Unit Plan for Assessing and Improving Student Learning in Degree Programs

Unit: Aerospace Engineering

Unit Head Approval: J. Craig Dutton **Date:** May 6, 2008

SECTION 1: PAST ASSESSMENT RESULTS

Brief description of changes or improvements made in your unit as a result of assessment results since 2000.

The required course AE 470 *Aerospace Numerical Methods* was added to the curriculum several years ago based on suggestions from our faculty and alumni that our graduates needed more facility with certain numerical techniques and software, such as finite element methods and Matlab®. These are used extensively in the aerospace industry. This curriculum addition has received a positive response from our alumni and from employers of our graduates. For our students minoring in Computer Science, that department counts AE 470 in place of its own numerical methods course.

Based on feedback from alumni and students, a new required junior-level course AE 383 *Aerospace Information Technology* is being added as part of an extensive undergraduate curriculum revision. In addition, AE 201 *Aerospace Flight Mechanics*, a required sophomore course, is being expanded from 2 credit hours to 3 to incorporate a substantial introduction to Matlab® for use in that and subsequent courses.

Also based on feedback from students and alumni, a required statistics course is being added. Either IE 300 *Analysis of Data* or STAT *400 Statistics and Probability I* will satisfy that requirement.

Due to other curriculum changes and feedback, the total number of credit hours required for the BS degree will decrease from 134 to 128 to be consistent with other departments in the College. The curriculum revision will also introduce more flexibility in the order that core courses are taken. This will make study abroad and co-operative education programs more attractive. In the graduate program a direct (no intermediate MS degree) PhD program has been initiated for qualified students.

There are several AE 498 and 598 *Special Topics* courses being offered, mostly new since 2000. These are trial offerings that are intended to evolve into permanent courses and include the following areas at the senior/grad level: manufacturing of composite materials, motion planning for aerospace vehicles,

space access project, rapid prototyping and manufacturing, software and systems safety, and design and fabrication of human powered watercraft. Courses in this category at the graduate level include advanced computational aerodynamics, contact mechanics and scanning probe microscopy, distributed systems and control theory, advanced fracture mechanics, and computational multi-phase flow.

Since 2000 there have been ten new faculty hired (nine full time and one at 33%), including one full professor, two associate professors, and seven assistant professors. These hires were based on assessed needs in specific areas of research and teaching. This has more than offset four retirements, one death, and the decrease of our department head to 0% time in AE to become Executive Associate Dean for Academic Affairs in our College of Engineering. Our new department head joined us in Fall 2007. Since 2000 there have been five associate professors promoted to full professor.

Section 2: REVISED ASSESSMENT PLAN

(a) PROCESS: Brief description of the process followed to develop or revise this assessment plan.

The process is based on feedback from our three main constituent groups: students, alumni, and faculty. Student involvement is primarily through the AE Undergraduate Advisory Board and the AE Graduate Advisory Committee. These groups meet separately and monthly with the Department Head, the Associate Head for either Undergraduate or Graduate Studies, and the Coordinator of either Undergraduate or Academic Programs.

At these meetings communications flow both ways. The students bring concerns about the graduation requirements, course offerings, computer labs, etc. The department administrators consult with the students on potential curriculum revisions, changes in graduation requirements, etc. On major issues the students in these groups consult with their own student constituencies.

The feedback from the alumni is primarily through the AE Alumni Advisory Board. This Board has 30 members, mostly from the aerospace industry along with a few from universities and government. Each fall 15-20 members come to campus for a one-day meeting as a committee of the whole and in subcommittees. Both faculty members and alumni make presentations for information and to elicit feedback. In some cases subcommittees have worked on specific projects prior to the Board meeting and report the results of their work at the meeting

Feedback from the faculty occurs at monthly meetings and at an annual all-day off-campus retreat. Also, rotating members on the Undergraduate Curriculum Committee and the Graduate Policy Committee review the assessment process and the results of the assessment in order to recommend changes.

(b) STUDENT OUTCOMES: List Unit's student learning outcomes (knowledge, skills, and attitudes).

These are based on educational outcomes suggested by the Accreditation Board for Engineering and Technology (ABET). That organization made accreditation visits in 2001 and 2007.

Outcome 1. an ability to apply knowledge of mathematics, science, and engineering
Outcome 2. an ability to design and conduct experiments, as well as to analyze and interpret data
Outcome 3. an ability to design a system, component, or process to meet desired needs
Outcome 4. an ability to function on multidisciplinary teams
Outcome 5. an ability to identify, formulate, and solve engineering problems
Outcome 6. an understanding of professional and ethical responsibility
Outcome 7. an ability to communicate effectively
Outcome 8. the broad education necessary to understand the impact of engineering solutions in a global and societal context
Outcome 9. a recognition of the need for and an ability to engage in life-long learning
Outcome 10. a knowledge of contemporary issues
Outcome 11. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
Outcome 12. a high overall satisfaction with the AE Program

(c) MEASURES AND METHODS USED TO MEASURE OUTCOMES:

AE outcome assessments are made using several internal and external measuring instruments. These were also used for the ABET accreditation:

AE senior design presentations and reports
National undergraduate design awards
AE departmental senior surveys
AE departmental alumni surveys
Chancellor's Senior Surveys
AE alumni surveys by the Engineering Career Services Office
AE alumni correspondence

Direct assessments are made in the required AE senior design courses. Each student gives a final presentation on his or her part of the team's design. Most of the outcomes listed above (primarily 1, 3, 4, 5, 6, 7, 8, 10, 11) are directly measured for each student on a numerical scale. Outcome 2 is measured in the two required laboratory courses. Each student writes a series of reports analyzing data and drawing conclusions. Outcomes 9 and 12 are best measured by the surveys.

The surveys represent indirect, but equally valuable measurements.

Assessments for the graduate students are made by their academic advisors in annual written student review reports that are submitted to the Graduate Policy Committee. Assessments are also made in certain courses that require written reports and/or presentations for graduate credit in a senior/grad elective.

Section 3: PLANS FOR USING RESULTS

(a) PLANS: Brief description of plans to use assessment results for program improvement.

The groups and constituencies described in Section 2(a) above, that develop and revise the assessment plans, are also the ones to review the results and recommend changes if needed. All major curriculum revisions must be approved by the AE faculty, and then by the College and the Campus Senate.

(b) TIMELINE FOR IMPLEMENTATION:

It is intended that the major undergraduate curriculum revision mentioned above will be submitted to the College in Fall 2008 and be implemented in Fall 2009.
In accordance with HLC accreditation and in preparation for the next ABET review in 2013, ongoing assessments will be made. Some of the measuring instruments listed above in Section 2(c) are annual: the senior design presentations and reports, the laboratory courses, the AE senior survey, the Chancellor's Senior Survey, and the graduate student review forms. Some are less frequent, such as the alumni surveys – every five or six years. And some are unpredictable, such as senior design national awards and alumni correspondence.

JEP