

School of Mechanical and Aerospace Engineering

Prepared by L. L. Hoberock

Degree Program(s) Assessed	Assessment Methods	Number of Individuals Assessed
B.S. in Mechanical Engineering, Majors Mechanical Engineering and Pre-Medical Option;	(1) Performance of seniors on national Fundamentals of Engineering Exam administered by the National Council of Engineering Examiners;	65
B.S. in Aerospace Engineering	(2) Graduating Senior Exit Survey	90
M.S. in Mechanical Engineering	Final defenses of reports and theses by all degree candidates	30
Ph.D. in Mechanical Engineering	Final defenses of dissertations by all degree candidates	4

Analysis and Findings:

In our preparation for the Fall 03 visit by our engineering accreditation agency, ABET, we began following a new assessment plan (different from that on file in the OSU Assessment Office), which has not yet been submitted to the OSU Assessment Office, but will be submitted Fall 04. This plan does not call for assessment of all our program outcomes every year. However, as a transition during the 2003-2004 academic year, we did use several of our assessment methods as listed above, and are discussed in what follows.

Performance of seniors on the national Fundamentals of Engineering Exam: The average percent correct answers from our students to questions on this exam, by selected categories, are divided by the national average percent correct. Our target is to be at or above the national average, so our target ratio is 1.0 or higher. Each of these categories corresponds to one of our program outcomes, and the key is given on the attached graphs, with the definition of Program Outcomes also given in the attached. We track the ratios for each spring and fall offering of this exam, examining trends. The results are given in the attached figures for mechanical and aerospace engineers separately. For aerospace engineering majors, the trends are upward for all outcomes and equal or exceed our targets. For mechanical engineering majors, the trends are upward and equal or exceed our targets for all outcomes except FE3 "Ethics" which corresponds to Program Outcome f (POf), "An understanding of professional and ethical responsibility", which for the April 04 exam stood at 0.90. We have not yet discovered reasons for this, and have commissioned our undergraduate advisory committee to examine first, the nature of the ethics questions on this exam, and secondly, whether we need to introduce additional ethics material into our coursework.

On the other hand, this metric is at variance with a companion "ethics" outcome metric from our senior exit interviews, discussed in what follows.

For our senior exit interviews, we track average student responses on a 5 point scale for each of 11 Program Outcomes, labeled POa through POk, common for both aerospace and mechanical engineering majors. A score of 1 on this scale indicates "Very Dissatisfied", while a score of 5 indicates "Expectations Surpassed". In addition, we track average student responses for extra Program Outcomes that are particular to the mechanical and aerospace engineering programs separately. These Outcomes are labeled MEP01 through MEP04 for the mechanical engineering program and AEP 01 through AEP03 for the aerospace engineering program. The actual definition of each of these labeled outcomes is given in the attached. Our target level for responses for these interview surveys is 3.0, which signifies satisfaction of the students with their achievement of this outcome. It should be emphasized that we have collected during the past two years extensive data from direct measurement of outcomes in a large number of courses, and this direct outcome measurement correlates very well with the exit interview results. We have met or exceeded our targets in all areas. It is especially noteworthy that Program

Outcome POf, "An understanding of professional and ethical responsibility", was assessed through our senior exit interviews, and has remained well above our target level of 3 on a 5 point response scale. This contradicts results from the FE exam, and gives us reason to re-examine our metrics, as well as our instruction for this outcome.

For the M.S.M.E. degree, each graduating student is required to submit either a written thesis or a written report and to hold an oral defense before a committee of at least 3 MAE faculty members. This committee directly assesses both the student's written work on his/her assigned project, but also assesses the quality of the work through both the student's oral presentation and his/her responses to questions from the committee members during the oral defense. During the 2003-2004, academic year, assessment results indicated that we may have too many students taking the 2-credit-hour report option (with 33 hours of organized courses) for the M.S. degree, which is less demanding than the 6-credit hour thesis option (with 24 hours of organized courses). Moreover, the quality of some of these reports appears to be marginal. Further assessment indicates that the total number of M.S. students who are not bound for the Ph.D. should be reduced.

For the Ph.D. degree, before being admitted to candidacy, each student must first have a faculty advisor who agrees to work with the student through to completion of his/her Ph.D. degree, assuming that student successfully completes all the required steps. Students who do not have such a faculty advisor are not admitted for study toward the Ph.D. Once the student has a faculty advisor, he/she must pass a preliminary examination, which consists of defining an appropriate research problem, laying out possible approaches to solve it, writing this work up in a prelim report, and defending it orally before his/her Ph.D. committee of at least 4 faculty members, one of whom must hold an appointment outside the department and be in mathematics, science, or engineering. This examination determines whether or not a student should be allowed to continue. During the 2003-2004 academic year, out of 5 students sitting for the prelim exam, 4 passed and were allowed to continue. The second step in the process is to pass a qualifying exam, which consists of an extensive written report laying out a problem (which may or may not be the same as that in the prelim exam) together with progress made on addressing this problem. The student must then also defend this work orally before his/her committee. During 2003-2004 all 4 sitting for the qualifying exam passed. The final step is to pass a final exam, consisting of a written dissertation and oral defense before the committee. During 2003-2004, all 4 sitting for this exam passed. In the assessment of these committees, no deficiencies or suggestions for improvement were found. Further assessment indicates that the proportion of Ph.D. to M.S. students should be increased, with a strategic target of at least 33% of our graduate students admitted to study for the Ph.D.

Uses of Assessment Results:

Assessment results are shared with all MAE faculty through mailings and discussion at MAE faculty meetings. Our Undergraduate Curriculum Committee uses assessment results in making curriculum and course change recommendations to the entire faculty, and such recommendations are discussed and acted upon during MAE faculty meetings.

During 2003-2004, we incorporated into designated required and elective MAE undergraduate courses substantially more material on engineering ethics, to assure that students achieve this outcome. Ethics topics are now included in ENGR 1111 course taken (required) by mechanical and aerospace engineering students, MAE 3033 Introduction to Engineering (required of all MAE undergraduates), MAE 4344 Design Projects (required of all mechanical engineering students), and MAE 4374 Aerospace Systems Design. It will likely take several years before the results of this show up in our outcome assessments. We also have undertaken a study to examine first, the nature of the ethics questions on the national Fundamentals of Engineering (FE) exam (one of our faculty members sits on the FE exam composition and review committee), and secondly, whether we need to introduce additional ethics material into our coursework. From previous years' assessment results, we also have continued to provide review sessions in mathematics, prior to students taking the FE exam, as well as changing the required calculus courses from a 5-5 credit hour course sequence to a 4-3-3 hour sequence. Finally, from previous years' assessment results, we have continued to require our students to take a new 3-credit hour course in statistics that includes substantial treatment of design of experiments, and we have incorporated this topic into our key laboratory courses.

At the M.S. level, we have begun upgrading our requirements for admission to graduate study in MAE, eliminating admission to those we feel would want to take the M.S. creative component route, and we are advising newly admitted students that the only acceptable route is to take the M.S. thesis route. Our intent is to drastically reduce the number of students who take the M.S. creative component route.

At the Ph.D. level, we have begun a new strategy to recruit more Ph.D. students into our program by providing rewards to faculty who provide from their grants and contracts full stipends to Ph.D. applicants as part of the recruitment strategy. We also are giving high preference to admitting those M.S. students who indicate that their longer term goal is to pursue a Ph.D.