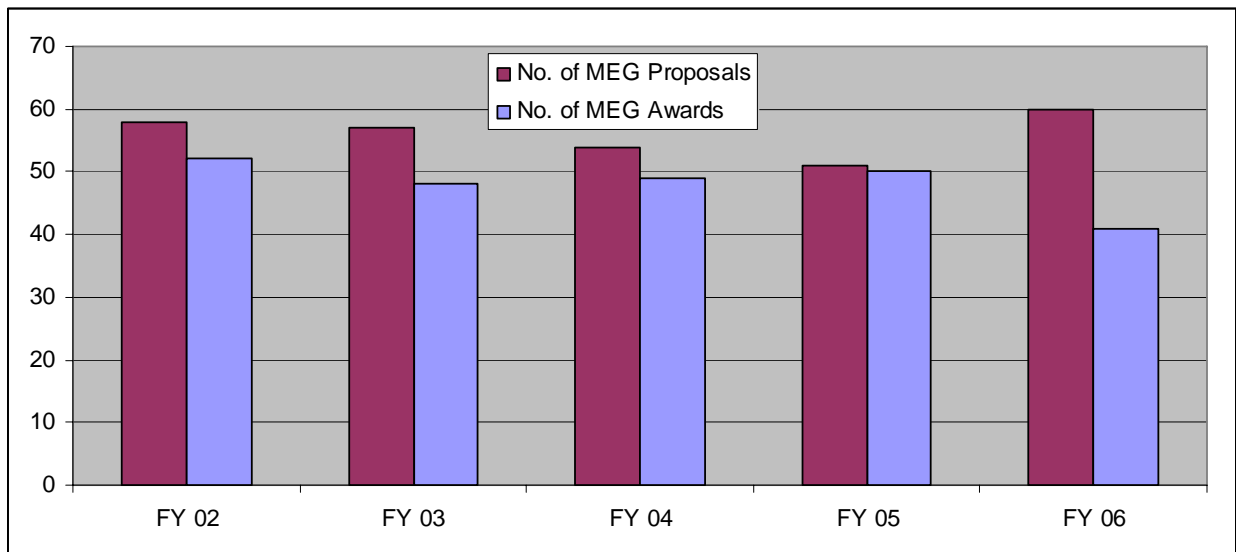
The department experienced a more significant change in its graduate enrollment as the figures below show. While the number of M.S. students is becoming smaller over the last two years, it is still considerably above 2001 levels. A more important development is the increase of the Ph.D. student numbers, which is a sign of the maturity of our program and its ability to attract top students in the field. Our current faculty members supervise an average of 5.3 graduate students, which is above the average of the leading research institutions as will be shown later in this section.



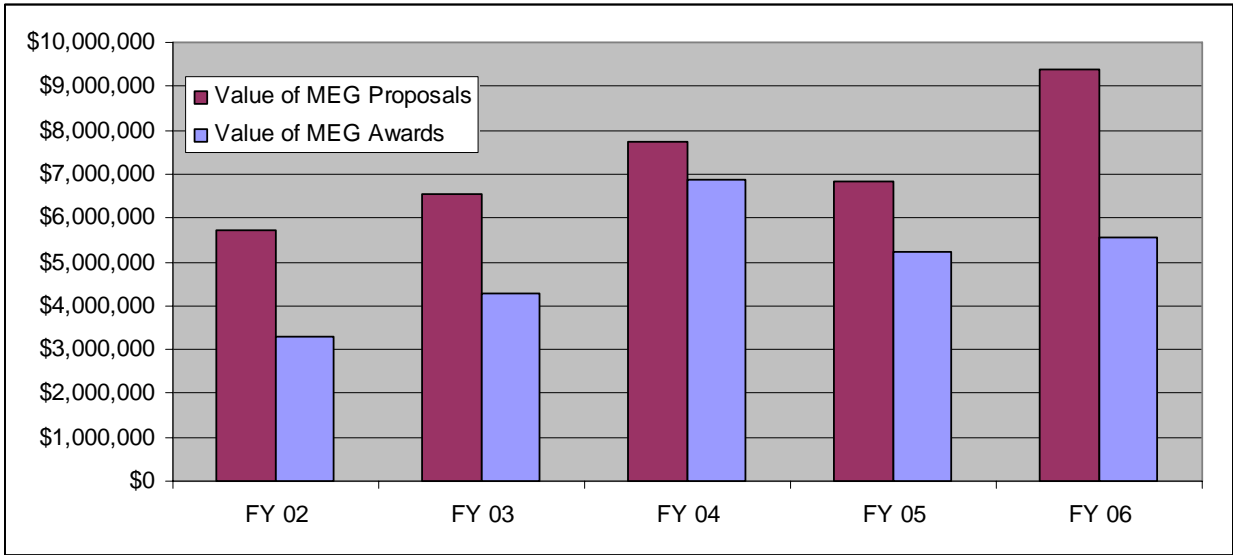
The figure below shows our instructor count. This number is however is misleading as one of our faculty, Dr. William Culbreth, is the Associate Dean. Additionally, Dr. Yitung Chen and Dr. Ajit Roy are both on 51% state-support and 49% research-support. This makes the number of our regular faculty practically close to 13 instead of 15. Additionally, we do not have any female or member of disadvantaged minorities in our faculty. Having representation from these groups can help in our recruitment efforts, especially with undergraduate students.



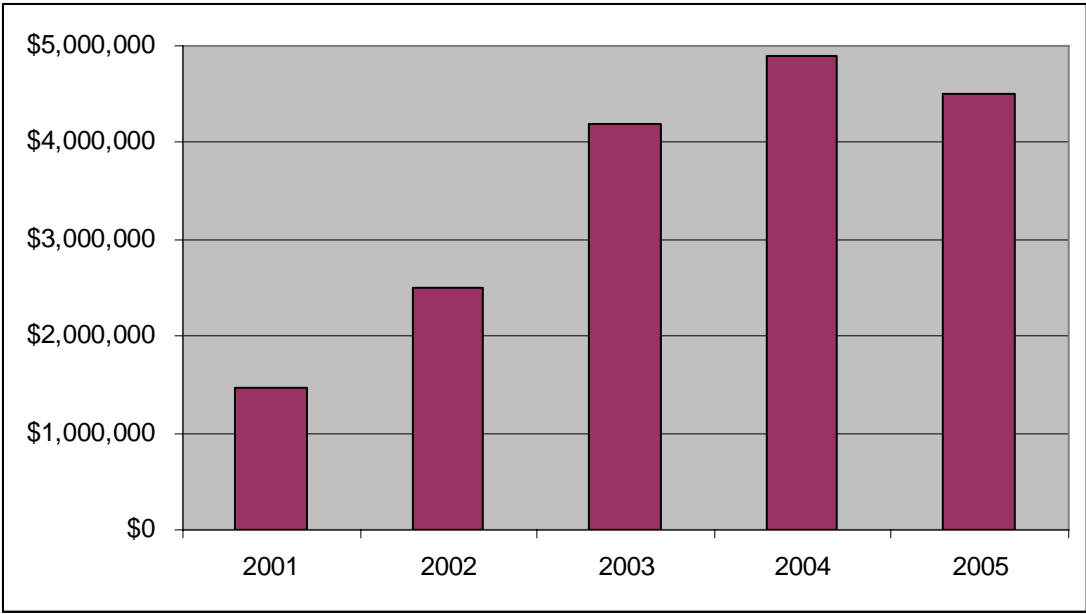
The value of submitted and awarded proposals by faculty in the department and associated centers (CER, CMEST, NACAM) continue an overall increase as the figures below show. As the figure below shows, research expenditures are matched by research expenditures. These funds have been spent in supporting graduate students. Sizable funds have been diverted toward lab upgrades, especially in the area of material performance testing and the intelligent structures and control laboratory. Increase in research activities was the impetus for sizable increase in the productivity of faculty, which stands now at about two journal article / book chapter and five refereed conference paper per faculty. These numbers are still below the averages of the more research focused-institutions as shown in the next section.



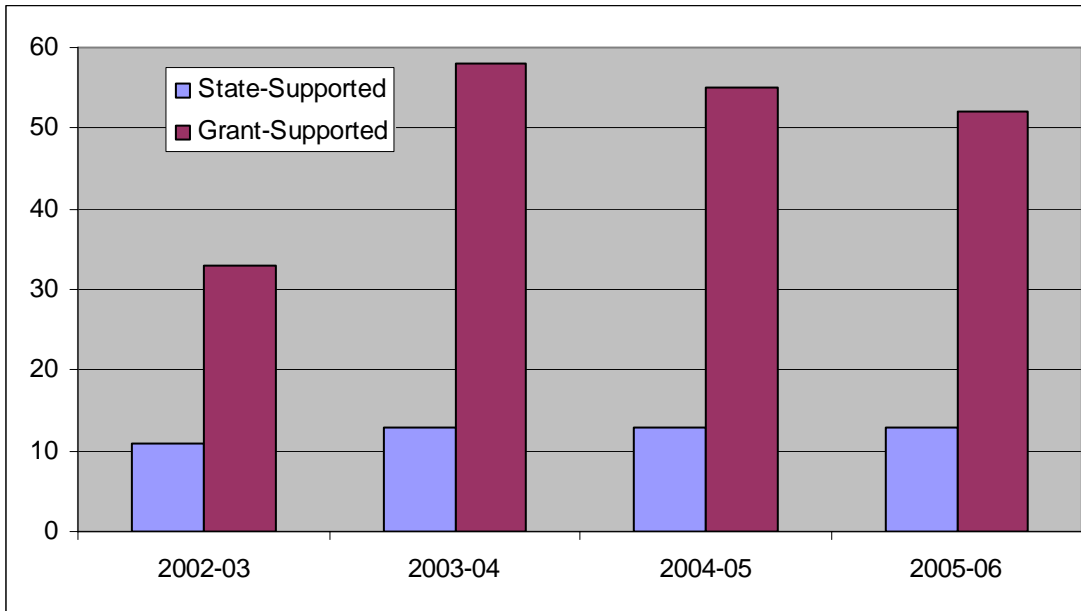
Number of MEG Department and Associated Centers Proposals and Awards in the Last Five Years



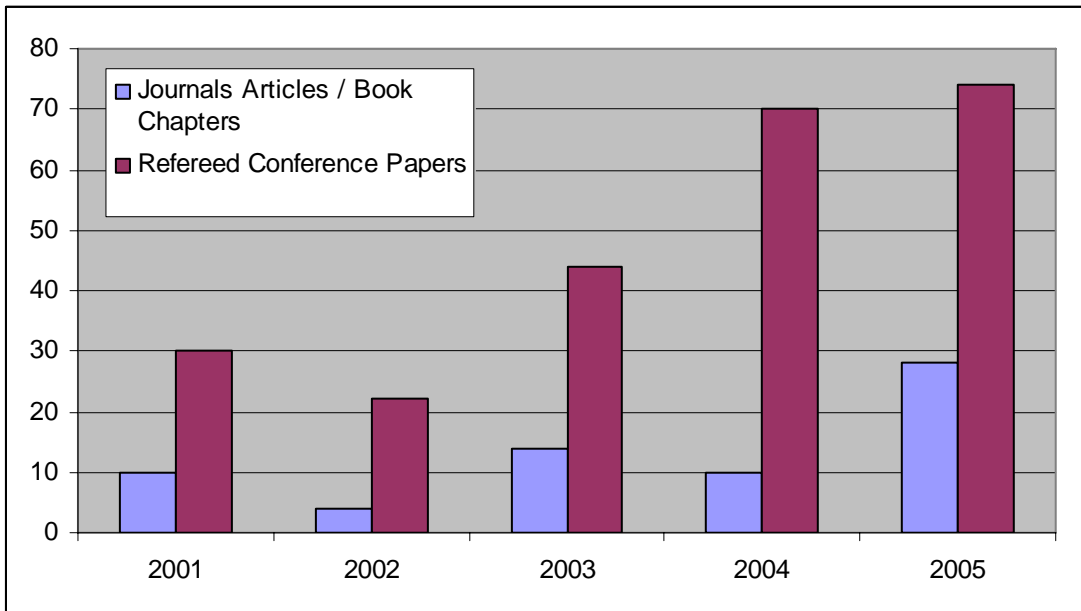
Value of MEG Department and Associated Centers Proposals and Awards in the Last Five Years



Research Expenditures of the MEG Faculty in the Last Five Calendar Years



Number of MEG Department State-Supported and Grant-Supported Graduate Students in the Last Five Years



Number of MEG Faculty Journal Articles, Book Chapters, and Refereed Conference Papers in the Last Five Years

### Comparison with Peer Institutions

Comparisons were conducted with mechanical engineering departments in universities in the 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> quartiles as per the 1995 National Research Council report, “Research-Doctorate Programs in the United States: Continuity and Change”

([http://www.nap.edu/dataset/pub/research\\_doctorate\\_programs\\_in\\_the\\_united\\_states/appendix\\_k/t20mee.xls](http://www.nap.edu/dataset/pub/research_doctorate_programs_in_the_united_states/appendix_k/t20mee.xls)), which contains information obtained in 1993. While these data may be slightly out of date, we feel that they represent the overall ranking of various schools. The data included:

- the number of faculty within the department
- the level of productivity with regards to publications per faculty member
- total number of graduate students enrolled in the program
- number of enrolled Ph.D. students

The data serve as a set of measures and targets for the department. The following three tables show comparisons with the UNLV Department of Mechanical Engineering.

Table 1: Comparison with 2<sup>nd</sup> Quartile School

<u>School</u>	<u>Fac.</u>	<u>Pub./Fac.</u>	<u># of Grad. Std.</u>	<u>Ph.D.</u>
Texas A&M	54	4.3	111	70
ASU	20	5.2	52	33
U Cincinnati	19	3.2	82	66
<i>Mean Values</i>	23	5.6	57	34
<b>UNLV</b>	<b>15</b>	<b>1.9</b>	<b>80</b>	<b>28</b>

Table 2: Comparison with 3<sup>rd</sup> Quartile School

<u>School</u>	<u>Fac.</u>	<u>Pub./Fac.</u>	<u># of Grad. Std.</u>	<u>Ph.D.</u>
U Oklahoma	15	4.3	30	21
U Pittsburgh	14	5.2	42	21
U Utah	23	3.2	68	27
<i>Mean Values</i>	19	3.3	46	22
<b>UNLV</b>	<b>15</b>	<b>1.9</b>	<b>80</b>	<b>28</b>

<u>School</u>	<u>Fac.</u>	<u>Pub./Fac.</u>	<u># of Grad. Std.</u>	<u>Ph.D.</u>
UM, Columbia	22	2.1	40	21
UT, Arlington	19	2.3	38	21
U of S. Carolina	17	2.4	18	13
<i>Mean Values</i>	<i>13</i>	<i>2.2</i>	<i>26</i>	<i>10</i>
<b>UNLV</b>	<b>15</b>	<b>1.9</b>	<b>80</b>	<b>28</b>

This comparison shows the following:

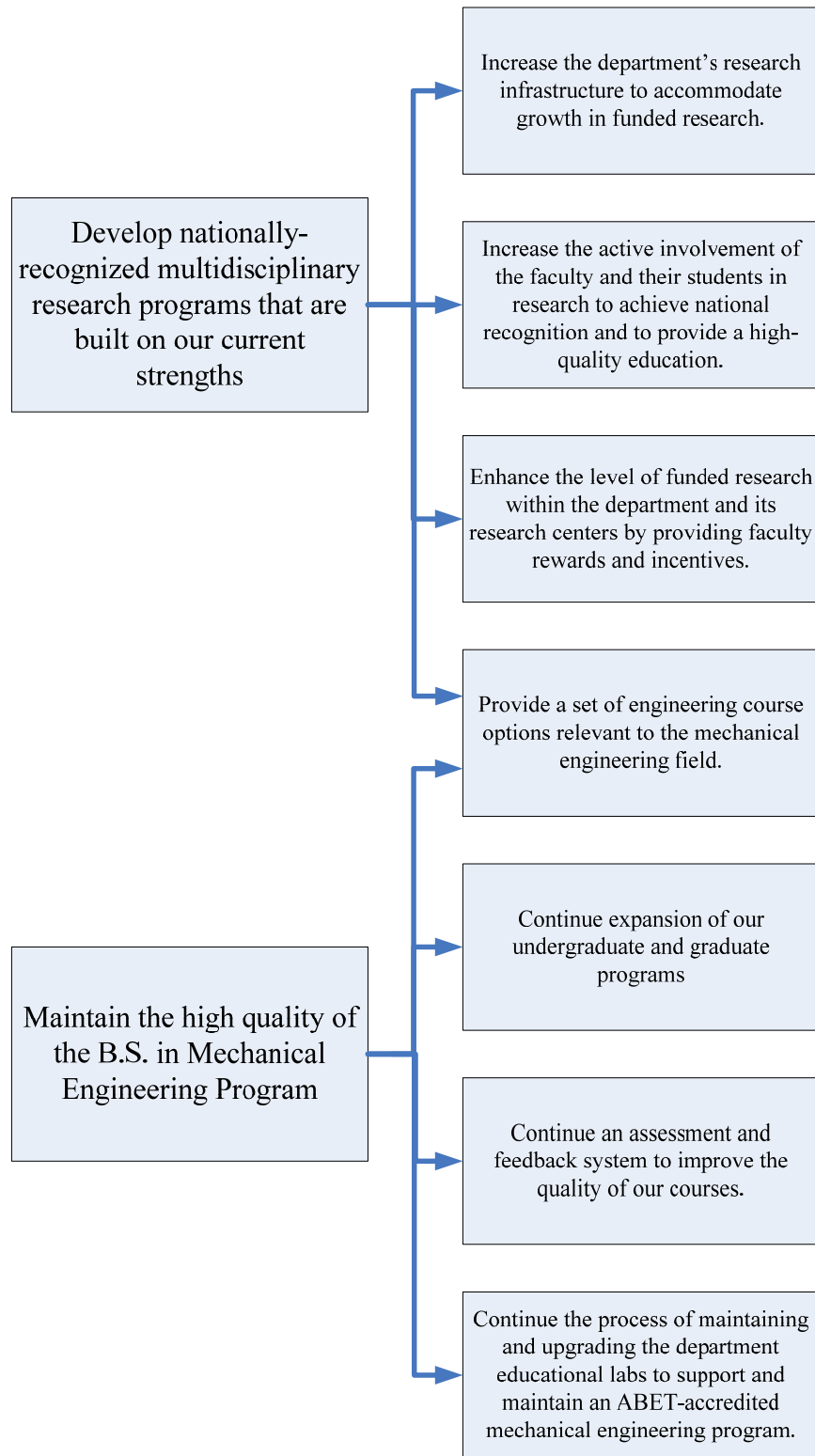
- The number of faculty is below the mean value for mechanical engineering departments in the 2<sup>nd</sup> and 3<sup>rd</sup> quartile schools.
- The ratio of graduate students to faculty is higher than the average of either the 2<sup>nd</sup>, 3<sup>rd</sup>, or 4<sup>th</sup> quartile schools.
- The number of publications produced yearly by the UNLV faculty compares with those in the 4<sup>th</sup> quartile schools. As the data of the previous section shows, this number has improved over the last five years.
- The total number of graduate students is higher than the mean values of either the 2<sup>nd</sup>, 3<sup>rd</sup>, or 4<sup>th</sup> quartile schools.
- The number of Ph.D. students is between the mean values of the 2<sup>nd</sup> quartile and 3<sup>rd</sup> quartile schools. These data should be assessed in the light of the fact that the PhD program at UNLV was not instigated until 1995.
- The ratio of Ph.D. students to the total number of graduate students is comparable with those in the 4<sup>th</sup> quartile schools.

## **Goals**

The department has the following goals:

- Increase the department's research infrastructure to accommodate growth in funded research.
- Increase the active involvement of the faculty and their students in research to achieve national recognition and to provide a high-quality education
- Enhance the level of funded research within the department and its research centers by providing faculty rewards and incentives.
- Provide a set of engineering course options relevant to the mechanical engineering field.
- Continue expansion of our undergraduate and graduate programs.
- Continue the process of maintaining and upgrading the department educational labs to support and maintain an ABET-accredited mechanical engineering program.
- Continue an assessment and feedback system to improve the quality of our courses.

The following figure shows how these goals are related to the department vision.



Relation of the Goals to the Department Vision

Increase the department's research infrastructure to accommodate growth in funded research

While our research capabilities were enhanced significantly as a result of our expanded research programs, additional equipment are needed to make us able to compete with other schools in securing research funding. Enhanced labs will also improve our chances of attracting the most qualified new faculty.

We need support of an IT professional to help with various hardware issues. Currently, this need is taken care of by faculty and students on an ad-hoc basis, which results in serious delays.

An additional professional position with background in accounting is needed to streamline financial management of our research accounts.

We are not requesting additional programs at this time. However, the Board of Regents recently approved the following departments within the department:

- Master of Science in Aerospace Engineering
- Master of Science in Biomedical Engineering
- Master of Science in Materials and Nuclear Engineering

The department feels that at the time being we should focus on enhancing these programs; all of these programs have a research-intensive nature.

Increase the active involvement of the faculty and their students in research to achieve national recognition and to provide a high-quality education

As comparison with national data shows, our collective publication levels should be maintained and enhanced. Faculty will be also encouraged to increase their level of participation in professional organization of their research fields. Faculty members are also encouraged to supervise post-doctoral researchers in their fields. We will also try to recruit highly qualified faculty for any new position and secure competitive start-up packages for them.

Some faculty increases occurred due to the addition of two positions that are 51% state-supported and 49 % research-supported three years ago. Continued increase in the number of students necessitates adding additional faculty positions to:

- Ensure quality of education by maintaining current classroom student to faculty ratios without resorting to part-time instructors.
- Ensure that students have variety of electives to meet their diverse needs.
- Ensure that faculty members supervise an average of three graduate students, as in the leading research institutions.

Enhance the level of funded research within the department and its research centers by providing faculty rewards and incentives.

The department is proud with the hard effort of its faculty to dedicate more of their time toward research activities. Our recent gains in obtaining research funding would not have happened without the dedication of the faculty. We can reach this goal through:

- Continue the process of having a reward system that reflects our current goals in tenure, promotion, and merit decisions.
- Reduce teaching load of extremely active faculty.
- Increase the number of faculty to ensure that the average annual teaching load of faculty who are active in research is three courses per year. Explore ways to promote research areas within the department that are less active than others.
- Strategic support of the research that can be unique in the state of Nevada

Based on the comparison with other mechanical engineering departments that was presented in the previous sections, we propose a plan whose objective is to ensure that our research program continues its current expansion by selective hiring of new faculty. Our long-term goal is to hire *two* new faculty per year for the next five years. Our proposed hiring for the next two fiscal years (FY 07 and FY 08) are:

- Upgrade Dr. Y. Chen, Associate Professor, half-tenure positions into regular tenure-track positions.
- Upgrade Dr. A Roy, Associate Professor, half-tenure positions into regular tenure-track positions.
- Hire a new faculty (Assistant / Associate) in the nano area with emphasis on materials.
- Hire a new faculty (Assistant / Associate) in the nano area with emphasis on biomedical applications.
- Hire a new faculty (Assistant / Associate) in the nuclear engineering area.

This plan ensures that additional faculty members will be able to contribute to the new master programs in Aerospace Engineering, Biomedical Engineering, and Material and Nuclear Engineering. We selected the nano field as a thrust area because of its inter-disciplinary nature. It has been identified by both ASME (American Society of Mechanical Engineers) and NSF (National Science Foundation) as an area of potential growth in research funding. This decision matches the plan of the university, which allocated a sizable space in the new Science and Engineering building for a nano lab.

Special attention will be focused on developing a plan to recruit women and under represented minorities for any new position. Due to increase competition between universities nation-wide for the most qualified candidates, there is a need to ensure that we can offer our candidates start-up packages that can attract them to coming to UNLV.

### Provide a set of engineering course options relevant to the mechanical engineering field

A necessary condition for a viable mechanical engineering department is the ability to offer variety of courses to be able to attract the best students. There is also a strong need for staff the new master programs in Aerospace Engineering, Biomedical Engineering, and Material and Nuclear Engineering while adding more faculty members to our already established programs.

Currently, we offer an average of *nine* 4XX/6XX-level courses and *six* 7XX-level courses per semester. Additional faculty hiring is needed to improve these numbers.

We also continue the current process of reviewing our undergraduate and graduate curriculum to eliminate irrelevant courses and add new courses that reflect changes in the engineering field.

### Continue expansion of our undergraduate and graduate programs

As our numbers show, both our undergraduate and graduate programs have gone through phenomenal expansion recently. We need to continue this trend without sacrificing quality. Recently the department raised its standards by raising the Admission to the Major to a minimum GPA 2.50. We also require an overall 2.3 GPA and 2.5 GPA in engineering courses for probation, transfer, and graduation.

To sustain this momentum, additional faculty should be hired. Additionally, we want to strengthen our relation with magnet schools in the Las Vegas Valley. Currently, we teach ME 100 and ME 100 L (Introduction to Mechanical and Aerospace Engineering) at three magnet high schools (Advanced Technologies H.S., Clark H.S., and Rancho H.S.) through the efforts of Dr. Mauer. Our objective is to make the brightest students aware of the local opportunities.

Additionally, we have been interacting with local high schools by providing mentors to schools participating in the FIRST Competition. Students can use this mentoring as a design elective. This arrangement, which is supervised by Dr. O'Toole, has been extremely successful.

We need to continue to increase the number of Ph.D. students as well as their percentage of the graduate student population. This effort entails creating more recruitment materials. We also need to continue our efforts to improve the quality of the program by expecting Ph.D. students who are supported as teaching or research assistants to produce at least two journal papers by graduation time.

### Continue the process of maintaining and upgrading the department educational labs to support and maintain an ABET-accredited mechanical engineering program

As a part of our preparation for accreditation, we proposed a five-year plan for maintenance and upgrade our educational labs, which costs around \$70,000 annually. This process was enhanced by the recent hiring of Mr. Jeff Markle as a Lab Director. Mr. Markle, who is a highly qualified person, dedicates sizable amount of his time, in collaboration with various faculty, for this goal. Additionally, we need to continue upgrading our machine shop, which is now used extensively by the students. Mr. Kevin Nelson, our Model Designer / Machinist has improved the quality of senior design projects. Many of our research projects experienced significant reduction in time needed to manufacture test fixtures.

### Five-Year Plan for Upgrading MEG Laboratories

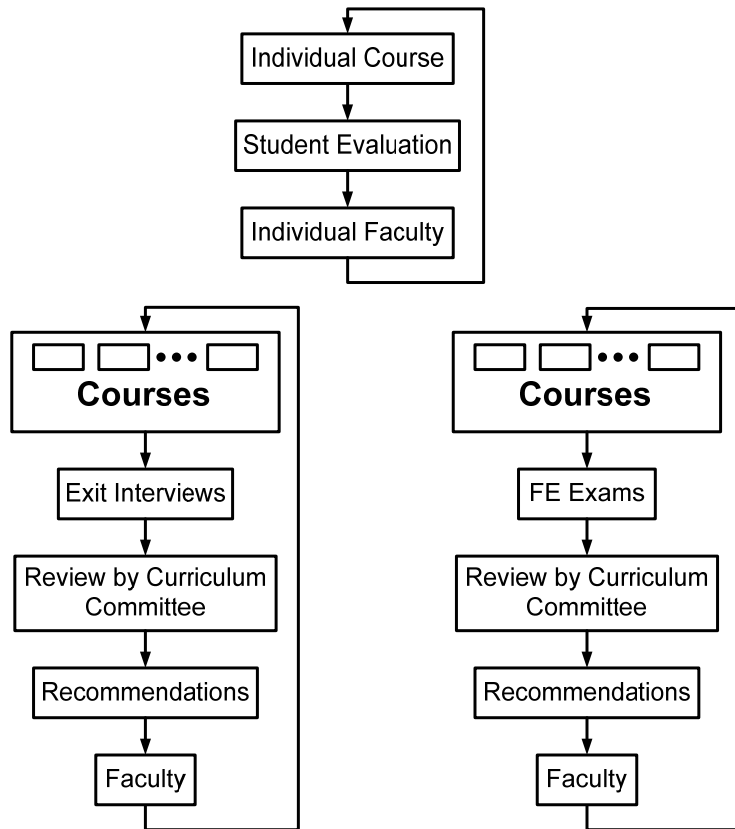
Year	Item	Cost
2005	• Rankine Cycler for Thermal Engineering Lab, MEG 315	\$20,000
	• Upgrade of Mechanics of Materials Lab, MEG 302L:	
	○ Soldering Iron Kits (15@ \$50.00)	\$750
	○ Soldering Accessories (spare tips, lighted magnifying lens, etc.	\$250
	○ New test fixtures	\$6,000
	• Remodeling of TBE B121 for appropriate workbenches and storage to better accommodate equipment and computers.	\$1,500
	• Replacement of computers in educational labs	\$6,000
	• Software Maintenance	\$22,000
	<i>Total:</i>	<b>\$56,500</b>
2006	• Upgrade of the Tinius Olsen machine for the Mechanics of Materials Lab, MEG 302L:	
	○ Computer for data acquisition	\$2,000
	○ Printer	\$500
	○ Strain gage conditioning system	\$5,000
	○ Load Cell	\$6,000
	○ Digital Controller for Tinius Olsen machine	\$10,000
	○ Displacement sensor and controller software	\$10,000
	• Replacement of computers in Computer Lab, TBE-B367 (four-year cycle)	\$60,000
	• Replacement of computers in educational labs	\$6,000
• Software Maintenance	\$23,000	
	<i>Total:</i>	<b>\$122,500</b>
2007	• Quasner 1st Rotary Motion Workstation 3 for Automatic Control Lab, MEG 421L	\$12,000
	• New Departmental Milling Machine	\$30,000
	• Replacement of computers in educational labs	\$6,000
	• Software Maintenance	\$24,000
		<i>Total:</i>
2008	• New Experiment Stations for the Mechanics of Materials Lab, MEG 302L	\$25,000
	• New Departmental Lathe	\$30,000
	• Software Maintenance	\$23,000
		<i>Total:</i>
2009	• New table-top test system (5,000 lb.) for the Mechanics of Materials Lab, MEG 302L	\$40,000
	• Quasner 2nd Rotary Motion Workstation for Automatic Control Lab, MEG 421L	\$5,500.00
	• Replacement of computers in educational labs	\$6,000
	• Software Maintenance	\$24,000
		<i>Total:</i>

Continue an assessment and feedback system to improve the quality of our courses.

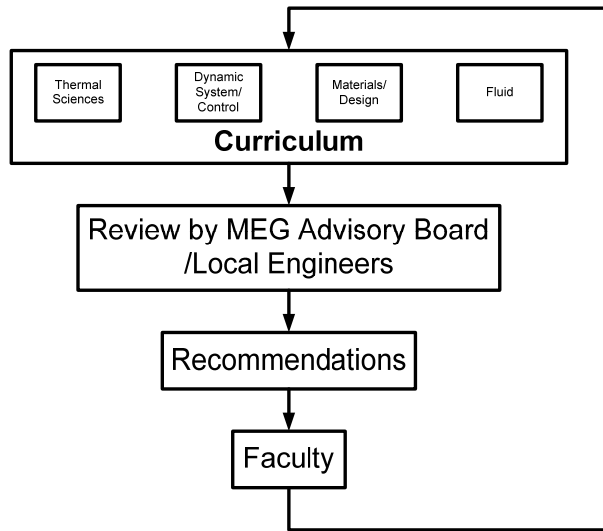
The department was recently accredited for six years by ABET. Part of this process is to create and maintain a process of assessment of the program through variety of external and internal mechanisms to ensure that the program produces students who meet local, regional, and national demands for well-qualified engineers who can be productive as shown in the figure below. The process is described in details in:

<http://www.me.unlv.edu/Undergraduate/ABET%20Self-Study%20Report%20I.pdf>

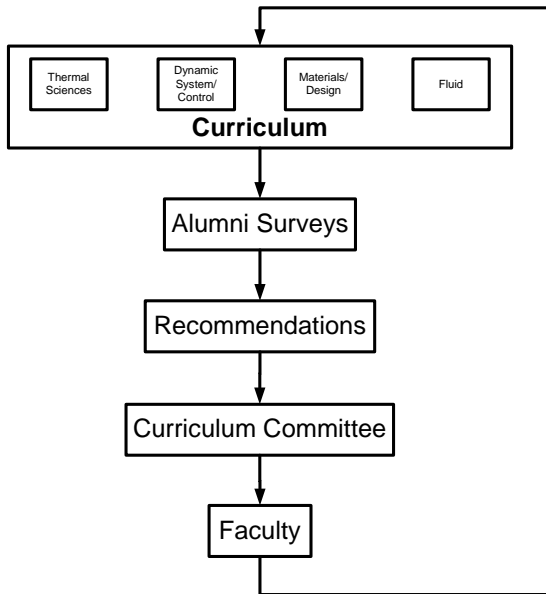
## Appendix A-MEG Program Assessment Process



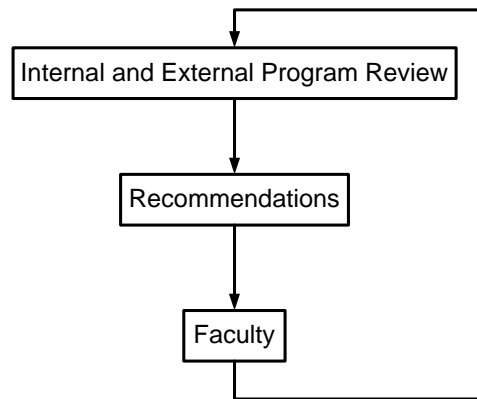
### Every-Semester Processes



**Annual Process**



**Tri-Annual Process**



**Five-Year Process**