MSU Departmental Assessment Update
Spring 2007

Department: Mechanical & Industrial Engineering

Department Head: Chris H. Jenkins

Assessment Coordinator: Ruhul Amin (ME), Kevin Cook (MET), Joe Stanislao (IE)

Date: August 5, 2007

<u>Degrees/Majors/Options Offered by Department</u>
B.S. Industrial Engineering
B.S. Mechanical Engineering
B.S. Mechanical Engineering Technology

Mechanical & Industrial Engineering Department
Montana State University—Bozeman

Industrial Engineering Program Assessment Plan Update AY 06-07

Please note that this is a continuation of the report filed during summer 2006. The Industrial Engineering Program assessment activities scheduled and completed during the AY 06-07 included the following:

- Assessment Plan Review
- Departmental Industrial Advisory Board (IAB)
- College of Engineering EAC and Engineering 2020
- Curriculum Changes
- Common Writing Expectations
- WTI Partnership Opportunity
- Employer Survey
- Student Exit Interviews
- FE Exam
- Alumni Survey
- Capstone Project Review
- Course Reviews

These assessment activities are summarized on the following pages.

Assessment Plan Review

- Plan was reviewed at retreat. We decided that highest priorities for 06-07 would be the Alumni Survey and the Senior Capstone Projects. Other assessment activities would continue. We must remember that we are trying to prepare students for academic careers as well as industrial careers.
- Specific plans and assignments for AY 06-07 activities were made.
- Plan was implemented immediately.

Departmental Industrial Advisory Board (IAB)

IE Program faculty met with the IAB on 9/27—28/06. The IAB congratulated the Mechanical and Industrial Engineering Dept. for their increased budget for research and development, for receiving the Top Tier ranking as a Research Institution from Carnegie while maintaining the undergraduate focus, for our outreach to Native Americans, and for working with two-year colleges to facilitate students transferring to MSU for a four-year degree in engineering. Their recommendations were:

- Encourage internships. Allow participation in longer programs, e.g., 6 months rather than 3 months. This is being explored.
- Incorporate more lean design and manufacturing throughout the curriculum. This is being done.

- Incorporate more plant tours. (This has begun.)
- Implement 3P Approach in Capstone Projects. (This appeals to students going into industry.)
- Expose students to real-world ethics, such as export controls, cross cultural differences, etc. (This is incorporated into several of our classes: I&ME 300, 325, 425, 434 and other advanced classes.)
- Continue to develop and implement Multi-D programs. (Dr. Sobek continues to lead this.)
- Faculty should explore corporate fellowship programs.
- Continue to protect quality of undergraduate education. (This is always a priority in our program.)
- Continue strategic planning for pending faculty retirements. (This continues. The WTI Partnership is one step in this planning.)

College of Engineering EAC and Engineering 2020

The attributes of Engineering 2020 and recommendations for adapting engineering education were presented. The EAC focused on technical foundation, lifelong learning, multidisciplinary awareness, diversity and cultural sensitivity, innovation and creativity, business sense, people skills, and real-world problem solving. The EAC recommendations are:

1. Continue dedication to engineering fundamentals.
2. Continue integration of learning theory into MSU engineering instruction.
3. Make an effort to obtain funds for research in learning in the engineering environment.
4. Develop implementation plan for Multi-D and tackle at least one of the elements of the multi-disciplinary cross-curriculum plan.
5. Continue efforts to make alliances with foreign universities.
6. Make increasing number of students doing internships a priority.
7. Continue to recruit a diverse faculty.
8. Nurture creativity in students and in small group pedagogy. (This is a challenge since there is a requirement for a certain enrollment to offer a course, but small group pedagogy does help nurture creativity. We currently do this with small group help sessions and sharing sessions.)
9. Increase undergraduate research opportunities for students.
10. Talk with School of Business regarding engineering participation in their Center for Entrepreneurship.
11. Have more speakers from industry.
12. Incorporate more breadth into coursework and relate to broader issues.

The Industrial Engineering Program Objectives I, II, III, IV, V, VI, and VII address these recommendations. Our expected Outcomes 1, 2, 3, 4, and 5 also relate to these.

Their Recommendations for adapting Engineering Education are:

(a) In addition to producing engineers who have been taught the advances in core knowledge and are capable of defining and solving problems in the short term, institutions must <u>teach students how to be lifelong learners.</u>

(b) Introduce interdisciplinary learning in the undergraduate curriculum.

(c) Work with two-year engineering programs in Montana.
(d) Encourage domestic students to obtain the M.S. and/or Ph.D. degrees.
(e) Participate in efforts to improve public understanding of engineering and efforts to improve math, science, and engineering education at the K—12 level.

As stated above, the Industrial Engineering Objectives and Outcomes guide us toward fulfilling these recommendations. Many of these recommendations duplicate those of the departmental IAB.

Curriculum Changes

On 1/24/07, the IE Faculty decided on these changes for the 2008—2010 catalog.

- Change ME 115 to ME 117.
- Make ME 117 prerequisite to I&ME 313 for IE majors.
    - ME 117 is a co- requisite to ME 116.
- Make ME 116 prerequisite to I&ME 442..
- Remove ME 116 co-requisite from I&ME 271.
- With small graduate enrollments, limit number of graduate courses offered each semester and perhaps create a new focus area.
- 2/02/07 Dr. Ed Mooney revised IE flowsheet to agree with curriculum changes related to ME 117 replacing ME 115, and the prerequisite and corequsite changes concerning this.

Common Writing Expectations

On 11/30/06, in response to the Industrial Advisory Board's feedback that some interviewed students said they were confused about what good technical writing is, we decided to work on a common writing expectations writing guide for the students to use. Dr. Ed Mooney shared an excellent white paper on formal technical writing, a checklist he uses for I&ME 422 reports, and a handout on proofreader's marks. Dr. Cole gives students a style template to use in I&ME 442. Creative writing style is not what our students need for technical writing. Document what is good technical writing. What are the key technical writing competencies? How should we build these in students? We should require students to do more reading. How are we measuring writing outcomes? This maps with IE Objective II and expected Outcome 4.

WTI Partnership Opportunity

On 10/12/06, all of the IE Program Faculty agreed that we want to work with WTI and hire a person in the human factors area. WTI will commit their 80% funding level for a minimum of 3 years. The new hire will be evaluated at third year review. This new faculty hire will teach one or more undergraduate courses within the IE Program. The Search Committee will be chaired by an IE Faculty member other than the Dean with equal representation on the committee from the IE Program and from WTI. Dr. Durward Sobek is the Chair of the Search Committee. Other members of the Search Committee are:

Dr. Michael Kelly (WTI)
Mr. Pat McGowen (WTI)
Dr. Joe Stanislao (IE)

Ms Allison Westergard (IE Student)
The committee has worked very hard and four candidates will be making campus visits to MSU within the next few weeks.
May 1, 2007 Candidates made campus visits and interviewed for the position. Separately, the Search Committee and the IE faculty, evaluated candidates and made recommendations to the department administration.

Employer Survey
On February 14, 2007, we were reminded that this is to be done every third fall, starting with F02. It should be done Fall 07. The Employer Survey, which was done via telephone, is being revised so that it can be sent out via the Web in a Survey Monkey format. This is a joint effort and should be ready by Fall 07.

Student Exit Interviews
The two procedures and tools developed and tested in the last two years are being used. Dr. Stanislao interviews students changing majors from IE to other programs. Dr. Schillings and Dr. Cole are using an oral non-threatening questionnaire to interview graduating seniors. Results of the Spring 07 exit interviews will be presented and discussed during Fall 07. Changes from student input in last year's exit interviews have been incorporated into the respective classes.

FE Exam
On 11/02/06, Dr. Mike Cole reported scores and test score placement for MSU. IE graduates were analyzed for weak areas in student preparation. The MSU engineering students ranked higher than the national averages in most areas including computers, ethics, engineering economy, modeling/computation, industrial management, manufacturing/production systems, facilities/logistics, HF/methods, and quality. The area of engineering probability and statistics was only slightly below the national average (-0.01). This was only seen in the AM portion of the exam. The PM portion of the exam is specifically related to Industrial Engineering. Starting with Fall 05, the IE specific part of the exam was changed from the previous categories used for questions. This makes it difficult to compare these results to those of previous years.

In all instances, except Fall 06, related to topics covered, MSU averages were within one standard deviation of the national averages. Overall, MSU students ranked above national averages as is shown in the table entitled "FE Exam Data for MSU Students" below.

FE Exam Data for MSU IE Students

Exam Date:	Number Passed: IE Students	Number Failed: IE Students	MSU PassRate	National Pass Rate:
Spring 06	6	1	86%	70%
Fall 06	0	1	0%	73%

Spring 07				

Alumni Survey

9/07/06 Dr. Gary Chen presented summary of Alumni Survey results from Spring 05. There was good support for Objective I in that 85% were employed in IE or management jobs. Professional society membership of 35% was better than the nationwide scores of 10%. Gary will revise survey questions for administering via Survey Monkey over the Internet. A question will be included asking alumni about internship opportunities for current students.

12/07/06 Dr. Chen distributed draft of new survey and asked for input feedback by 1/15/07. Survey will be put in Survey Monkey format and sent out during Spring Semester 07.

02/01/07 Gary distributed updated IE Alumni Survey for approval before changing it to Survey Monkey format. The survey will be sent out as soon as changed to this format.

02/14/07 Alumni Survey, 2nd Draft, was discussed and reviewed. Gary will work with Carol Anderson and Carolyn Plumm to have survey on-line via Survey Monkey in March/April. Survey population is Alumni from 1995—2004. Someone will e-mail alumni to ask them to participate. Paul will encourage reluctant alums. All responses should be in by April 30, 07. Dr. Chen will analyze and summarize results with help as needed/desired. Results will be presented at fall retreat.

Capstone Project Review

9/21/06 In keeping with the plan proposed last year to have a three-pronged review of the projects looking at sponsor satisfaction, faculty review of last year's reports, and IAB review of some reports from last year, Dr. Mike Cole sent copies of a few capstone projects, clean copies of his evaluation sheet, and a set of instructions used for the IAB via Terry. The IAB was asked to evaluate reports for quality of engineering work and written communication.

10/26/06 Dr. Cole presented one-page summary reviews of each of the Spring 06 Senior Design Capstone projects for faculty review.
Strengths: There was a wide variety of projects, some "brought in" by students.
Weaknesses: (1) Some reports did not do a good job synthesizing I&ME courses.
(2) Grammar and style were often weak.
Dr. Cole's plans for improving I&ME 444:

1. "Coach" the students more (per IAB comments).
2. Develop an "IE technical content" checklist for student use.
3. Revise grading sheet and distribute it to students early in the semester.
4. Require students to give more frequent technical presentations to class.
5. Ensure that students justify their use or non-use of the IE toolbox (time study, BOM, ergonomics, etc.) per comment by IAB.

6. For projects with at least two very strong students, apply less bureaucratic oversight and more "coaching."

Dr. Chen plans to require better reporting of project management, e.g., "who did what."

In an effort to improve students' writing skills, the faculty is working on an "IE Technical Content Guide" for students. This was described above.

Course Reviews

During Fall 06 and Spring 07, the following courses were reviewed:
I&ME 454 "Engineering Probability and Statistics II" presented by Dr. Paul Schillings
I&ME 444R "Senior Design Project" presented by Dr. Mike Cole
I&ME 313 "Work Design & Analysis" presented by Dr. Durward Sobek
I&ME 471 "Computer Integrated Manufacturing" presented by Dr. Gary Chen
I&ME 364 "Principles of Operations Research I" by Dr. Schillings and Dr. Mooney
I&ME 422 "Introduction to Simulation" by Dr. Ed Mooney. Scheduled for 3/28/07.
I&ME 434 "Project and Engineering Management" by Dr. Joe Stanislao. Scheduled for 4/18/07. Rescheduled to 4/25/07.

1. **I&ME 454 "Engineering Probability and Statistics II"**
   10/19/06
   Dr. Schillings presented this course review. Dr. Paul Schillings prepared and distributed four handouts related to syllabus, course review, exam preparation, course activities, and teams and term projects. Paul is incorporating some calculator training in I&ME 354 lab to help students who do not know how to use their calculators. He observes that students do not want to read to learn; they want the instructor to explain. This course is more application oriented and focuses problems on engineering applications and has fewer proofs than the statistics courses from the Math Department. Many graduate students need to take 454 before I&ME 554, "Application & Design of Industrial Experiments."
   Dr. Schillings and Dr. Mooney have worked together to improve the sequencing of information and methods covered in I&ME 264, 364, and 454 so that students can transfer knowledge more easily from one course to the other. Suggestion for improving course was to post class handouts on the web.

2. **I&ME 444R "Senior Design Project"**
   I&ME 445R "Independent I&ME Senior Design" 10/26/06
   Projects were presented by Dr. Mike Cole and covered a wide variety of industrial engineering applications. Dr. Cole reported that some student reports did not do a good job of synthesizing I&ME courses and that grammar and style were often weak. Other faculty members who had supervised some of these senior design projects assisted in the discussion. Plans for improving were to:
   a. "Coach" the students more.
   b. Develop an "IE Technical Content" checklist or paper for student use.
   c. Revise grading sheet and distribute it early in the term.
   d. Require students to give more frequent technical presentations to class.

It is important that the faculty be consistent in writing requirements.

3. **I&ME 313 "Work Design and Analysis"**
   11/16/06
   This course review was presented by Dr. Durward Sobek who passed out a packet of materials related to the course. He reviewed the role of I&ME 313 in meeting IE Program outcomes. The course has a strong technical writing emphasis. Lab structure requires "field work" and two formal reports and meets every other week. Tools/concepts are demonstrated via hands-on activities in lab. Rewrites of lab reports are incorporated. The same textbook by Groover will be used in I&ME 142 and 313. I&ME 313 will have greater emphasis on ergonomics and work measurement, since 142 covers much of the process charting and diagramming that were covered in 313 (before 142 was). Suggestions to improve I&ME 313 were to:
   a. Require explanations on T/F questions on exams and other written assignments.
   b. Require students to summarize their improvements/changes on lab report rewrites.

4. **I&ME 471 "Computer Integrated Manufacturing"**
   02/07/07
   Dr. Gary Chen explained the syllabus and the course review he had sent to the IE Faculty via e-mail and additional course material passed out at the meeting. Additional material included sample graded lab reports, sample graded "literature review" reports, and the 2006 final exam. ME 255 and I&ME 471 differ in that students in ME 255 *use* CAD output, while students in I&ME 471 *create* CAD/CAM output. ME 255's coverage of nontraditional manufacturing may be a place to build an interface between the two courses. I&ME 471 has different prerequisites for different majors: IE students must have completed I&ME 271 while ME/MET students must have completed ME 255. The purpose of I&ME 471 course is to introduce students to modern manufacturing systems with a focus on use of computers for integrating various functions and resources in manufacturing automation. Units covered or introduced are CIM, CAD, CAPP, CAM, and CE. Students write five lab reports as a team. The goal for student lab reports is to effectively communicate the process of designing and manufacturing a part. Objectives and program outcomes were added. This course addresses Outcomes 1, 2, 4, and 5. The course is a professional elective for IE majors.

5. **I&ME 364 "Principles of Operations Research I"**
   03/07/07
   This course review was presented by Dr. Paul Schillings and Dr. Ed Mooney. Paul distributed a packet of pre-2006 I&ME 364 materials, which provided a historical view of the pre-I&ME 264 era. Ed distributed a packet of information on I&ME 264, a new course which pre-requisites into I&ME 364. I&ME 264

covers some of the topics previously discussed only in 364. I&ME 264 and 364 use the same textbook (currently Winston). Both courses are required courses and provide breadth (and increasing depth in 364). Still more depth is provided in the elective course, I&ME 464. Ed distributed copies of material from the 364 website, including the syllabus and a sample exam. He noted that almost every student is now following the 264—364 sequence. Related to optimization software, Ed has the students use Lingo. He said they gain some exposure to C++ and MySQL. Students are not required to do a project in 364.

6. **I&ME 422 "Introduction to Simulation"**
   03/28/07
   Dr. Ed Mooney provided and discussed a packet comprised of the following: 1 web site live demo, 1 syllabus, Exams 1 and 2 from Fall 2006, and an example of a student final report. Ed said that 2 weeks is the usual lead-time allowed for homework assignments and that the concurrent lectures, labs, and web info reinforce homework assignments. He also stated that homework complexity and grading strictness (including technical writing requirements) increase as the semester progresses. Ed noted that I&ME students are better prepared for the modeling component than the programming component, but that CS students were oppositely prepared. Ed said that I&ME students who have taken I&ME 264 are better prepared than those under the old curriculum. In general, he emphasizes to students that modeling, programming, and writing are incremental in nature; students should not expect to create a final perfect answer the first time they attack a problem. Ed clarified the IE usage of the terms: stochastic, deterministic, dynamic, and static. When asked whether C++ and the SIMPL library are required and whether Arena is an option, Ed replied that C++ is required, and that Arena is not an option. He stated that requiring C++ ensures the students gain a solid foundation in simulation. Ed said that he might include some coverage of Arena in the future but that a course built around Arena would not satisfy either I&ME or CS requirements. Mike mentioned that Arena might be a valuable addition to I&ME 442. When asked whether simulation had to be taught using C++, Ed said no, but to model more complex "real world" problems, knowledge of C++ is often very useful to augment the simulation software's programmed functions. Ed discussed the SIMPL object model to illustrate how general purpose it is. Mike asked whether I&ME 442 should pre-requisite into I&ME 444. Ed and Durward replied that doing so would make the I&ME program too inflexible. Durward noted that it is a challenge to teach both a high-level systems view (modeling) and a low-level detailed view (C++ program implementation) in one course.

7. **I&ME 434 "Project and Engineering Management"**
   04/25/07
   Dr. Joe Stanislao presented a review of I&ME 434. The presentation included the following exhibits: syllabus (Fall 2006), case problems 1—4, syllabus additions

(2007), ABET Course Review, sample exams, and course textbook and related textbooks. Joe stated that he has taught I&ME 434 for 10+ years. At the beginning and end of the semester, he reads the course objectives (from syllabus) to the class and asks whether the objectives have been met during the semester. Student input and suggestions are encouraged and noted for future planning. Early in the semester, Joe emphasizes to the students that I&ME 434 is a prerequisite to I&ME 444 (Senior Design Project) and that they will use project management in I&ME 444. Joe said that I&ME 434 has three components or phases:

a. Information on managing a project (qualitative, conceptual)
b. Relevant tools and techniques (quantitative)
c. Information and economic analysis on implementing a plan

Joe stated that students earn the lowest grade on the qualitative phase, although he has tried many different ways to teach that material. Joe discussed the four case problems and explained that he gets cases from the Harvard website and from various textbooks and other publications. Case problems are changed each year. When he first taught the course, he included a required project, but recently decided that the case problems are more efficient related to students' time and more effective in teaching principles.

Joe discussed the textbook—Badiru & Pulat-- used in I&ME 434. This is the only textbook he has found that presents project management from a quantitative, engineering perspective. Several competing texts are aimed at business students. Many are written around a specific software package. Joe prefers to teach the project management fundamentals rather than how to use a particular software package. The second phase of 434 covers quantitative project management tools such as PERT, CPM, scheduling algorithms, etc. He said that students do well in this part of the course. The third phase of the course includes economic analysis, such as amortization. Joe discussed the "Syllabus Additions (2007)" handout, which should help the course meet university and other requirements. In the faculty discussion following the presentation, Joe noted that Civil Engineering students used to take I&ME 434 but they now take a CET course, which would not meet the needs of I&ME students.

Mike noted some challenges encountered by students in I&ME 444: defining a scope, list of tasks, and precedence relationships.

Recommendations of IE Faculty:

(1) Cover Work Breakdown Structures and Analysis more extensively.
(2) Give students more written feedback on their case study reports.
(3) Mike (instructor of I&ME 444) will meet with Joe to ensure continuity between I&ME 434 and 444.

Industrial Engineering

Industrial Engineering Educational Objectives and Outcomes – Assessment Responsibility Matrix

Assessment Item	Frequency of Collection	Mechanism for Review	Documentation	Coordinator
Dept. IAB Program Review	Fall	1	IAB Notebook	Joe
College EAC Sr. Project Review	Spring	1,2	COE EAC IE Senior Project Assessment	Durward
Alumni Survey	Spring odd years	1,2	IE Alumni Survey Notebook	Gary
Employer Survey	Every 3rd Fall, starting F02	1,2	IE Employer Survey Notebook	Ed
Student Exit Interviews	Fall and Spring	1	IE Senior Interviews Notebook	Mike/X
FE Exam	Fall and Spring	1,2	FE Exam Results Notebook	Mike
Placement	Summer	1,2	IE Placement Notebook	Gary
Capstone Project Review	Spring	1,2	I&ME 444 Senior Project Survey Notebook	Mike/X
Course Reviews	Every semester	Faculty mtgs.	Faculty supplied documentation + minutes of discussion	Durward
Faculty Discussions	As needed	Faculty mtgs.	IE Faculty Meeting Minutes	Mike
Internships/Co-ops	As needed	Faculty mtgs.	Internship Notebook	Ed
Review Mission Statement, Objectives, Outcomes	Summer	1,2	IE Educational Objectives	Joe
Facilities Review	Fall	2	IAB Notebook	Joe
Curriculum Reviews	As needed	1,2	Catalog changes	Joe
Multidisciplinary Awareness	As needed	1	Multidisciplinary Notebook	Durward
Diversity	As needed	1	Diversity Notebook	Ed
Research	As needed	Faculty	Research	Gary

Opportunities		mtgs.	Opportunity Notebook	

1 – annual faculty retreat
2 – IAB annual meeting

Assessment Plan (MSU)
Mechanical & Industrial Engineering Department

Mechanical Engineering Program Assessment Plan Update AY 06-07

Mechanical Engineering Objectives (expected from graduates 3-5 years out)

ME graduates will:

I. Undertake professional careers;
II. Assume leadership roles by advancing in the engineering profession;
III. Employ effective communication;
IV. Work in multidisciplinary professional teams;
V. Engage in life-long learning, including post-graduate education for some graduates;
VI. Contribute to industry and society, in Montana or elsewhere, including involvement in professional and other service activities
VII. Solve technical problems in design, analysis, manufacturing, project management, or testing.

Mechanical Engineering Outcomes (expected from students upon graduation)

ME graduates will demonstrate upon graduation:

1. An understanding of math, basic sciences, and engineering sciences necessary to solve mechanical engineering problems.
2. An ability to integrate learned concepts (such as theoretical, applied, experimental, computer, and manufacturing) to solve mechanical engineering problems
3. An understanding of the engineering design process necessary to solve open-ended problems.
4. An ability to work in teams to solve mechanical engineering problems.
5. An understanding of the importance of multidisciplinary activity in solving mechanical engineering problems.
6. Written, oral, and technical skills to effectively communicate.
7. An awareness of the social, ethical, political, economic, safety and environmental impacts of their work.

The Mechanical Engineering Program assessment activities scheduled during the AY 05-06 included the following:

- Dept IAB Input
- College EAC Input
- Alumni Survey
- Student Interviews
- FE Exam
- Placement
- Course Reviews

What follows is a brief summary of those activities.

Department Industrial Advisory Board Input

The M&IE Industrial Advisory Board met in September 2006. Several comments from the IAB with specific relevance to the ME program included:

- Good revised mission statement; review connection between new vision statement and ME curriculum.

- Good progress on lab improvements. Review acquiring state-of-the art manufacturing equip.
- Capstone projects had good technical content with writing acceptable. Ethics showed the weakest performance.
- Review ME 315 concerns and consider addition of a controls course.

A complete summary of IAB input may be found in the ME assessment notebook. Results will be discussed and reviewed at the Fall 2007 retreat.

College Engineering Advisory Council Input

The College EAC meet in May 2007. Several issues they feel are important in a graduate engineer include:

- Technical Foundation
- Lifelong Learning
- Multi-Disciplinary Awareness
- Diversity/Cultural Sensitivity
- Innovation/Creativity/Flexibility
- Business Sense
- People Skills

A complete summary of IAB input may be found in the ME assessment notebook. Results will be discussed and reviewed at the Fall 2007 retreat.

Alumni Survey

During the Spring 2007 semester, approximately 150 MSU alumni (1999 – 2004) students were asked several questions about how well the ME program is meeting its program educational objectives. Survey Monkey was used to manage the survey electronically. Eighty-three responded (55%). All answers were generally positive. The survey responses indicate we are clearly meeting all 8 ME program objectives. The only concern is Objective VI (contributions to industry and society, professional activities); we need to encourage our students to be more involved in their professional societies and communities. The survey results will be reviewed and discussed at the Fall 2007 retreat.

Student Interviews

During the last two weeks of the Spring 2007 semester, a total of 25 graduating seniors were interviewed in ten groups by either Ruhul Amin, Ahsan Mian, or Chris Jenkins. A set of questionnaire developed in consultation with the ME Faculty were used. The questions were designed to map the seven ME Educational Outcomes. There were additional questions to gather information in some other areas. Results will be reviewed and discussed at the Fall 2007 retreat.

FE Exams

FE exams were taken in Fall 2006 and Spring 2007. The largest number of ME students took the "general topics" portion of the exam. In that category, the results are as follows:

Exam Date	Number Passed	Number Failed	Pass Rate	National Pass Rate
Fall 2006	23	3	88 %	79 %
Spring 2007	35	3	92 %	84 %

MEs continue to out perform the national pass rate. (Whether or not Mechanical Engineering Technology students were combined with the Mechanical Engineering students needs to be resolved.) Results will be reviewed and discussed at the Fall 2007 retreat.

Placement

Placement of ME graduates, either in a job or in graduate school, exceeds 90%. Results will be reviewed and discussed at the Fall 2007 retreat.

Course Reviews Summary

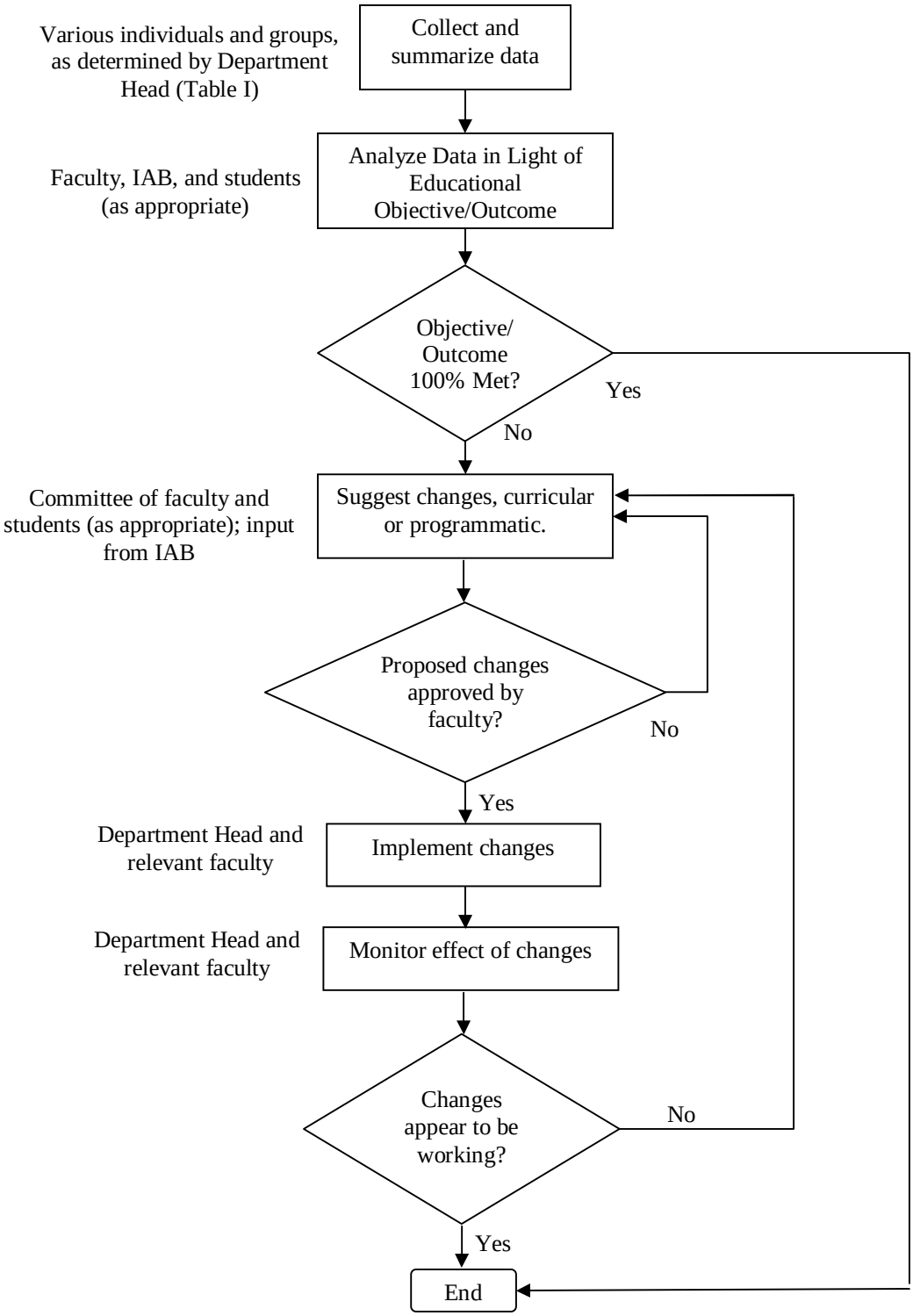
During the Fall 2006 semester, 9 ME courses were reviewed: ME 321, ME 102, ME 255/257, ME 117/118, ME 320, ME 360, and ME 101. A previously developed "course review plan" was followed for each review. A summary of the review outcomes including follow-up items is contained in the ME program assessment notebook. Results will be reviewed and discussed at the Fall 2007 retreat.

Assessment Plan Timetable

Assessment Tool	Frequency	Past Occurrences	Next Occurrence	Notes
Dept. IAB Input	Annual	Fall '05, Fall '06	Fall, 2007	Chris
College EAC Input	Annual	Spring '06, Spring '07	Spring 2008	Chris
Alumni Surveys	Every other year	Spring ' 05, Spring '07	Spring 2009	Ruhul to coordinate
Employer Surveys	Every 3rd year	Spring, 2006	Spring 2009	Ruhul to coordinate
Student Interviews	Annual	Spring ' 06, Spring '07	Spring 2008	Ruhul/Chris
FE Exam	Annually, spring and fall	Spring '06, Fall '06, Spring '07	Fall, 2007	Ruhul
a-k Surveys	each semester	Spring, 2004	--	Discontinued
Faculty Duscussions	As needed	Spring '06, Fall '06, Spring '07	Fall, 2007	
Placement	Annually, summers	Summer '06, Summer '07	Summer 2008	Carol
Capstone Project Sponsor Review	Annually, Spring	Spring '07	Spring, 2008	Vic
Review Educational Objectives	Annually, Fall	Fall '05, Fall '06	Fall, 2007	Faculty meeting
Review Outcomes	Annually, Fall	Fall '05, Fall '06	Fall, 2007	Faculty meeting
Facilities Review	Annually, Fall	Fall '05, Fall '06	Fall, 2007	At IAB
Curriculum Review	As needed, but annually at a minimum	Fall '05, Fall '06	Fall, 2007	
Formal Course Review	1/3 of courses reviewed each year	Spring '06, Fall '06, Spring '07	Fall, 2007	Faculty meeting

Plan for Utilizing Data

All programs in the department utilize the following flowchart for making change. In the table below, IAB refers to the departmental Industrial Advisory Board (IAB).


Various individuals and groups, as determined by Department Head (Table I)
Collect and summarize data
Faculty, IAB, and students (as appropriate)
Analyze Data in Light of Educational Objective/Outcome
Objective/ Outcome 100% Met?
Yes
No
Committee of faculty and students (as appropriate); input from IAB
Suggest changes, curricular or programmatic.
Proposed changes approved by faculty?
No
Yes
Department Head and relevant faculty
Implement changes
Department Head and relevant faculty
Monitor effect of changes
Changes appear to be working?
No
Yes
End

Student Outcomes and Assessment Update
Department of Mechanical and Industrial Engineering
Mechanical Engineering Technology (MET)
AY 2006/2007

The Mechanical Engineering Technology Program assessment activities scheduled during the AY 06 – 07 included the following:

- M&IE Department Industrial Advisory Board (IAB) meeting
- College of Engineering (COE) Industrial Advisory Board (IAB) meeting
- Alumni Surveys
- Employer Surveys
- Student Interviews
- FE Exam
- Faculty Discussions
- Placement
- Capstone Review
- ABET Reviews

What follows is a brief summary of those activities.

Assessment Tool: M&IE Department Industrial Advisory Board (IAB)

Dates	Data Collection Method	Implementation Responsibility
9/28/06	Scheduled Meetings and Meeting Summary Notes	MET Faculty

MET faculty met with the IAB in September of 2006 and faculty members presented a MET AY 2005/2006 summary report. The purpose of this meeting was to share information and to discuss issues within the MET program. Information shared and subsequent discussion resulted in the following approvals and recommendations.

- The IAB members approved the MET outcomes and objectives as presented.
- The IAB members approved the MET CI plan as presented.
- The IAB members agreed to support the MET curriculum plan through:
    - Hosting faculty members in industry
    - Providing industry case – study material
    - Developing mentors for students
    - Providing lab development support

Results will be reviewed and discussed at the Fall 2007 faculty retreat.

Assessment Tool: College of Engineering (COE) Industrial Advisory Board (IAB)

Dates	Data Collection Method	Implementation Responsibility
April 2007	Scheduled Meetings and Meeting Summary Notes	MET Faculty

The COE IAB met in April of 2007. Discussion did not directly relate to the MET program, and thus did not result in any input.

The minutes from this meeting will be reviewed by faculty in the Fall 2007 faculty retreat.

Assessment Tool: Alumni Surveys

Dates	Data Collection Method	Implementation Responsibility
April 2006	Internet-based Survey Tool (Survey Monkey)	MET Faculty

Alumni Survey data was reviewed and results assessed. This data directly contributed to decisions made regarding curriculum revision, and degree that the program is meeting stated objectives. Results can be reviewed in the alumni survey notebook in the MET Program Coordinators office.

Assessment Tool: Employer Surveys

Dates	Data Collection Method	Implementation Responsibility
July 2007	Internet-based Survey Tool (Survey Monkey)	MET Faculty

Employer surveys were rescheduled to summer 2007. Data will be collected and reviewed during fall semester of 2007.

Assessment Tool: Student Interviews

Dates	Data Collection Method	Implementation Responsibility
Spring 2007	Discussions with students	MET Faculty

Every year the MET faculty survey senior students completing the senior capstone course and junior students completing their machine design course in MET. They are asked to provide input utilized to assess the MET outcomes, objectives, and the capstone experience. In addition, they are given an opportunity to provide input on the MET program in general. The comments are collected and reviewed by faculty members at the annual retreat in August, where the input is evaluated. Input from Spring of 2006 contributed to all curriculum and course changes made during this year. Especially notable was implementation of “mini design / build” projects in the MET 456 course. These projects were designed to mimic real-world product development projects, and required design, build, and inspection of a flashlight. What made this unique and much more beneficial, was the fact that each group was responsible for the following:

1. Design of a flashlight
2. Review of a second groups flashlight design
3. Build of third groups flashlight design
4. Inspection of a fourth groups flashlight design
5. Availability to answer questions on their own design.

Benefits included improvements in design and project resolution, as well as communication ability of each individual involved.

Results from Spring 2007 will be reviewed and discussed at the Fall 2007 faculty retreat.

Assessment Tool: FE Exam

Dates	Data Collection Method	Implementation Responsibility
Fall 2005 Spring 2006	National Results Summary	MET Faculty

The MET students are required to sit for the Fundamentals of Engineering (FE) exam during their senior year. Although this is not a test designed for a MET student, it does provide an indication of how well the students actually meet the outcomes of the program. The MET faculty has set a pass rate of 75 % as a goal. Results for the Fall 2005 and Spring 2006 exams have been extremely difficult to obtain from the state exam board. The data that has been obtained shows an extremely low pass rate. Based on this data, the MET faculty recommends that all students take the general (vs. mechanical) exam and to pay extremely close attention when marking discipline on the test. Hopefully, better data will be available in the future. The MET faculty will continue to assess results as they become available.

Assessment Tool: Faculty Discussions

Dates	Data Collection Method	Implementation Responsibility
As required throughout AY	Meeting minutes Action Item Assignments	MET Faculty

Mechanical engineering technology faculty met 26 times throughout the 2006 – 2007 academic year to discuss current issues within the program, as well as to provide status of action items in work. Specific decisions and actions are documented in the Faculty Meeting Notebook. This notebook resides in the MET Program Coordinators office (203 Roberts Hall).

Assessment Tool: Placement

Dates	Data Collection Method	Implementation Responsibility
Spring 2007 Fall 2006	Student Employment Info. Annual Career Fair	MET Faculty

Students are asked to voluntarily supply employment information upon acceptance of a position. If they have not accepted a position prior to graduation, they are encouraged to supply that information to the department in the future. Also, faculty members are continuously investigating opportunities for students through industry contacts as well as through the annual career fairs at MSU. The data collected provides guidance on the most available opportunities for our graduates and potentially provides direction to the

faculty when making curricular decisions. The table below provides summary data related to placement.

Year	Placement %	Average Salary
2006/2007	88	$51,500 / yr.

Results will be reviewed and discussed at the Fall 2007 faculty retreat.

Assessment Tool: Capstone Review

Dates	**Data Collection Method**	**Implementation Responsibility**
Fall 2006 Spring 2007	Presentation Evaluation Survey Project Review Surveys	MET Faculty

MET students give formal capstone presentations at the end of the Fall semester to present their final designs. These presentations are attended by faculty, students, and project sponsors. All presentations are evaluated and the data is collected for review by the course instructor as well as the MET faculty. Results are discussed in the MET faculty meetings and support the curriculum review committee when assessing changes. Also, the results of this assessment tool have contributed to better communication of roles and responsibilities of faculty advisors and student team members. Results will be reviewed and discussed at the Fall 2007 faculty retreat.

Assessment Tool: ABET Reviews

Dates	**Data Collection Method**	**Implementation Responsibility**
As required	Official Notice from ABET	MET Faculty

To maintain currency, the MET faculty curriculum committee annually reviews the applicable ABET criteria related to the program. No specific changes have resulted from direct ABET input during this assessment period.

Additional Programmatic Items Requiring Assessment and Review

Item	Reviewed by	Review Date	Action
Educational Objectives	Faculty Students IAB	Summer 06 Spring 06 Fall 06	Objectives approved as written. No changes recommended.
Educational Outcomes	Faculty Students IAB	Summer 06 Spring 06 Fall 06	Outcomes approved as written. No changes recommended.
MET Facilities Review	Faculty IAB	Summer 06 Fall 06	Meets expectations. Will continue to review and monitor
Curriculum Review	Faculty	AY 2006/2007	Changes recommended and incorporated into 2006-2008 catalog.

			Revisions for 2008-2010 catalog are currently being developed and implemented
MET CI Plan Review	Faculty	Summer 06	Minor updates recommended and incorporated.
MET Faculty Development Plans	Faculty Department Head	Summer 06	Meets expectations. Faculty will continue to review and update as required.

Assessment Documentation

In support of this yearly assessment activity, the MET faculty group has established and maintains a set of Assessment and Informational Notebooks. The analysis, feedback, and any subsequent changes made to the MET program are summarized in these program assessment notebooks. These notebooks are updated yearly and reside in the MET Program Coordinators office (Roberts Hall 203).

AY 2006/2007 Accomplishments

- The M&IE Industrial Advisory Board approved the MET outcomes and objectives as presented.
- The M&IE Industrial Advisory Board approved the MET Continuous Improvement Plan as presented.
- The MET program hired a new tenure track faculty member, thus bolstering long-term viability of the program.
- The MET program completed assessment of the MET Alumni Survey data.
- A MET employer survey tool was developed and will be implemented Fall 2007.
- The MET capstone course professor communicated clear capstone course expectation for MET capstone students and faculty supervisors, thus improving communication to all involved parties.
- The MET faculty implemented phase I of the MET curriculum revision:
    - Taught MET 119 – MET Graphical Communication
    - Reduced MET 325 – Heat Transfer from 4 cr. To 3 cr.
    - Removed ME 117 and ME 118 from the program
    - Restructured MET 315 – Welding course
    - Restructured ME 324 to be more relevant to MET program and be taught by an MET professor
- Maintained interdisciplinary MET/ME senior capstone projects where appropriate
- Implemented “mini design / build projects” in MET 456
- Implemented a “rube Goldberg” design competition in MET 104 / 401
- The MET faculty established implementation plans for Phase II of the MET curriculum revision:

    - Delete Math 160 requirement from program
    - Reduce MET 119 from 3 cr. to 2 cr.
    - Reduce MET 201 from 2 cr. to 1 cr.
    - Add MET 211 – Graphics for Design
    - Revise MET 417 and rename to MET 420
    - Delete MET 455 and replace with MET 466
    - Add lab component to ME 448
    - Offer MET 460 - Advanced Measurements and Instrumentation
- The MET faculty Modified / Updated the MET Professional Electives Policy.
- The MET faculty updated the equivalencies / transfer policy
- The MET students and faculty advisors participated in professional societies (ASME, SAE, ASHRAE) and professional society competitions:
    - ASME North American Pacific District Student Professional Development Conference at University of Idaho (April 2007)
        - 1st Place - Micro-Baha Car Competition
        - 2nd Place - National Design Competition
        - 1st Place Ingersoll Rand Competition
        - 1st Place – Student Kilometer Award
    - ASHRAE Student HVAC Design Competition – Montana Section
        - 12 MET students participated
    - ASME Human Powered Vehicle Competition at San Jose State University
        - 5th place out of 24 teams
    - SAE Mini-Baha Competition
- The MET faculty updated MET Faculty Development Plans.

In addition, a "Faculty Meetings Notebook" is maintained to summarize all faculty meeting business and can be reviewed in the MET Program Coordinators office.