

**Outcome D.** Graduates will have an ability to function on multidisciplinary teams.

Course	Performance indicators
MAE 345, 475	Use of various areas/disciplines in engineering problem formulation and/or solution.
MAE 345, 475	Use of team organizational tools for planning, task distribution, reporting, monitor team effort.
MAE 345, 475	Grade distribution.

Tools used: Course assessment by faculty, Alumni survey, Employer survey.

Data Collection: The data are collected every semester based on the course offerings.

Frequency of data collection: The data are collected every time courses are taught.

Data Analysis: The data obtained are analyzed every year.

Closing the loop: This outcome is subject to review every year based on performance criteria and metrics and specific action items are developed, if necessary, to revise the content of the courses. The analyzed data are presented separately to the following groups in meetings.

- a) Feedback to students on all assignments
- b) Feedback to faculty, particular from majors.

Outcome and Performance Indicator		Performance Indicator Rubric				
<b>Assessment Outcome D.</b> “Graduates will have an ability to function on multidisciplinary teams.”		<b>Poor</b>	<b>Fair</b>	<b>Good</b>	<b>Very Good</b>	<b>Excellent</b>
PI1	Use of various areas/disciplines in engineering problem formulation and/or solution	Use of only one discipline	A second discipline mentioned	Two disciplines equally used	Two or more disciplines Used well	Various disciplines used and explained
PI2	Use of team organizational tools for planning, task distribution, reporting, monitor team effort.	No organizational tools used	Some team organization plans	Task/time charts used	Task/time charts used with team effort	Task/Time/ Effort with follow up
PI3	Grade distribution	1 (F)	2 (D)	3 (C)	4 (B)	5 (A)

**Explanations:**

**Performance Indicator 1. (PI1).** “Use of various areas/disciplines in engineering problem formulation and/or solution” Engineering problems often require the use of methods, concepts and techniques of various disciplines or sub-disciplines in an engineering field. Some exercises are typically offered to students in which they can use the various disciplines with which they are familiar. The following rubrics are used to assess this indicator:

- **Poor.** This rubric is used when only one discipline or area is used on a problem that offers the opportunity to integrate other disciplines or sub-disciplines within the field.
- **Fair.** This rubric is used when at least two disciplines or areas are used on a problem that offers the opportunity to integrate other disciplines or sub-disciplines within the field. In this case, the first discipline is emphasized and the second discipline is addressed minimally.
- **Good.** This rubric is used when at least two disciplines or areas are used on a problem that offers the opportunity to integrate other disciplines or sub-disciplines within the field. In this case, both disciplines are given similar importance and the issues are clearly connected.
- **Very Good.** This rubric is used when at least two disciplines or areas are used on a problem that offers the opportunity to integrate other disciplines or sub-disciplines within the field. In this case, both disciplines are given appropriate importance and the issues are clearly connected.
- **Excellent.** This rubric is used when in addition to the previous rubric, the procedures are well described, explained, illustrated and documented.

**Performance Indicator 2. (PI2).** “Use of team organizational tools for planning, task distribution, reporting, monitor team effort” Engineering problems often require the use of organizational tools and techniques to, plan monitor, review and assess the progress towards reaching the objectives. The following rubrics are used to assess this indicator:

- **Poor.** This rubric is used when an assignment requiring group work and multiple tasks does not provide evidence of simple organizational tools or techniques being used.
- **Fair.** This rubric is used when an assignment requiring group work and multiple tasks provides some evidence of simple organizational tools including at least an activity timeline and task distribution.
- **Good.** This rubric is used when an assignment requiring group work and multiple tasks provides evidence of organizational tools including a timeline charts, task-effort distribution, and means to monitor progress activity.
- **Very Good.** This rubric is used when an assignment requiring group work and multiple tasks provides clear evidence of organizational tools including a Gantt charts, task-effort distribution, means to monitor tasks progress and effort spent on tasks, including progress reports.
- **Excellent.** This rubric is used when in addition to the previous rubric; there is evidence of organizational tools being used to produce follow-up activity.

**Performance Indicator 3. (PI3).** Grade distribution from class on applicable assignments or exercises. A, B, C, D ,F

**Assessment Tool:**

**Course Assessment Rubric by Faculty**

## Aerospace Engineering Program Course-Outcome Matrix (October, 2014)

ABET Outcome		a	b	c	d	e	f	g	h	i	j	k	
Required Course	Credit Hours	Apply Math, Science, and Engr	Design Experiments and Analyze and	Design System, Component, or Process	Multi-disciplinary Teams	Identify, Formulate and Solve Engr Problems	Professional and Ethical Responsibility	Communicate Effectively	Broad Education - Global and Societal	Life-long Learning	Contemporary Issues	Techniques, Skills, and Modern Engr Tools	Number of Outcomes per course
ENGR 101 <i>Engr. Problem Solving 1</i>	3						F	G					2
MAE 215 <i>Intro to Aero Engr</i>	3			C			F						2
MAE 241 <i>Statics</i>	3	A											1
MAE 242 <i>Dynamics</i>	3	A											1
MAE 243 <i>Mech. of Materials</i>	3					E							1
MAE 244 <i>Dynam. &amp; Strength Lab</i>	1		B		<del>B</del>							K	3
MAE 316 <i>Analy. of Engr. Sys.</i>	3	A										K	2
MAE 320 <i>Thermodynamics</i>	3					E			H		J		3
MAE 335 <i>Incomp Aerodynamics</i>	3	A								I	J		3
MAE 336 <i>Comp Aerodynamics</i>	3	A								I			2
MAE 343 <i>Intermed. Mech. Matls.</i>	3	A								I			2
MAE 345 <i>Aerospace Structures</i>	3			C	D	E							3
MAE 365 <i>Flight Dynamics</i>	3	A										K	2
MAE 423 <i>Heat Transfer</i>	3			C					H		J		3
MAE 426 <i>Flt Vehicle Propulsion</i>	3			C		E							2
MAE 434 <i>Exp Aerodynamics</i>	3		B					G				K	3
MAE 456 <i>CAD &amp; Finite Elem. Ana.</i>	3			C		E						K	3
MAE 460 <i>Automatic Controls</i>	3					E						K	2
MAE 475 <i>Flt Vehicle Design</i>	3			C	D		F	G					4
MAE 476 <i>Space Flight</i>	3	A							H		J		3
No. of courses/outcome	58	8	2	6	2	6	3	3	3	3	4	6	
MATH 155 <i>Calculus 1</i>	4	r											
CHEM 115 <i>Fund. of Chemistry</i>	4	r	r				r						
ENGR 199 <i>Orientation to Engr.</i>	1	r		r		r	r	r		r	r		
ENGL 101 <i>Composition and Rhetoric</i>	3							r					
MATH 156 <i>Calculus 2</i>	4	r								r			
ENGR 102 <i>Engr. Problem Solving 2</i>	3	r		r		r							
PHYS 111 <i>General Physics</i>	4	r	r			r		r					
PHYS 112 <i>General Physics</i>	4	r	r			r		r		r			
ENGL 102 <i>Composition &amp; Rhetoric</i>	3							r		r			
MATH 251 <i>Multivariable Calculus</i>	4	r								r			
MATH 261 <i>Elem. Diff. Equations</i>	4	r								r			
IENG 302 <i>Manufacturing Processes</i>	2	r		r	r								
IENG 303 <i>Manufact. Processes Lab</i>	1	r	r	r	r								
EE 221 <i>Intro. to Electrical Engr.</i>	3	r		r	r	r							
EE 222 <i>Intro. to Electrical Engr. Lab</i>	1	r	r	r	r							r	
GEC (21 hours) (Econ)	21							r	r	r	r		
Technical Electives (6 hours)	6								r	r	r	r	

Outcome	<b>ABET Assessment Team members To conduct Assessment of Year 2014</b>	
a	Ismail Celik, Yu Gu, Mario Perhinschi and Pat Browning	<b>Outcome a</b> “Graduates will have an ability to apply knowledge of mathematics, science and engineering.”
b	Marvin Cheng, Alfred Lynam and Marcello Napolitano	<b>Outcome b</b> “Graduates will have an ability to design and conduct experiments, as well as to analyze data.”
c	Ken Means, Terry Musho and Greg Thompson	<b>Outcome c</b> “Graduates will have an ability to design a system, component or process to meet desired needs.”
d	Kostas Sierros, Jim Smith and Scott Wayne	<b>Outcome d</b> “Graduates will have an ability to function on multidisciplinary teams.”
e	Ever Barbero, John Kuhlman, Andrew Nix and Jason Gross	<b>Outcome e</b> “Graduates will have an ability to identify, formulate and solve engineering problems.”
f	Wade Huebsch and David Mebane	<b>Outcome f</b> “Graduates will have an understanding of professional and ethical responsibility.”
g	Salva Akkerman, Cosmin Dumitrescu and Nithi Sivaneri	<b>Outcome g</b> “Graduates will have an ability to communicate effectively.”
h	Victor Mucino and John Christian	<b>Outcome h</b> “Graduates will have the broad education necessary to understand the impact of engineering solutions in a global and societal context”.
i	Xingbo Liu, Ed Sabolsky and Samir Shoukry	<b>Outcome i</b> “Graduates will have a recognition of the need for, and an ability to engage in, life-long learning”.
j	Bruce Kang, Sam Mukdadi and Nick Wu	<b>Outcome j</b> “Graduates will have knowledge of contemporary issues.”
k	Larry Banta, Hailin Li and Xueyan Song	<b>Outcome k</b> “Graduates will have an ability to use the techniques, skills and modern engineering tools necessary for engineering practice.”

AEROSPACE ENGINEERING				D	Outcome D-2014				
<b>Assessment Outcome D.</b> “Graduates will have an ability to function on multidisciplinary teams.”				<b>Assessment Team:</b> Kostas Sierros, Jim Smith, Scott Wayne					
<b>Performance Indicators:</b> PI1. Use of various areas/disciplines in engineering problem formulation and/or solution PI2. Use of team organizational tools for planning, task distribution, reporting, monitor team effort. PI3. Grade average for the entire class.				Rubrics for Performance Indicators:					
<b>Performance: <math>P = (PI1 + PI2 + GA) / 3</math></b> P= Performance PI1 = Performance Indicator 1 PI2 = Performance Indicator 2 GA= Average grade of class in assignment* (if GA is based on 100 pt scale, divide by 20; if GA is based on 4 pt scale, multiply by 1.25)									
				Poor (1)	Fair (2)	Good (3)	Very good (4)	Excellent (5)	
				PI1	Use of only one discipline	A second discipline used but with unbalanced emphasis	A second discipline used with balanced emphasis	Two or more disciplines used with appropriate balance in emphasis	Two or more disciplines used with appropriate balance in emphasis and explained well
				PI2	No organizational tools used	Some planning tools used but no follow up	Planning tools used with some follow up	Planning tools used with follow up reports	Planning tools used with follow up reports and discussion
Course/Term	PI1	PI2	Grade Average*	Performance	Observations (Score explanation)				
MAE 345									
MAE 475									
Overall Performance 2014									
Overall Performance 2013									
Follow-up or Corrective Actions:					Responsible Person/Team/Cmte.				
					To: AE CC				
					To: Instructor (by Course)				

	To: Instructor (by Course)
	To: Instructor (by Course)



AEROSPACE ENGINEERING		MAE 345		Outcome D-2014	
<b>Assessment Outcome D.</b> “Graduates will have an ability to function on multidisciplinary teams.”				<b>Assessment Team:</b> Kostas Sierros, Jim Smith, Scott Wayne	
<b>Performance Indicators:</b> PI1. Use of various areas/disciplines in engineering problem formulation and/or solution PI2. Use of team organizational tools for planning, task distribution, reporting, monitor team effort. PI3. Grade average for the entire class.				Rubrics for Performance Indicators:	
<b>Performance: <math>P = (PI1 + PI2 + GA) / 3</math></b> <b>P= Performance</b> <b>PI1 = Performance Indicator 1</b> <b>PI2 = Performance Indicator 2</b> <b>GA= Average grade of class in assignment*</b> (if GA is based on 100 pt scale, divide by 20; if GA is based on 4 pt scale, multiply by 1.25)				Poor (1)	Fair (2)
				Good (3)	Very good (4)
				Excellent (5)	
				PI1 Use of only one discipline	A second discipline used but with unbalanced emphasis
				PI2 No organization al tools used	Some planning tools used but no follow up
				A second discipline used with balanced emphasis	Two or more disciplines used with appropriate balance in emphasis
				Planning tools used with some follow up	Planning tools used with follow up reports
				Two or more disciplines used with appropriate balance in emphasis and explained well	Planning tools used with follow up reports and discussion
Course MAE 345	PI1	PI2	Class Grade Ave.	Average	Observations (Score explanation)
Key Asg. 1 (HW)					
Key Asg. 2 (HW)					
Key Asg. 3 (HW)					
Test 1 (Problem)					
Test 2 (Problem)					
Other (Project)					
Total Average					
<b>Overall Performance 2014</b>					

<b>Overall Performance 2013</b>		
<b>Follow-up or Corrective Actions:</b>		<b>Responsible Person/Team/Cmte.</b>
		To: AE CC
		To: Instructor (by Course)

AEROSPACE ENGINEERING		MAE 475		Outcome D-2014					
<b>Assessment Outcome D.</b> “Graduates will have an ability to function on multidisciplinary teams.”				<b>Assessment Team:</b> Kostas Sierros, Jim Smith, Scott Wayne					
<b>Performance Indicators:</b> PI1. Use of various areas/disciplines in engineering problem formulation and/or solution PI2. Use of team organizational tools for planning, task distribution, reporting, monitor team effort. PI3. Grade average for the entire class.				Rubrics for Performance Indicators:					
<b>Performance: <math>P = (PI1 + PI2 + PI3 + GA) / 4</math></b> <b>P= Performance</b> <b>PI1 = Performance Indicator 1</b> <b>PI2 = Performance Indicator 2</b> <b>PI3 = Performance Indicator 3</b> <b>GA= Average grade of class in assignment*</b> (if GA is based on 100 pt scale, divide by 20; if GA is based on 4 pt scale, multiply by 1.25)				Poor (1)	Fair (2)	Good (3)	Very good (4)	Excellent (5)	
				PI1	Use of only one discipline	A second discipline used but with unbalanced emphasis	A second discipline used with balanced emphasis	Two or more disciplines used with appropriate balance in emphasis	Two or more disciplines used with appropriate balance in emphasis and explained well
				PI2	No organizational tools used	Some planning tools used but no follow up	Planning tools used with some follow up	Planning tools used with follow up reports	Planning tools used with follow up reports and discussion
Course MAE 475	PI1	PI2	Class Grade Ave.	Average	Observations (Score explanation)				
Key Asg. 1 (HW)									
Key Asg. 2 (HW)									
Key Asg. 3 (HW)									
Test 1 (Problem)									
Test 2 (Problem)									
Other (Project)									
Total Average									
<b>Overall Performance 2014</b>									

<b>Overall Performance 2013</b>		
<b>Follow-up or Corrective Actions:</b>		<b>Responsible Person/Team/Cmte.</b>
		To: AE CC
		To: Instructor (by Course)

**Assessment Tool:**

**Alumni Survey**

# MAE Alumni Survey of Educational Success

Dear Alum, in an effort to improve the quality of our Educational Programs in Mechanical and Aerospace Engineering, we would like to request few minutes of your time to help us assess the level of attainment of our Educational Objectives and Learning Outcomes that our graduates exhibit in the development of their professional activity. This survey will serve as a tool for the assessment of our Program and is not intended to be used to evaluate you individually.

**Please tell us your year of graduation and the degree that you earned.**

**This is a required question**

**In my work, I am able to apply knowledge of math, science and engineering effectively.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

**This is a required question**

**In my work, I am able to design and conduct experiments, and analyze data.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

**This is a required question**

**In my work, I am able to design a system, component or process to meet desired needs and constraints.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

**This is a required question**

**In my work, I am able to function productively on multidisciplinary teams.**

- Strongly Agree
- Agree
- Neutral

- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**In my work, I am able to identify, formulate and solve engineering problems.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**In my work, I have a good understanding of professional and ethical responsibility.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**In my work, I am able to communicate effectively, both verbally and in writing.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**In my work, I understand the impact of engineering solutions in a global and societal context.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**In my work, I recognize the need for, and engage in, life-long learning.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**In my work, I am aware of and appreciate contemporary engineering issues.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**In my work, I am proficient in the use of techniques, skills and modern tools necessary for engineering practice.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**In my work, I am prepared to meet the varying demands of the workforce in the technological arena.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**Please add comments below to clarify or add to any of your answers above, or to provide general comments about the level of satisfaction you have with the way your education in the MAE department has prepared you for your career.**

This is a required question

**In general, How would you rate yourself in the following categories**

	Poor	Fair	Good	Very Good	Excellent
Your proficiency in your field	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your drive to learn on your own.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Your preparedness to meet the demands of the job-market	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Please enter one response per row

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**Assessment Tool:**

**Employer Survey**

# Employer Survey of MAE Graduates

Dear Employer, in an effort to improve the quality of our Educational Programs in Mechanical and Aerospace Engineering, we would like to request few minutes of your time to help us assess the level of attainment of our Educational Objectives and Learning Outcomes that our graduates exhibit in the development of their professional activity in your company. This survey will serve as a tool for the assessment of our Program and is not intended to be used to evaluate the graduate's work for you or in your company.

**Please tell us how many WVU MAE graduates you employ, and for how long.**

**This is a required question**

**WVU MAE graduates in my employ are able to apply knowledge of math, science and engineering effectively.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

**This is a required question**

**WVU MAE graduates in my employ are able to design and conduct experiments, and analyze data.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

**This is a required question**

**WVU MAE graduates in my employ are able to design a system, component or process to meet desired needs and constraints.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

**This is a required question**

**WVU MAE graduates in my employ are able to function productively on multidisciplinary teams.**

- Strongly Agree
- Agree

- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**WVU MAE graduates in my employ are able to identify, formulate and solve engineering problems.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**WVU MAE graduates in my employ have a good understanding of professional and ethical responsibility.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**WVU MAE graduates in my employ are able to communicate effectively, both verbally and in writing.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**WVU MAE graduates in my employ understand the impact of engineering solutions in a global and societal context.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**WVU MAE graduates in my employ recognize the need for, and engage in, life-long learning.**

- Strongly Agree
- Agree
- Neutral

- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**WVU MAE graduates in my employ are aware of and appreciate contemporary engineering issues.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**WVU MAE graduates in my employ are proficient in the use of techniques, skills and modern tools necessary for engineering practice.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**WVU MAE graduates in my employ are prepared to meet the varying demands of the workforce in the technological arena.**

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree
- Not Applicable

This is a required question

**Please add comments below to clarify or add to any of your answers above, or to provide general comments about the level of satisfaction you have with graduates of the MAE department at WVU.**

This is a required question

**In general, How would you rate WVU MAE graduates in the following categories**

	Poor	Fair	Good	Very Good	Excellent
Proficiency in his/her field	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Drive to learn on his/her own	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Preparedness to meet the demands of the job market	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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