

# Mechanical Engineering Technology

## 2008-09 Assessment Report

### I. Introduction

The Bachelor of Science program in Mechanical Engineering Technology is offered in three locations—Klamath Falls, Portland Metro Center, and at the Boeing Company in Seattle. In Klamath Falls and Seattle the entire program is offered; the Portland campus offers a degree-completion program (i.e. only Junior and Senior courses are offered, the lower-division courses are expected to be taken at a community college).

The Mechanical Engineering Technology (MET) Program at Oregon Institute of Technology (OIT) was first accredited by ABET in 1970. There has been no major program changes since the last ABET visit in fall 2002.

However, the Manufacturing and Mechanical Engineering and Technology (MMET) Department in which the MET Program resides has experienced numerable changes and upgrades over the past five years. The first major change was the merging of the Manufacturing Engineering Technology Department with the Mechanical Engineering Technology Department in 2004. This was done to increase administrative efficiency. The result was a stronger program with more resources available and better faculty collaboration. The second major change was the addition of a Bachelor of Science in Mechanical Engineering Degree Program; with the first students graduating in 2007.

### II. Program Mission, Objectives and Student Learning Outcomes

The program faculty reviewed the program mission, objectives and student learning outcomes during fall 2008. The faculty reaffirmed the statements below.

#### Mission Statement

The Mechanical Engineering Technology Program at Oregon Institute of Technology is an applied engineering technology program. Its mission is to provide graduates with the skills and knowledge for successful careers in mechanical and manufacturing engineering.

#### Program Educational Objectives

Program educational objectives (PEO's) are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. The Program Educational Objectives of OIT's mechanical engineering technology program is to produce alumni who:

- are able to analyze and design practical mechanical systems.
- communicate effectively and work well on team-based engineering projects.
- succeed in entry-level mechanical and manufacturing engineering positions.
- pursue continued professional development.
- pursue engineering technology graduate studies if desired.

#### Student Learning Outcomes

The Mechanical Engineering Technology Program outcomes have been mapped to the ABET a-k outcomes. Within this report outcomes will be referenced by the ABET a-k nomenclature. These are listed below for reference. An engineering technology program must demonstrate that graduates have:

- a. An appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines
- b. An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology

- c. An ability to conduct, analyze and interpret experiments and apply experimental results to improve processes
- d. An ability to apply creativity in the design of systems, components or processes appropriate to program objectives
- e. An ability to function effectively on teams
- f. An ability to identify, analyze and solve technical problems
- g. An ability to communicate effectively
- h. A recognition of the need for, and an ability to engage in lifelong learning
- i. An ability to understand professional, ethical and social responsibilities
- j. A respect for diversity and a knowledge of contemporary professional, societal and global issues
- k. A commitment to quality, timeliness, and continuous improvement.

In addition to the eleven a-k outcomes there is an additional outcome identified through the ABET Mechanical Engineering specific criteria for the 2008 - 2009 year. This outcome is shown below.

MET a: Baccalaureate degree programs must demonstrate that graduates can apply specific program principles to the analysis, design, development, implementation, or oversight of more advanced mechanical systems or processes depending on program orientation and the needs of their constituents.

### III. Three-Year Cycle for Assessment of Student Learning Outcomes

The faculty planned a three-year assessment cycle for the program's student learning outcomes as shown in Table 1 below.

Student Learning Outcome	2008-09	2009-10	2010-11
a. An appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines.			x
b. An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology	x		
c. An ability to conduct, analyze and interpret experiments and apply experimental results to improve processes			x
d. An ability to apply creativity in the design of systems, components or processes appropriate to program objectives	x		
e. An ability to function effectively on teams		x	
f. An ability to identify, analyze and solve technical problems	x		
g. An ability to communicate effectively			x
h. A recognition of the need for, and an ability to engage in lifelong learning			x
i. An ability to understand professional, ethical and social responsibilities		x	
j. A respect for diversity and a knowledge of contemporary professional, societal and global issues		x	
k. A commitment to quality, timeliness, and continuous improvement		x	
Met a. Baccalaureate degree programs must demonstrate that graduates can apply specific program principles to the analysis, design, development, implementation, or oversight of more advanced mechanical systems or processes depending on program orientation and the needs of their constituents.	x		

Table 1. MET Assessment Cycle

#### IV. Summary of 2008-09 Assessment Activities

The Mechanical Engineering Technology faculty conducted formal assessment of four student learning outcomes during 2008-09. These four outcomes have been mapped to the curriculum as shown in Appendix A. The four outcomes are Outcome b “An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology”; Outcome d “An ability to apply creativity in the design of systems, components or processes appropriate to program objectives”; Outcome f “An ability to identify, analyze and solve technical problems”; and Outcome MET a “Baccalaureate degree programs must demonstrate that graduates can apply specific program principles to the analysis, design, development, implementation, or oversight of more advanced mechanical systems or processes depending on program orientation and the needs of their constituents”.

#### **Outcome b: An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology.**

The faculty assessed this outcome using the following performance criteria:

*Given an emerging application, the student will be able to:*

1. Apply mathematical principles to obtain analytical or numerical solution(s) to an engineering problem.
2. Apply scientific principles that govern the performance of a given process or system in engineering problem(s).
3. Apply engineering principles that govern the performance of a given process or system in engineering problem(s).

Outcome b was assessed on all three campuses, with a minimum of two direct and one indirect measurement.

#### Direct Assessment #1

The faculty assessed this outcome in MET 360 Materials II in fall 2008 at the Klamath Falls campus, using exam questions. There were three manufacturing majors and 11 mechanical engineering technology majors in the course. The faculty rated the proficiency of students using the performance criteria described in Table 2 below:

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results	MET Results
Math principles	Exam questions	1-4 proficiency scale	80% will achieve a 3 or 4	66%	91%
Science principles	Exam questions	1-4 proficiency scale	80% will achieve a 3 or 4	100%	85%
Engineering principles	Exam questions	1-4 proficiency scale	80% will achieve a 3 or 4	100%	91%

Table 2. Assessment Results for SLO b

The results for the manufacturing students are low for math principles, but there were only two students taking the exam. The MET students met the faculty criteria for minimum acceptable performance.

### Direct Assessment #2

The faculty assessed this outcome in MET 313 in winter 2009 at the Portland campus campus, using a homework problem. The faculty rated the proficiency of students using the performance criteria described in Table 3 below. There were 10 students in this course.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Applies Math Principles	HW problem	1-4 proficiency scale	80% will achieve a 3 or 4	100%
Applies Science Principles	HW problem	1-4 proficiency scale	80% will achieve a 3 or 4	100%
Applies Engineering Principles	HW problem	1-4 proficiency scale	80% will achieve a 3 or 4	80%
Applies Technology Tools	HW problem	1-4 proficiency scale	80% will achieve a 3 or 4	80%

Table 3. Assessment Results for SLO b

As can be seen, the students met the faculty criteria for minimum acceptable performance for all four performance criteria. The students were exceptionally strong in both their math and science principles.

### Direct Assessment #3

The faculty assessed this outcome in MET 313 in spring 2009 at the Klamath Fall campus, using a homework open-ended problem. Ten MET students completed the assignment. The faculty rated the proficiency of students using the performance criteria described in Table 4 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Applies Math Principles	HW problem	1-4 proficiency scale	80% will achieve a 3 or 4	100%
Applies Science Principles	HW problem	1-4 proficiency scale	80% will achieve a 3 or 4	40%
Applies Engineering Principles	HW problem	1-4 proficiency scale	80% will achieve a 3 or 4	100%
Applies Technology Tools	HW problem	1-4 proficiency scale	80% will achieve a 3 or 4	90%

Table 4. Assessment Results for SLO b

The students met three of the four assessment criteria; there was a significant problem with “Applies Science Principles”. These performance criteria should be looked at in more detail when this outcome is reassessed.

### Direct Assessment #4

The faculty also assessed MET 360, Materials II, in spring 2009 at the Portland campus, using quiz questions. There were three manufacturing students and four mechanical engineering technology majors in the course. The faculty rated the proficiency of students using the same performance criteria as above, as shown in Table 5 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results	MET Results
Math principles	Exam questions	1-4 proficiency scale	80% will achieve a 3 or 4	100%	100%
Science principles	Exam questions	1-4 proficiency scale	80% will achieve a 3 or 4	100%	100%
Engineering principles	Exam questions	1-4 proficiency scale	80% will achieve a 3 or 4	100%	100%

Table 5. Assessment Results for SLO b, Portland

All students met all performance criteria in this assessment.

No direct assessment material was received from the Boeing campus; hopefully this material will be gathered and evaluated by the end of the summer; at which time it will be incorporated into this document.

#### Indirect Assessment #1

As part of the senior exit survey the students (all senior MET students at all campuses) were asked to rate themselves as to their ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology. This survey was given at all three campuses to students in their last term of Senior Projects (MET 492). The results are shown below in table 6. Note that the responses have been broken up into the individual campuses. From the Klamath Falls campus there were 14 student responses; from Portland 4 student responses; and from Boeing 6 student responses. A minimum acceptable performance of 80% of our students rating themselves as either Prepared or Highly Prepared was set by the faculty.

	Klamath Falls	Portland	Boeing
Highly Prepared	64.3%	100.0%	33.3%
Prepared	35.7%	0.0%	66.7%
Inadequately Prepared	0.0%	0.0%	0.0%

Table 6 Senior Exit Survey Result for TAC b.

As can be seen, all students at all three campuses considered themselves either prepared or highly prepared. The students at our Portland campus considered themselves all highly prepared.

**Outcome d: An ability to apply creativity in the design of systems, components or processes appropriate to program objectives.** The faculty assessed this outcome using the following performance criteria:

The student will be able to

1. Identify an appropriate set of realistic constraints and performance criteria.
2. Generate one or more creative solutions to meet the criteria and constraints.
3. Create a detailed design within the realistic constraints.
4. Plan and manage a small technical project.

#### Direct Assessment #1

The faculty assessed this outcome in MET 316 in winter 2009, on the Klamath Falls campus, using a rubric-graded project. There were three manufacturing students and 13 mechanical engineering technology students in the course. The faculty rated the proficiency of students using the performance criteria described in Table 7 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Mfg Results	MET Results
Identify constraints and criteria	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	66.7%	53.8%
Generate one or more solutions	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	0%	30.8%
Create detailed design	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	66.7%	91.7%
Plan/manage small tech project	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	100%	91.7%

Table 7. Assessment Results for SLO d

The MET students did not meet performance criteria for “identifying constraints and criteria” and “generating one or more solutions”. The instructor clarified that students were not assessed lower if they had only one solution, which means that students weren’t able to perform at an acceptable level with just one suggested solution. In the future the rubric should be supplied to the students, and they should be told this is an expectation of the assignment.

The MET students met the performance criteria for “create detailed design”, and “Plan/manage small technical project”. This is an improvement over last year’s data, which suggested that the MET students needed more experience in planning a project.

#### Direct Assessment #2

The faculty assessed this outcome in MET 492 during spring 2009, on the Klamath Falls campus, using a rubric-graded project. There were 5 manufacturing students, 18 mechanical engineering and 13 mechanical engineering technology students in the course. In total there were 11 different projects, involving 36 students. Only eight of the projects were evaluated due to time constraints. The faculty rated the proficiency of the student groups using the performance criteria described in Table 8 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MET Results
Identify constraints and criteria	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	87.5%
Generate one or more solutions	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	100%
Create detailed design	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	100%
Plan/manage small tech project	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	87.5%

Table 8. Assessment Results for SLO d

All four performance criteria were met with at least an 80% acceptable rate.

### Direct Assessment #3

The faculty assessed this outcome in MET 316, Machine Design II, in spring 2009, on the Portland Campus, using a rubric-graded project. There were four manufacturing students and ten mechanical engineering technology students in the course. The faculty rated the proficiency of students using the same rubric and performance criteria as the Klamath Campus, as shown in Table 9 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Mfg Results	MET Results
Identify constraints and criteria	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	100%	100%
Generate one or more solutions	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	100%	100%
Create detailed design	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	100%	60%
Plan/manage small tech project	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	100%	60%

Table 9. Assessment Results for SLO d, Portland

The MET students only met two of the four criteria; falling short in creating a detailed design and planning/managing a small technology project. These performance criteria should be looked at in more detail when this outcome is reassessed.

### Direct Assessment #4

The faculty assessed this outcome in MET 316, Machine Design II, in spring 2009, at the Boeing site, using a rubric-graded project. There were four manufacturing students and three mechanical engineering technology students in the course. The faculty rated the proficiency of students using the same rubric and performance criteria as the Klamath Campus, as shown in Table 10 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Mfg Results	MET Results
Identify constraints and criteria	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	100%	100%
Generate one or more solutions	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	50%	100%
Create detailed design	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	50%	100%
Plan/manage small tech project	Project w/ rubric	1-4 proficiency scale	80% score 3 or 4	n/a	n/a

Table 10. Assessment Results for SLO d, Boeing

The MET students met the faculty criteria for minimum acceptable performance for all four performance criteria.

### Indirect Assessment #1

As part of the senior exit survey the students (all senior MET students at all campuses) were asked to rate themselves as to their ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology. This survey was given at all three campuses to students in their last term of Senior Projects (MET 492). The results are shown below in Table 11.

Note that the responses have been broken up into the individual campuses. From the Klamath Falls campus there were 14 student responses; from Portland 4 student responses; and from Boeing 6 student responses. A minimum acceptable performance of 80% of our students rating themselves as either Prepared or Highly Prepared was set by the faculty.

TAC d

	Klamath Falls	Portland	Boeing
Highly Prepared	78.6%	50.0%	50.0%
Prepared	21.4%	50.0%	50.0%
Inadequately Prepared	0.0%	0.0%	0.0%

Table 11 Senior Exit Survey Result for TAC d.

As can be seen, all students at all three campuses considered themselves either prepared or highly prepared.

**Outcome f: An ability to identify, analyze and solve technical problems.** The faculty assessed this outcome using the following performance criteria:

The student will be able to

1. Identify an engineering problem.
2. Make appropriate assumptions.
3. Formulate a plan which will lead to a solution.
4. Apply engineering principles to analyze the problem.
5. Document results in an appropriate format.

Direct Assessment #1

The faculty assessed this outcome in MET 437 in winter 2008 at the Klamath Falls campus, using a rubric-graded lab report. The faculty rated the proficiency of students using the performance criteria described in Table 12 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify the problem	Instructor rating	1-4 proficiency scale	80% score 3 or 4	93.3%
Appropriate assumptions	Instructor rating	1-4 proficiency scale	80% score 3 or 4	93.3%
Formulate a plan which will lead to a solution	Instructor rating	1-4 proficiency scale	80% score 3 or 4	86.7%
Apply engineering principles to analyze problem	Instructor rating	1-4 proficiency scale	80% score 3 or 4	93.3%
Document results in appropriate format	Instructor rating	1-4 proficiency scale	80% score 3 or 4	66.7%

Table 12. Assessment Results for SLO f.

A total of 15 MET students were assessed using this rubric. More than 80% of the students scored at a proficiency scale of 3 (proficient) or higher in four of the five categories. The one area where less than

80% of the students were proficient was in the documentation criteria. This will be looked at in further detail when the other assessments are completed.

### Direct Assessment #2

The faculty assessed this outcome in MET 316 in winter 2009, on the Klamath Falls campus, using rubric-graded problems. There were three manufacturing and 13 mechanical engineering technology students in the class. The faculty rated the proficiency of students using the performance criteria described in Table 13 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results	MET Results
Identify the problem	Instructor rating	1-4 proficiency scale	80% score 3 or 4	0%	38.5%
Appropriate assumptions	Instructor rating	1-4 proficiency scale	80% score 3 or 4	100%	84.6%
Formulate a plan which will lead to a solution	Instructor rating	1-4 proficiency scale	80% score 3 or 4	66.7%	46.2%
Apply engineering principles to analyze problem	Instructor rating	1-4 proficiency scale	80% score 3 or 4	33.3%	69.2%
Document results in appropriate format	Instructor rating	1-4 proficiency scale	80% score 3 or 4	100%	92.3%

Table 13. Assessment Results for SLO f.

Students met performance criteria for “appropriate assumptions” and “documenting results”.

They did not meet performance criteria for “identifying the problem”, “formulating a plan leading to a solution”, or “applying engineering principles to analyze the problem”. This assessment conflicts with the assessment done in MET 437 above. This outcome will need to be looked at in more detail in future years.

### Direct Assessment #3

The faculty assessed this outcome in MET 316 Machine Design II, in spring 2009 on the Portland campus, using a rubric-graded project. There were four manufacturing students and ten mechanical engineering technology students in the course. The faculty rated the proficiency of students using the same rubric and performance criteria as Klamath Falls, as shown in Table 14 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results	MET Results
Identify the problem	Instructor rating	1-4 proficiency scale	80% score 3 or 4	100%	100%
Appropriate assumptions	Instructor rating	1-4 proficiency scale	80% score 3 or 4	100%	100%
Formulate a plan which will lead to a solution	Instructor rating	1-4 proficiency scale	80% score 3 or 4	100%	60%
Apply engineering principles to analyze problem	Instructor rating	1-4 proficiency scale	80% score 3 or 4	100%	100%
Document results in appropriate format	Instructor rating	1-4 proficiency scale	80% score 3 or 4	100%	60%

Table 14. Assessment Results for SLO f, Portland

The MET students met only three of the five performance criteria; falling short in Formulating a plan and documenting results. These performance criteria should be looked at in more detail when this outcome is reassessed.

#### Direct Assessment #4

The faculty assessed this outcome in MET 437 Heat Transfer Lab, in spring 2009 on the Portland campus, using a rubric-graded lab report. There were 17 MET students in the course. The faculty rated the proficiency of students using the same rubric and performance criteria as Klamath Falls, as shown in Table 15 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Identify the problem	Rubric	1-4 proficiency scale	80% score 3 or 4	100%
Appropriate assumptions	Rubric	1-4 proficiency scale	80% score 3 or 4	100%
Formulate a plan which will lead to a solution	Rubric	1-4 proficiency scale	80% score 3 or 4	100%
Apply engineering principles to analyze problem	Rubric	1-4 proficiency scale	80% score 3 or 4	100%
Document results in appropriate format	Rubric	1-4 proficiency scale	80% score 3 or 4	100%

Table 15. Assessment Results for SLO f, Portland

All of the students scored at an acceptable performance level in all five criteria.

#### Direct Assessment #5

The faculty assessed this outcome in MET 316, Machine Design II, in winter 2009 at the Boeing site, using a rubric-graded project. There were four manufacturing students and three mechanical engineering technology students in the course. The faculty rated the proficiency of students using the same rubric and performance criteria as Klamath Falls, as shown in Table 16 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	MFG Results	MET Results
Identify the problem	Instructor rating	1-4 proficiency scale	80% score 3 or 4	50%	100%
Appropriate assumptions	Instructor rating	1-4 proficiency scale	80% score 3 or 4	50%	100%
Formulate a plan which will lead to a solution	Instructor rating	1-4 proficiency scale	80% score 3 or 4	75%	100%
Apply engineering principles to analyze problem	Instructor rating	1-4 proficiency scale	80% score 3 or 4	75%	100%
Document results in appropriate format	Instructor rating	1-4 proficiency scale	80% score 3 or 4	50%	100%

Table 16. Assessment Results for SLO f, Boeing

The MET students met all five of the performance criteria at an acceptable rate.

#### Indirect Assessment #1

As part of the senior exit survey the students (all senior MET students at all campuses) were asked to rate themselves as to their ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology. This survey was given at all three campuses to students in their last term of Senior Projects (MET 492). The results are shown below in Table 17. Note that the responses have been broken up into the individual campuses. From the Klamath Falls campus there were 14 student responses; from Portland 4 student responses; and from Boeing 6 student responses. A minimum acceptable performance of 80% of our students rating themselves as either Prepared or Highly Prepared was set by the faculty.

TAC f	Klamath Falls	Portland	Boeing
Highly Prepared	64.3%	100.0%	83.3%
Prepared	35.7%	0.0%	16.7%
Inadequately Prepared	0.0%	0.0%	0.0%

Table 17 Senior Exit Survey Result for TAC f.

As can be seen, all students at all three campuses considered themselves either prepared or highly prepared. The students at our Portland campus considered themselves all highly prepared.

**Outcome MET a: Baccalaureate degree programs must demonstrate that graduates can apply specific program principles to the analysis, design, development, implementation, or oversight of more advanced mechanical systems or processes depending on program orientation and the needs of their constituents.**

Direct Assessment #1

The faculty assessed this outcome in MET 492 in spring 2009 at the Klamath Falls campus using a rubric-graded project. There were 5 manufacturing students, 18 mechanical engineering and 13 mechanical engineering technology students in the course. In total there were 11 different projects, involving 36 students. Only six of the projects were evaluated due to time constraints. The faculty rated the proficiency of the student groups using the performance criteria described in Table 18 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Analyzes advanced mechanical systems	Rubric	1-4 proficiency scale	80% score 3 or 4	100%
Designs an advanced mechanical system.	Rubric	1-4 proficiency scale	80% score 3 or 4	100%
Develops an advanced mechanical system	Rubric	1-4 proficiency scale	80% score 3 or 4	100%
Implements an advanced mechanical system	Rubric	1-4 proficiency scale	80% score 3 or 4	33.3%

Table 18. Assessment Results for SLO MET a

The students met three of the four performance criteria; falling below the minimum acceptable level for implementing an advanced mechanical system. It is believed that the reason for the poor showing for

this performance criterion is due to the poor economy. The groups that did not meet this criterion were all large-budget projects, and with the poor economy a lot of their normal funding was unavailable. Thus, the students were forced to build a number of parts that would normally have been purchased; leading to them not sticking to their schedule. This should be watched in future senior project courses.

#### Direct Assessment #2

The faculty assessed this outcome in MET 415 in spring 2009 at the Klamath Falls campus, using a rubric-graded project. There were 16 MET students enrolled in this course. The faculty rated the proficiency of students using the performance criteria described in Table 19 below.

Performance Criteria	Assessment Method	Measurement Scale	Minimum Acceptable Performance	Results
Analyzes advanced mechanical systems	Rubric	1-4 proficiency scale	80% score 3 or 4	75%
Designs an advanced mechanical system.	Rubric	1-4 proficiency scale	80% score 3 or 4	53%
Develops an advanced mechanical system	Rubric	1-4 proficiency scale	80% score 3 or 4	100%
Implements an advanced mechanical system	Rubric	1-4 proficiency scale	80% score 3 or 4	75%

Table 19. Assessment Results for SLO MET a

As shown from the results of the assessment, almost half of the students performed poorly in the design of and advanced mechanical system. This is in comparison to the 100% who were judged to be prepared in the assessment of senior projects shown above.

#### Indirect Assessment #1

As part of the senior exit survey the students (all senior MET students at all campuses) were asked to rate themselves as to their ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology. This survey was given at all three campuses to students in their last term of Senior Projects (MET 492). The results are shown below in Table 20. Note that the responses have been broken up into the individual campuses. From the Klamath Falls campus there were 14 student responses; from Portland 3 student responses; and from Boeing 6 student responses. A minimum acceptable performance of 80% of our students rating themselves as either Prepared or Highly Prepared was set by the faculty.

#### TAC MET a

	Klamath Falls	Portland	Boeing
Highly Prepared	42.9%	100.0%	33.3%
Prepared	50.0%	0.0%	66.7%
Inadequately Prepared	7.1%	0.0%	0.0%

Table 20 Senior Exit Survey Result for TAC f.

As can be seen, all of the students at the Portland and Boeing campuses considered themselves either prepared or highly prepared. At the Klamath Falls campus 92.9% of the respondents considered themselves either prepared or highly prepared; which is above the Minimum Acceptable Performance

criteria set by the faculty of 80%. The students at our Portland campus considered themselves all highly prepared.

## **V. Summary of Student Learning**

In June 2009, the program faculty met to discuss the assessment results on the student learning outcomes, summarized below:

### **Outcome b: An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology.**

Students met all of the performance criteria for this outcome (with the exception of science for one of the direct assessments). No actions were deemed necessary; however the science performance criteria will be looked at closely when this outcome is reassessed.

### **Outcome d: An ability to apply creativity in the design of systems, components or processes appropriate to program objectives.**

The students mostly met all four performance criteria, depending on the specific assessment. All of the students at all three campuses felt that they were either prepared or highly prepared.

Actions: The faculty agreed to include the rubric for these design projects at the beginning of the term when the syllabus is distributed, more explicitly train the students in the design steps necessary for solving engineering problems, and ensure that design project assignments consistently include the rubric.

### **Outcome f: An ability to identify, analyze and solve technical problems.**

There were mixed results for this outcome. For some assessments the students met all of the performance criteria; however they did not meet all of them in other assessments. All of the students at all three campuses felt that they were either prepared or highly prepared.

Actions: The faculty agreed to include the rubric for solving engineering problems at the beginning of the term when the syllabus is distributed; more explicitly train the students in the strategies for solving engineering problems, and ensure that engineering problem assignments consistently include the rubric.

### **Outcome MET a: Baccalaureate degree programs must demonstrate that graduates can apply specific program principles to the analysis, design, development, implementation, or oversight of more advanced mechanical systems or processes depending on program orientation and the needs of their constituents.**

There were mixed results on this outcome. One thing that did come out was that a majority of the student senior projects were not completed on time. This may be due to economic issues. Almost all of the students at all three campuses felt that they were either prepared or highly prepared.

Actions: Timelines for future senior projects, especially those that require a lot of fund raising, will be watched closely.

## **OVERALL PROCESS**

The overall assessment went better than expected. This assessment process was carried out across three campuses; with two of the campuses operating on a 12-month schedule with most evening courses (Boeing and Portland), and the Klamath Falls campus operating on a 9-month schedule with traditional day-time courses. A few things to concentrate on for next year include earlier planning (already accomplished), and making careful choices for which courses to evaluate (trying to assess senior projects final reports at the end of spring term, and incorporating them into the final report has been problematic this year).

## **VI. Changes Resulting from Assessment**

During the 2007-08 academic year, the faculty decided to make improvements on student learning outcome d on design, as follows:

“It was thus recommended that several small design projects be placed throughout the curriculum to better prepare students for senior projects and eventual project planning and management in industry. It was decided to require students to plan and manage very small design projects in Fluid Mechanics I and Machine Design II. This will be implemented next year, at which time we will evaluate the effectiveness of this change.”

The faculty did add a rubric-scored design project to MET 316 Machine Design II and re-assessed student learning as noted above in SLO d. The faculty obtained mixed results again on this outcome and will continue to work on this, as noted above in Section V.

Appendix A1  
SLO-Curriculum Map

**Outcome b: An ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology.**

I = Introduced      R = Reinforced      E = Emphasized

	Freshman			Sophomore			Junior			Senior		
<b>Fall</b>	Math 111	Coll Algebra		MATH 252	Integral Calc		ENGR 236	Elect Circuits		MET 323	Heat Transfer	R
	MET 111	Orient I	I	MET 160	Materials I	R	ENGR 266	Comp Program		MET 326	EPS	
	WRI 121	Eng Comp		PHY 201/221	Physics		MET 315	Machine Design I	R	IMGT 345	Engineer Economy	
	CHE 101	Chem		WRI 227	Tech Report		MET 360	Materials II	E	MET 490	Senior Proj I	R
	CHE 104	Chem Lab		MET 241	CAD I	R	MET 363	Instrum	R	WRI 321	Adv Tech Wr	
		Psy Elective									MET Elective	
<b>Win</b>	Math 112	Trig		ENGR 211	Statics		ENGR 212	Dynamics		MET 426	FPS	
	MET 112	Orient II	I	Math 254N	Vector Calc I		ENGR 355	Thermo	I	MET 437	Heat Tran Lab	R
	MFG 103	Welding		MET 242	CAD II		MET 316	Machine Design II	R	MET 491	Senior Proj II	R
	WRI 122	Eng Comp		MFG 112	Intro Mfg Proc	I	MET 375	Solid Modelling		SPE 321	Small Group	
		Soc Sci Elective		PHY 202/222	Physics			Soc Sci Elective		WRI 322	Adv Tech Wr	
											MET Elective	
<b>Spr</b>	Math 251	Diff Calc		ENGR 213	Strengths		MET 313	Applied Thermo	E	MET 492	Senior Proj III	R
	MFG 120	Mfg Proc I	I	Math 361	Stats I		MET 415	Design Project		MFG 331	Indust Controls	
	SPE 111	Speech		MET 218	Fluids	R	MET 351	FEA		WRI 323	Adv Tech Wr	
		Econ Elective		PHY 203/223	Physics		MFG 314	GDT			Engineer Exam	
		Hum Elective						Hum Elective			Hum Elective	
											MET Elective	
											MET Elective	

Appendix A2  
SLO-Curriculum Map

**Outcome d: An ability to apply creativity in the design of systems, components or processes appropriate to program objectives.**

I = Introduced      R = Reinforced      E = Emphasized

	Freshman			Sophomore			Junior			Senior		
<b>Fall</b>	Math 111	Coll Algebra		MATH 252	Integral Calc		ENGR 236	Elect Circuits		MET 323	Heat Transfer	
	MET 111	Orient I	I	MET 160	Materials I		ENGR 266	Comp Program		MET 326	EPS	
	WRI 121	Eng Comp		PHY 201/221	Physics		MET 315	Machine Design I	R	IMGT 345	Engineer Economy	
	CHE 101	Chem		WRI 227	Tech Report		MET 360	Materials II		MET 490	Senior Proj I	E
	CHE 104	Chem Lab		MET 241	CAD I	R	MET 363	Instrum		WRI 321	Adv Tech Wr	
		Psy Elective									MET Elective	
<b>Win</b>	Math 112	Trig		ENGR 211	Statics		ENGR 212	Dynamics		MET 426	FPS	
	MET 112	Orient II	I	Math 254N	Vector Calc I		ENGR 355	Thermo		MET 437	Heat Tran Lab	
	MFG 103	Welding		MET 242	CAD II	R	MET 316	Machine Design II	E	MET 491	Senior Proj II	E
	WRI 122	Eng Comp		MFG 112	Intro Mfg Proc		MET 375	Solid Modelling	E	SPE 321	Small Group	
		Soc Sci Elective		PHY 202/222	Physics			Soc Sci Elective		WRI 322	Adv Tech Wr	
											MET Elective	
<b>Spr</b>	Math 251	Diff Calc		ENGR 213	Strengths		MET 313	Applied Thermo		MET 492	Senior Proj III	E
	MFG 120	Mfg Proc I	I	Math 361	Stats I		MET 415	Design Project	E	MFG 331	Indust Controls	
	SPE 111	Speech		MET 218	Fluids	R	MET 351	FEA	E	WRI 323	Adv Tech Wr	
		Econ Elective		PHY 203/223	Physics		MFG 314	GDT			Engineer Exam	
		Hum Elective						Hum Elective			Hum Elective	
											MET Elective	
											MET Elective	

Appendix A3  
SLO-Curriculum Map

**Outcome f: An ability to identify, analyze and solve technical problems.**

I = Introduced      R = Reinforced      E = Emphasized

	Freshman			Sophomore			Junior			Senior		
<b>Fall</b>	Math 111	Coll Algebra		MATH 252	Integral Calc		ENGR 236	Elect Circuits	R	MET 323	Heat Transfer	E
	MET 111	Orient I	I	MET 160	Materials I		ENGR 266	Comp Program	R	MET 326	EPS	R
	WRI 121	Eng Comp		PHY 201/221	Physics		MET 315	Machine Design I	E	IMGT 345	Engineer Economy	
	CHE 101	Chem		WRI 227	Tech Report		MET 360	Materials II		MET 490	Senior Proj I	E
	CHE 104	Chem Lab		MET 241	CAD I		MET 363	Instrum	E	WRI 321	Adv Tech Wr	
		Psy Elective									MET Elective	
<b>Win</b>	Math 112	Trig		ENGR 211	Statics	R	ENGR 212	Dynamics	E	MET 426	FPS	R
	MET 112	Orient II	I	Math 254N	Vector Calc I		ENGR 355	Thermo	E	MET 437	Heat Tran Lab	E
	MFG 103	Welding		MET 242	CAD II		MET 316	Machine Design II	E	MET 491	Senior Proj II	E
	WRI 122	Eng Comp		MFG 112	Intro Mfg Proc		MET 375	Solid Modelling		SPE 321	Small Group	
		Soc Sci Elective		PHY 202/222	Physics			Soc Sci Elective		WRI 322	Adv Tech Wr	
											MET Elective	
<b>Spr</b>	Math 251	Diff Calc		ENGR 213	Strengths	R	MET 313	Applied Thermo	E	MET 492	Senior Proj III	E
	MFG 120	Mfg Proc I	I	Math 361	Stats I		MET 415	Design Project	E	MFG 331	Indust Controls	R
	SPE 111	Speech		MET 218	Fluids	R	MET 351	FEA	E	WRI 323	Adv Tech Wr	
		Econ Elective		PHY 203/223	Physics		MFG 314	GDT			Engineer Exam	
		Hum Elective						Hum Elective			Hum Elective	
											MET Elective	
											MET Elective	

Appendix A4  
SLO-Curriculum Map

**Outcome MET a:** Baccalaureate degree programs must demonstrate that graduates can apply specific program principles to the analysis, design, development, implementation, or oversight of more advanced mechanical systems or processes depending on program orientation and the needs of their constituents.

I = Introduced      R = Reinforced      E = Emphasized

	Freshman		Sophomore		Junior			Senior		
<b>Fall</b>	Math 111	Coll Algebra	MATH 252	Integral Calc	ENGR 236	Elect Circuits		MET 323	Heat Transfer	
	MET 111	Orient I	MET 160	Materials I	ENGR 266	Comp Program		MET 326	EPS	
	WRI 121	Eng Comp	PHY 201/221	Physics	MET 315	Machine Design I	I	IMGT 345	Engineer Economy	
	CHE 101	Chem	WRI 227	Tech Report	MET 360	Materials II		MET 490	Senior Proj I	E
	CHE 104	Chem Lab	MET 241	CAD I	MET 363	Instrum		WRI 321	Adv Tech Wr	
		Psy Elective							MET Elective	
<b>Win</b>	Math 112	Trig	ENGR 211	Statics	ENGR 212	Dynamics		MET 426	FPS	R
	MET 112	Orient II	Math 254N	Vector Calc I	ENGR 355	Thermo		MET 437	Heat Tran Lab	R
	MFG 103	Welding	MET 242	CAD II	MET 316	Machine Design II	R	MET 491	Senior Proj II	E
	WRI 122	Eng Comp	MFG 112	Intro Mfg Proc	MET 375	Solid Modelling		SPE 321	Small Group	
		Soc Sci Elective	PHY 202/222	Physics		Soc Sci Elective		WRI 322	Adv Tech Wr	
									MET Elective	
<b>Spr</b>	Math 251	Diff Calc	ENGR 213	Strengths	MET 313	Applied Thermo		MET 492	Senior Proj III	E
	MFG 120	Mfg Proc I	Math 361	Stats I	MET 415	Design Project	E	MFG 331	Indust Controls	
	SPE 111	Speech	MET 218	Fluids	I MET 351	FEA		WRI 323	Adv Tech Wr	
		Econ Elective	PHY 203/223	Physics	MFG 314	GDT			Engineer Exam	
		Hum Elective				Hum Elective			Hum Elective	
									MET Elective	
									MET Elective	