

SJSU **BSAE 2018** Annual Program Assessment Report

Department:	Aerospace Engineering
Programs:	BSAE
College:	Engineering
Program Website:	BSAE: http://www.sjsu.edu/ae/programs/bsae/index.html
Link to Program Learning Outcomes (PLOs) on program website:	BSAE: http://www.sjsu.edu/ae/programs/bsae/bsae_program_outcomes/
Program Accreditation (if any):	ABET
Contact Person and Email:	Dr. Nikos J. Mourtos nikos.mourtos@sjsu.edu
Date of Report:	15 March 2019

Part A

1A. – **BSAE Program Learning Outcomes**

BSAE student learning outcomes are specified by ABET. AE faculty have broken down each outcome into elements and performance indicators for each outcome element (see below). BSAE PLOs were re-grouped in March 2018 and reduced to seven (7) following a revision by ABET.

PLO-1: Ability to identify, formulate and solve complex aerospace engineering problems by applying principles of engineering, science, and mathematics.

Outcome Element 1.1: Ability to identify, formulate and solve complex problems.

Outcome Performance Indicators:

- 1.1.1: Engage in the solution of problems (spend adequate time on task, ask questions, etc.).
- 1.1.2: Define open-ended, complex aerospace engineering problems in appropriate engineering terms.
- 1.1.3: Explore problems (i.e., examine various issues, make appropriate assumptions, etc.).
- 1.1.4: Develop a plan for the solution (i.e., select theories, principles, approaches from aerospace structures, aerospace dynamics, aerodynamics, flight mechanics, aerospace propulsion, stability, and control, as appropriate).
- 1.1.5: Implement the solution plan and check the accuracy of the calculations.
- 1.1.6: Evaluate the results (do they make sense?)
- 1.1.7: Reflect on personal strengths and weaknesses in applying the problem solving methodology.

Outcome Element 1.2: Ability to apply principles of engineering, science, and mathematics.

Outcome Performance Indicators:

- 1.2.1: Apply principles of mathematics, science and aerospace structures. AE114
- 1.2.2: Apply principles of mathematics, science and dynamics. AE140
- 1.2.3: Apply principles of mathematics, science and aerodynamics. AE164
- 1.2.4: Apply principles of mathematics, science and flight mechanics. AE165

- 1.2.5: Apply principles of mathematics, science and aerospace propulsion. AE167
1.2.6: Apply principles of mathematics, science, stability and control. AE168

PLO-2: Ability to design aerospace vehicles that meet specified requirements and subject to public health, safety and welfare, global, cultural, social, environmental, and economic constraints.

Outcome Performance Indicators:

- 2.1: Research, evaluate, and compare vehicles designed for similar missions.
2.2: Follow a prescribed process to develop the conceptual / preliminary design of an aerospace vehicle.
2.3: Examine economic, environmental, social, cultural, global, health and safety, manufacturability, and sustainability constraints for a vehicle being designed.
2.4: Select an appropriate configuration for an aerospace vehicle with a specified mission.
2.5: Apply AE principles (e.g. aerodynamics, structures, flight mechanics, propulsion, stability and control) to design and analyze vehicle subsystems.
2.6: Develop and compare alternative configurations for an aerospace vehicle, considering trade-offs and appropriate figures of merit.
2.7: Develop final specifications for an aerospace vehicle.

PLO-3: An ability to communicate effectively with a range of audiences.

Outcome Element 3.1: Ability to communicate in writing

Outcome Performance Indicators:

- 3.1.1: Produce well-organized reports, following guidelines.
3.1.2: Use clear, correct language and terminology while describing experiments, projects or solutions to engineering problems.
3.1.3: Describe accurately in a few paragraphs a project / experiment performed, the procedure used, and the most important results (abstracts, summaries).
3.1.4: Use appropriate graphs and tables following published engineering standards to present results.

Outcome Element 3.2: Ability to communicate orally

Outcome Performance Indicators:

- 3.2.1: Give well-organized presentations, following guidelines.
3.2.2: Make effective use of visuals.

PLO-4: Ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, considering the impact of engineering solutions in global, economic, environmental, and societal contexts.

Outcome Element 4.1 – Recognize ethical responsibilities.

Outcome Performance Indicators:

- 4.1.1: Be familiar with professional codes of ethics (e.g. NSPE, ASME).
4.1.2: Properly acknowledge the work of others by citing all sources when writing reports.
4.1.3: Given a job-related scenario that requires a decision with ethical implications, identify possible courses of action, discuss the pros and cons of each one, decide on the best course of action, and justify the decision.

Outcome Element 4.2 – Recognize professional responsibilities.

Outcome Performance Indicators:

- 4.2.1: Demonstrate professional excellence in performance.
4.2.2: Demonstrate collegiality when working with others.

Outcome Element 4.3 – Make informed judgments, taking into consideration the impact of engineering solutions in global, economic, environmental, and societal contexts.

Outcome Performance Indicators:

- 4.3.1: Discuss the impact of aerospace vehicles in a societal context. Use appropriate references to support their arguments.
- 4.3.2: Discuss the impact of aerospace vehicles in a global context. Use appropriate references to support their arguments.
- 4.3.3: Describe the economic impact of aerospace vehicles, including those designed in course projects. Use appropriate references to support their arguments.
- 4.3.4: Describe the environmental impact of aerospace vehicles, including those designed in course projects. Use appropriate references to support their arguments.

PLO-5: Ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

Outcome Performance Indicators:

- 5.1: Contribute to the creation of a collaborative and inclusive environment by showing respect for others.
- 5.2: Participate in making decisions, negotiate with partners, and resolve conflicts arising during teamwork.
- 5.3: Establish goals related to team projects, generate timelines, organize and delegate work among team members, and coach each other as needed to ensure that all tasks are completed.
- 5.4: Demonstrate leadership by taking responsibility for various tasks, motivating and disciplining others as needed.

PLO-6: Ability to design and conduct appropriate experiments, analyze and interpret data, and use engineering judgment to draw conclusions.

Outcome Elements

- 6.1: Ability to design aerospace engineering experiments.
- 6.2: Ability to conduct aerospace engineering experiments.
- 6.3: Ability to analyze data from aerospace engineering experiments.
- 6.4: Ability to interpret data from aerospace engineering experiments.

6.1: Ability to design experiments

Outcome Performance Indicators:

- 6.1.1: Define goals and objectives for the experiment.
- 6.1.2: Research relevant theory and published data from similar experiments.
- 6.1.3: Select the dependent and independent variables to be measured.
- 6.1.4: Select appropriate methods for measuring/controlling each variable.
- 6.1.5: Select a proper range for the independent variables.
- 6.1.6: Determine an appropriate number of data points for each type of measurement.

6.2: Ability to conduct experiments

Outcome Performance Indicator:

Given an experimental setup, become familiar with the equipment, calibrate the instruments to be used, and follow the proper and safe procedures to collect the data.

6.3: Ability to analyze data from experiments

Outcome Performance Indicators:

- 6.3.1: Given a set of experimental data, carry out the necessary calculations.

6.3.2: Tabulate and plot experimental results using appropriate choice of variables and software.

6.4: Ability to interpret data and draw conclusions

Outcome Performance Indicators:

6.4.1: Given a set of results in tabular or graphical form, make observations and draw conclusions regarding the variation of the parameters involved.

6.4.2: Given a set of results in tabular or graphical form, compare with theoretical predictions and/or other published data and explain any discrepancies.

PLO-7: Ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Outcome Performance Indicators:

7.1: Access information effectively and efficiently from a variety of sources.

7.2: Develop a systematic approach to acquiring new knowledge.

7.3: Reflect regularly on the effectiveness of this approach (i.e. determine what works and what doesn't).

7.4: Make any necessary adjustments to improve the effectiveness and the efficiency of this process.

GE Area S: Self, Society, and Equality in the US

S-LO1: Describe how identities (i.e. religious, gender, ethnic, racial, class, sexual orientation, disability, and/or age) are shaped by cultural and societal influences within contexts of equality and inequality.

S-LO2: Describe historical, social, political, and economic processes producing diversity, equality, and structured inequalities in the U.S.

S-LO3: Describe social actions which have led to greater equality and social justice in the U.S. (i.e. religious, gender, ethnic, racial, class, sexual orientation, disability, and/or age).

S-LO4: Recognize and appreciate constructive interactions between people from different cultural, racial, and ethnic groups within the U.S.

GE Area V: Culture, Civilization, & Global Understanding

V-LO1: Compare systematically the ideas, values, images, cultural artifacts, economic structures, technological developments, and/or attitudes of people from more than one culture outside the U.S.

V-LO2: Identify the historical context of ideas and cultural traditions outside the U.S. and how they have influenced American culture

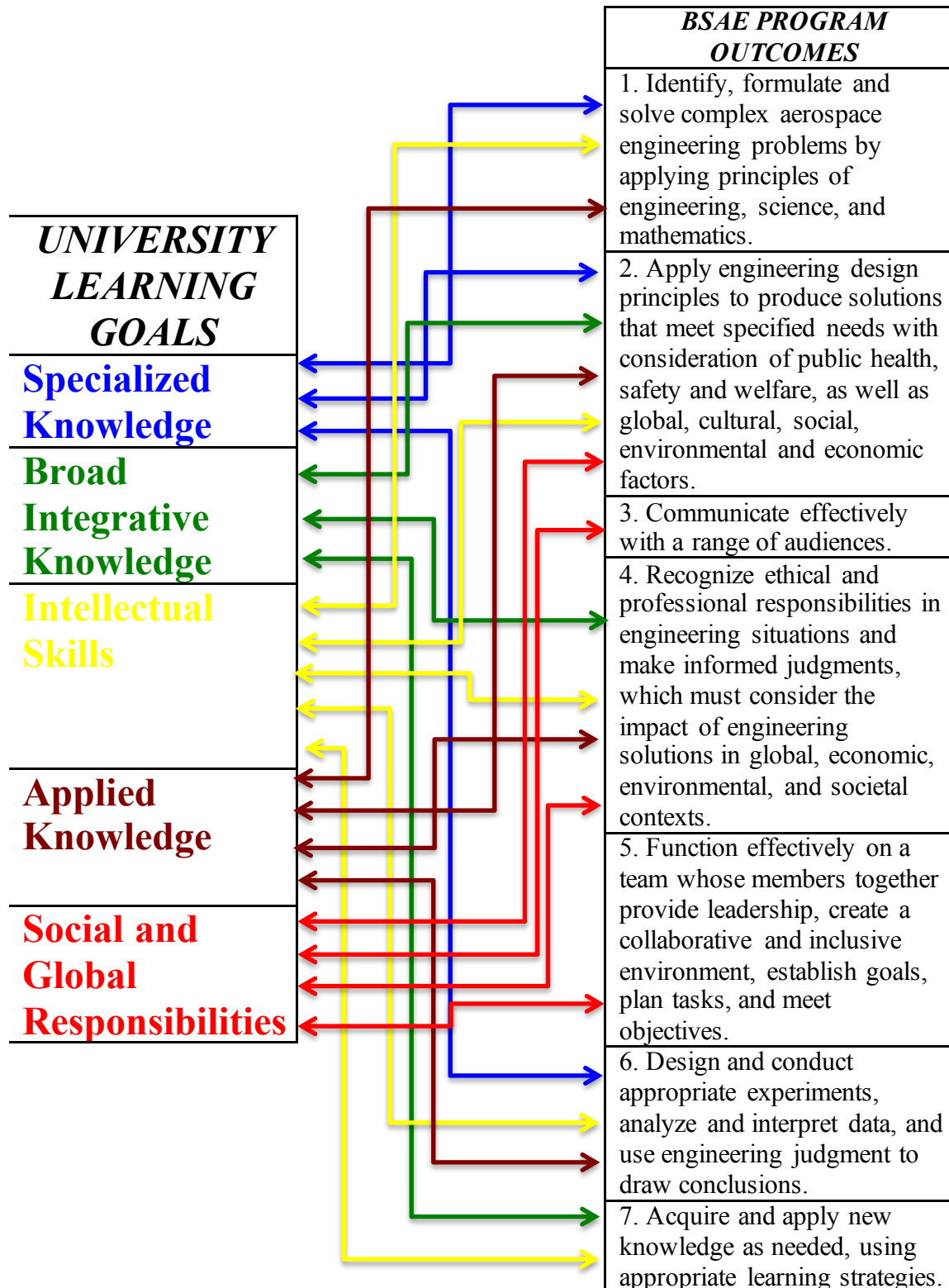
V-LO3: Explain how a culture outside the U.S. has changed in response to internal and external pressures.

BSAE PLO performance targets are defined as follows:

The scores earned by all students, in the assignments and test questions, which pertain to a particular performance indicator, in each course where this performance indicator is assessed, must be at least 70% to ensure working knowledge of the material.

to University Learning Goals (ULGs)

The BSAE map of PLOs to ULGs below was revised in March 2018 to reflect the changes in PLOs discussed above.



3. Alignment – Matrix of PLOs to Courses

Outcomes are addressed at different levels throughout the BSAE curriculum. For example, each and every upper division BSAE course addresses Outcome 1 at least at level 3 or 4 in the Bloom / Anderson Taxonomy. The table below shows only the courses which address outcomes at their highest level (5 or 6 in the Bloom / Anderson Taxonomy) and in which outcomes are assessed.

Student Outcomes							
<i>BSAE Outcomes</i>	1	2	3	4	5	6	7
<i>Courses Assessed</i>							
Engr.100W			+++				
AE 114	+++						
AE 140	+++						
AE 162	+++					+++	+++
AE 164	+++						
AE 165	+++						
AE 167	+++						
AE 168	+++						
AE 171 A&B and AE 172 A&B		+++	+++	+++	+++		
GE Areas S&V		++		+++			

++: Skill level 3 or 4 in Bloom/Anderson Taxonomy

+++ : Skill level 5 or 6 in Bloom/Anderson Taxonomy

4. Planning – [Assessment Schedule](#)

BSAE Assessment Schedule

<i>ABET visits</i>		<i>BSAE Student Outcomes</i>						
		1	2	3	4	5	6	7
Fall 2017	AY 17-18		X					X
	AY 18-19	X		X				
	AY 19-20		X		X			
	AY 20-21			X		X		
	AY 21-22				X		X	
	AY 22-23					X		X
Fall 2023	AY 23-24						X	

5. Student Experience

BSAE PLOs can be found here:

http://www.sjsu.edu/ae/programs/bsae/bsae_program_outcomes/

a. How are your PLOs and the ULGs communicated to students, e.g. websites, syllabi, promotional material, etc.?

- BSAE website (link above)
- Syllabi include a table, which shows how CLOs are linked to PLOs.
- The skills included in PLOs and their importance to engineering practice are discussed in every upper division (for BSAE) course on the first day of class and revisited throughout the semester, as various course activities and assignments are linked to CLOs and PLOs.

b. Do students have an opportunity to provide feedback regarding your PLOs and/or the assessment process? If so, please briefly elaborate.

Students are given opportunities in *each course* during the semester to provide feedback in regards to:

- How effective is the teaching in terms of helping them acquire the skills outlined in the CLOs / PLOs.
- How well the various assessment methods in each course measure their level of competence in these skills.

Graduating seniors are surveyed with the following questions:

Question 1: What do you think are the most important skills for an AE to compete successfully for entry-level positions in industry?

Question 2: What do you think are the most important skills for an AE to succeed in graduate school?

Question 3: Do you feel that our AE program prepared you adequately in the skills you consider important? Write “yes” OR “no” next to each skill you identified in questions 1 and 2 above.

Questions 4: Which courses prepared you for these skills? Write next to each skill you identified in questions 1 and 2 the course(s) you think helped you develop these skills.

Responses from questions 1 and 2 are summarized and compared to the skills listed in the BSAE PLOs. If students identify any new skills not listed in the BSAE PLOs, AE faculty discuss and recommend whether to modify PLOs and include these newly identified skill(s).

Responses from questions 3 and 4 help determine whether – always according to students – the BSAE Program prepares them adequately in the skills they consider important and which courses are most effective in this regard.

Part B

6,7,8 Assessment Data, Results, Analysis, and Proposed Changes

(Please briefly describe the data collected for this report (e.g., student papers, posters, presentations, portfolios, assignments, exams). The instruments used to evaluate student achievement (e.g., rubrics or other criteria) and actual data (e.g., assignment description or instructions) should be attached as appendices. PLOs should be evaluated based on direct assessments of learning, not grades earned by students.)

As shown in our assessment schedule in Section 4, BSAE assessment is performed on an academic year basis, while SJSU annual assessment follows a calendar year. As a result of this misalignment in the two timelines, the data and analysis presented in our Annual Assessment Report comes from two different academic years and covers more outcomes, as shown in the table below.

		BSAE	
	Outcomes:	<i>2 – Design</i>	<i>7 – Lifelong Learning</i>
AY F17–S18	Courses: Who: Semester:	AE171B & AE172B Profs. Mendoza & Papadopoulos Spring 2018	AE162 Prof. Mourtos Spring 2018
AY F18–S19	Outcomes:	<i>1 – Mathematics Science Engineering & Problem Solving</i>	<i>3 – Communication Skills</i>
	Courses: Who: Semester:	AE164, AE168 Profs. Vergine & Hunter Fall 2018	Written: Engr100W Fall 2018 Oral: AE171A Prof. Mendoza, Fall 2017 & AE172 Prof. Papadopoulos, Spring 2018
	Courses: Who: Semester:	AE114, AE140, AE162, AE165, AE167 Profs. Hunter, Andrade, Swei, Vergine Spring 2019	

PLO–1: Ability to identify, formulate and solve complex aerospace engineering problems by applying principles of engineering, science, and mathematics.

Assessment Summary: Based on the two outcome performance indicators discussed below, PLO–1 is not currently satisfied in the BSAE Program.

Outcome Performance Indicator 1.2.3 – Apply principles of mathematics, science and aerodynamics.

AE164 – Aerothermodynamics

Prof. Fabrizio Vergine

Assessment Summary: The performance target is not met for OPI – 1.2.3.

Course Activities

- Use the 1st and 2nd laws of thermodynamics to calculate heat transfer, work done and entropy changes in a thermodynamic system.
- Use thermodynamics and conservation equations to calculate flow parameters at various points of a flow field.
- Calculate stagnation and critical conditions at various points of a flow field for isentropic flow, adiabatic flow, flow with heat addition and flow with friction.
- Calculate the flow properties downstream of a Mach wave, an oblique shock wave, a Prandtl-Meyer

expansion wave, and a normal shock wave.

- Calculate the lift and drag coefficients on supersonic airfoils using shock - expansion theory.
- Calculate the flow properties downstream of a reflected / refracted shock wave.
- Calculate the flow properties at various locations of an (a) ideally expanded, (b) over-expanded and (c) under-expanded nozzle.
- Identify when heat transfer occurs as conduction, convection, or radiation solve basic heat transfer problems.

Assessment Tool

Comprehensive final exam, worth 30% of the course grade.

Student Performance Results

Approximately 25% of the students passed the final exam with A-, A or A+, 14% earned B-, B or B+, 9% earned C and C+ and 51% earned non-passing grades (C-, D or F). Statistics for each problem are as follows:

Problem 1 – 28% of the students scored above or equal to 90% (A-, A and A+ range), 4% scored between 89% and 80% (B-, B and B+ range), 3% scored between 73% and 79% (C and C+) and the remaining 58% scored 72% or below (C-, D or F).

Problem 2 – 25% of the students scored above or equal to 90% (A-, A and A+ range), 39% scored between 89% and 80% (B-, B and B+ range), 8% scored between 73% and 79% (C and C+) and the remaining 27% scored 72% or below (C-, D or F).

Problem 3 – 5% of the students scored above or equal to 90% (A-, A and A+ range), 0% scored between 89% and 80% (B-, B and B+ range), 0% scored between 73% and 79% (C and C+) and 93% scored 72% or below (C-, D or F).

Analysis

The large percentage of failing grades in the final exam should not be underestimated, although it may be understandable given the challenge presented to students to solve complex problems from any topic covered in the class without relying on books or notes. The distribution of scores in Problem 1 presented percentages similar to those of the exam as a whole due to its weight in the computation of the grade (i.e., 50% of the total points came from Problem 1). In Problem 1, many students had issues calculating the necessary total pressure needed for a normal shock to form at the exit of a de Laval nozzle and the total pressure needed to attain an under-expanded flow with a given flow deflection at the exit of the nozzle. This result was unexpected, given the time dedicated to the topic during the course (approximately two weeks), the relatively large number of example problems presented in class, and the workouts assigned during group activities. The class performed definitely better in the calculation of the flow properties across normal shock waves, oblique shock waves, and expansion waves in Problem 2. In any case, a much lower number of failing grades was expected due to the emphasis given to these calculations during the semester. The poor performance of students in Problem 3 was very likely due to the fact that it was a bonus question. In fact, many students either underestimated the problem or did not even try to solve it, thus explaining the results.

Recommendations

The following are recommendations intended to improve the ability of students to master solving complex, high-speed aerodynamics problems:

- Address the most pressing problems in the following class (i.e., AE167–Aerospace Propulsion). Due to the direct application of many of the topics covered in AE164 to aerospace propulsion systems, one lecture at the beginning of AE167 will be dedicated to the review of the most common issues encountered by the students in Aerothermodynamics.

- Remove bonus problems and limit possible extra credits to only parts of an exam question.
- Provide at least two group workouts on quasi-1D nozzle flows.

Implementation: Spring 2019 (AE167) and Fall 2019 (AE164)

Outcome Performance Indicator 1.2.6 – Apply principles of mathematics, science, stability and control.

AE168 – Aerospace Vehicle Dynamics & Control

Prof. Jeanine Hunter

Assessment Summary: The performance target is met for OPI – 1.2.6.

Course Activities

- Develop perturbation equations for aerospace vehicle six degree-of-freedom motion
- Determine the natural frequencies and damping ratios of the short period and phugoid modes
- Derive transfer functions and plot vehicle time response
- Analyze aircraft robustness with respect to perturbations and disturbances
- Design closed-loop control systems for longitudinal and lateral/directional dynamics
- Derive the equations of a satellite using gravity-gradient passive control
- Design a satellite control law using a momentum wheels, thrusters and other actuation mechanisms

Student Performance Results

Students who scored 70% or higher

Midterm 71 %

Final exam 91 %

Analysis

AE168 is a senior-level dynamics and controls class. The scope of the class is analysis/design of open loop dynamics as well as autopilot (closed-loop system) design. AE168 builds on several core topics, including rigid body dynamics, flight mechanics and automatic control theory. After AE157 was added to the curriculum as a prerequisite to AE168, the expectation was that control theory would be well understood by the students once they began AE168. Unfortunately, the consistent observation has been that while the students can usually run Matlab correctly, they don't really understand what they are doing. The following topics are examples of their lack of conceptual understanding: Why do we use rate damping in a feedback control system? How do you tune a PID controller? What is the significance of the frequency response of a rigid body? Without the conceptual and practical understanding of these topics, students will not have the tools for research, analysis or design.

Recommendation

A new approach to teaching controls in AE157 is needed so that students not only master Matlab but more importantly, the conceptual and analytical tools to use the program effectively in their work.

Implementation – Spring 2019

PLO-2: Ability to design aerospace vehicles that meet specified requirements and subject to public health, safety and welfare, global, cultural, social, environmental, and economic constraints.

Assessment Summary: Overall, PLO – 2 is satisfied in the BSAE Program.

AE171B – Aircraft Design II

Prof. Gonzalo E. Mendoza

Outcome Performance Indicator 2.1: Research, evaluate, and compare vehicles designed for similar missions. Assessed in Fall 2017.

Outcome Performance Indicator 2.2: Follow a prescribed process to develop the conceptual / preliminary design of an aerospace vehicle.

Assessment Summary: The performance target is met for OPI – 2.2.

Course Activities

AE171B – Students follow an iterative process (Roskam, 1985; Raymer, 2006) to design their airplanes. This process involves mission specification, configuration selection, weight sizing, performance sizing, component design, weight and balance, stability and control analysis, drag polar estimation, and final specification. The open-ended nature of design requires students to iterate through their design process in order to meet their mission requirements.

AE172B – Students follow standard systems engineering methodologies for spacecraft design outlined in Space Mission Analysis and Design by Willey Larson as well as NASA’s space systems engineering handbook to analyze and model all the sub-systems in their space vehicle design. These subsystems typically include propulsion, thermal, power, structure, main computer, attitude-determination and control (ADCS), GN&C, flight dynamics, aerodynamics, payload and instrumentation among others. The design process is iterative and progressive in varying order of fidelity.

Assessment Tools

AE171B – One team oral design review and one written examination with concepts from all aspects of design. The reviews include directed Q&A sessions.

AE172B – An interim report, a final report, and oral presentations address all aspects of the spacecraft system architecture and design. The students have to present and pass a preliminary design review that includes a directed Q&A session.

Student Performance Results

AE171B

In Class Written Examination Students who scored 70% or higher	Team Design Reviews (DR) Students scoring 70% or higher
2 nd Exam (S18)	Final DR (S18)
32%	100%

AE172B

Interim and Final Reports Students scoring 70% or higher
Final DR (S18)
85%

Analysis

AE171B – Student performance was mixed, even though student teams produced reasonably good designs. Students typically divide tasks among team members which is necessary, but limits exposure to the different aspects of design, particularly after the conceptual design stage. To ensure that all students are adequately knowledgeable in the entire design process, students are challenged with questions on various aspects of the design individually during each of their design reviews in class. Students do relatively well in this area, as evidenced by the scores. The written examinations posed greater difficulty for the students. Exams were divided into take home and in-class portions, with the in-class part focused more on general design ideas, rather than detailed calculations. The in-class exams are conceptual in

nature, with a design issue posed and a series of questions regarding potential treatments to improve mission suitability of the design, followed by more general questions regarding design procedures and aerodynamic, systems, and stability and control concepts. The recommendation below, which carries over from the year prior, did not substantially improve the scores in the in-class exams. That has led to a slightly different approach with the inclusion of additional problems and examples.

AE172B – Student performance was acceptable and the teams produced reasonably good designs. The projects are typically load-balanced among students. All students are made responsible collectively for the final system design and they are rotated in their design roles. During the preliminary and critical design reviews all group members are asked questions that address all sub-stems of the design. Students have been performing adequately as evidenced by their grades. The students are given in-class workouts to re-enforce the design process and to keep them on track for meeting key system design milestones.

Recommendations

AE171B – Conceptual design questions used in the written exams form the basis for excellent discussions following the actual test. Similar exercises should be posed to the students during class to facilitate these discussions before the test and thus potentially improve the results.

AE172B – None

Implementation:

AE171B: AY 18-19

AE172B: N/A

Outcome Performance Indicator 2.3: Develop economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints and design a vehicle that meets these constraints.

Assessment Summary: The performance target is met for OPI – 2.3.

Course Activities

AE171B

- Develop economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints as appropriate for their airplane.
- Take into consideration these constraints in the design of their airplane and discuss how well their particular design meets these constraints.

Assessment Tools

AE171B – A sections in the Final Design Report and participation in online and class discussions on this topic.

Student Performance Results

AE171B

Students who scored 70% or higher	
Final Design Report (S18)	Participation (S18)
100%	59%

Analysis

AE171B – Student performance is generally good in this area. Sometimes students need help identifying realistic constraints, especially for airplanes designed for student competitions, such as the SAE Aero-Design or the AIAA Design-Build-Fly events. Students also often need help analyzing how well their airplane meets certain constraints. Nevertheless, students grasp the importance of specific constraints in

airplane design and do a fairly good job of attempting to meet those constraints in their designs. Specific assignments tied to outcomes F and G also broaden their horizons beyond the technical aspects of airplane design. These assignments provide a better understanding of how to identify and deal with a wider set of constraints beyond aircraft performance and manufacturability. The class incorporates a fair number of examples of real-life designs which test safety, ethical, environmental, economic, and other societal concerns. Participation in online discussion threads on these topics are part of the evaluation plan. Students do well in the discussions, but often do not participate regularly enough to obtain a high score. Early deficiencies during the Mission Specification Report are required to be addressed in the Final Design Report for a satisfactory score.

Recommendations: AE171B – None

Implementation: N/A

AE172B – Performance Indicator 2.3 was assessed in Fall 2017.

Outcome Performance Indicator 2.4: Select an appropriate configuration for an aerospace vehicle with a specified mission. Assessed in Fall 2017.

Outcome Performance Indicator 2.5: Apply AE principles (e.g. aerodynamics, structures, flight mechanics, propulsion, stability and control) to design various vehicle subsystems.

Assessment Summary: The performance target is met for OPI – 2.5.

Course Activities

AE171B – Students apply AE principles throughout their conceptual and preliminary design of their airplane.

AE172B – Students apply AE principles throughout their conceptual and preliminary design of their spacecraft. They follow the Space Mission Analysis and Design theories and formulations to design and size their sub-systems.

Assessment Tools

AE171B – Iterations of the Final Design Report.

AE172B – Iterations of the Final Design Report.

Student Performance Results

AE171B

Students who performed at 70% or higher	
Draft Design Report (S18)	Final Design Report (S18)
66%	100%

AE172B

Students who performed at 70% or higher	
Interim Report (S18)	Final Report (S18)
85%	100%

Analysis

AE171B – This PI is very broad. Student performance in the various reports varies from team to team and from year to year. It is not uncommon for a team to receive a low score in one of their reports, and a number of them scored grades just below the 70% threshold. Detailed written and oral feedback is provided to each team, and opportunities for resubmitting the assignment are given. The offer for re-submitting reports is often declined early in the semester, as students place their efforts in either hardware research or other priorities. This has been a consistent trend. In the end, a satisfactory evaluation of the

analyses employed in the design of their aircraft is required to approve the course. Thus, performance improves as the students dedicate additional time to their assignments toward the final design report. Previous recommendations for this area included providing additional resources and examples to aid development of aerodynamic and mass models, with the objective of improving stability and control assessments. The overall assessments were not materially improved, though results were generally satisfactory. Multiple Teams missed significant elements of the rubric provided for their weight and balance report and simply chose to improve on their mass models as part of their stability and control assessment. Some Teams encountered difficulties estimating weight on electrically powered aircraft with small statistical basis for regression. The re-introduction of the Stability and Control Report as a joint assignment with the AE168 course provided students with additional time and focus to work on the assignment.

AE172B – Students use engineering level excel tools (consistent with the SMAD reference textbook) for their sub-system design. Overall, they demonstrated their ability to follow the instructions and implement the tools appropriately. On occasion a higher fidelity and/or CFD analysis may be required. In such cases the teams are paired together in a way that ensures the required computational skill set exists within the expanded team.

Recommendation

AE171B – The development of rational mass models represents an area which requires additional attention. Introduction of practical examples for the estimation of weights for electrically powered aircraft is proposed.

AE172B – None.

Implementation:

AE171B: AY 19–20

AE172B: N/A

Performance Indicator 2.6: Develop and compare alternative configurations for an aerospace vehicle, considering trade-offs and appropriate figures of merit.

Assessment Summary:

The performance target is met for PI – 2.6.

Course Activities

AE171B – Extensive class discussion related to aircraft designs of varying configurations, missions, and degrees of success. Selection of configuration and design concepts for application in student design projects. Comparative analysis of projects with similar performance goals.

AE172B – The design process is initiated with the investigation of historical data for the project at hand. The related system architectures and analyzed, decomposed and traded appropriately using a one-at-a-time DoE approach. This study leads the students to refine their own design architecture. A DoE trade study is given to the students as a separate assignment.

Assessment Tools

AE171B – Final Design Report: requires students to compare and select between various configurations for major components or overall design concepts. The selection must be based on objective or practical evaluation of a reasonable number of alternatives and how they are tied to mission requirements for their design.

AE172B – Interim report and preliminary design presentation. The students have to present their DoE trade study and make the appropriate observations. Base on observations design decisions are proposed and implemented by the groups.

Student Performance Results

AE171B

Students who scored 70% or higher
Final Design Report
100%

AE172B

Students who scored 70% or higher
Interim Report
85%

Analysis

AE171B – Students enjoy and perform well in these areas. Issues associated with configuration selection were largely addressed by the completion of the Final Design Report. Common themes remained, such as the selection or dismissal of configuration choices based on unsubstantiated or erroneous data regurgitated in popular enthusiast online groups. This last point is a relatively minor issue which improves throughout the class experience.

AE172B – Students are able to perform a sub-system trade studies, make observations and assess main and side design effects of their design variables. Results of the trade study are presented in class and documented in a class assignment. The students overall meet this objective.

Recommendations: None

Implementation: N/A

Outcome Performance Indicator 2.7: Develop final specifications for an aerospace vehicle.

Assessment Summary: The performance target is met for OPI – 2.7.

Course Activities

AE171B – Students are required to develop specifications for their designs such that the mission goals from the Mission Analysis exercise are met. Students either test proof of concept aircraft or, if impractical, provide design validation analyses for their designs and are asked to compare the actual or estimated performance of their airplane against their design specifications.

AE172B – The students are asked to develop system level and sub-system level requirements that appropriately support the mission objective of their projects. They have to produce a requirements document that specifies the requirements descriptions and related justifications. Towards the end of their projects the students are required provide verification and validation evidence to substantiate that their developed design specifications meet system and sub-system level requirements and that their design is “in family” of historical data.

Assessment Tools

AE171B – The skills described in OPI-2.7 are specifically assessed through the Final Design Report, which contains the final set of specifications for the design and relevant mission scorecard.

AE172B – The skills described in OPI-2.7 are specifically assessed through the Final Design Report, which contains the final set of specifications for the design along with verification and validation analysis and testing.

Student Performance Results

AE171B

Students who scored 70% or higher

Final Design Report
100%

AE172B

Students who scored 70% or higher
Final Design Report
100%

Analysis

AE171B – Students typically participate in design competitions such as AIAA Design Build Fly or SAE Aero Design. These competitions provide an interesting exercise in that the specifications are the product of mission score analyses, rather than suitability to a particular “realistic” mission. Thus, aircraft with rather poor performance characteristics may very well achieve high scores based on one or more design attributes (low weight, short wingspan, etc). Students at San José State have done very well in these types of contests through careful analysis and definition of design specifications which result in high scoring aircraft. In AY17-18, three of the six student teams designed airplanes for these competitions. Other projects showed reasonable judgment in the selection and analysis of final design specifications. As has been the case in the past, one team struggled with the idea of having mission requirements dictate the specifications of their design. Corrective feedback resulted in a satisfactory outcome, but only after significant effort was spent in an unworkable design for the desired mission.

AE172B – Students typically participate in the design and development of the TechEdSat micro-satellite program led by the AE Department at SJSU. Most student have the opportunity to see their design actually deployed and flown in space. The process we follow requires that the specifications of the system developed in class meets the NASA International Space Station requirements. The projects have to pass through the formal NASA review process for the system specifications to be approved for flight. For student projects that are not flown, extensive testing is required both at the sub-system level as well at the system level to showcase that specifications meet the mission objective and are in compliance with system level requirements.

Recommendations: None

Implementation: N/A

PLO–3: An ability to communicate effectively with a range of audiences.

Assessment Summary: Overall, Outcome 3 is satisfied in the BSAE Program.

Outcome Element 3.1: Ability to communicate in writing

Engr100W – Engineering Reports

Prof. Stacey Knapp

AE171B – Aircraft Design II

Prof. Gonzalo E. Mendoza

AE172B – Spacecraft Design I

Prof. Periklis Papadopoulos

Outcome Performance Indicator 3.1.1: Produce well-organized reports, following guidelines.

Assessment Summary: The performance target is met for OPI – 3.1.1

Course Activities

AE172B – Students are required to submit one interim and one final report. The documentation required is extensive and they must follow specific guidelines. Students have to address prescribed elements of the design process from preliminary to final design.

Assessment Tool

AE172B – An interim and a final report and presentations that address all aspects of the spacecraft system architecture and design. Students submit and get an approval to proceed through an interim report that reflects their preliminary design review and address directed guidelines.

Student Performance Results

Engr100W (Fall 2018)

# of AE students enrolled	Average WST score for incoming AE students	# of AE students passed	Average exit score for AE students
59	8.4	59 (100%)	8.915

AE172B

Preliminary Design Reviews and Interim Report Students who scored 70% or higher	Critical Design Reviews (DR) Final Report Students scoring 70% or higher
90%	100%

Analysis

Engr100W – Only one student was a no-pass on the WST (matriculated through 100A).

The student raised his score to a “7” which is passing but considered “at risk”. Faculty standard is an “8” on the Exit Exam but technically a “7” is a pass. A score of “6” or lower equals a “0” on 20% of their final course grade.

AE172B – Student performance was acceptable, and the teams produced reasonably well documented reports.

Recommendations: None

Implementation: N/A

Outcome Performance Indicator 3.1.2: Use clear, correct language and terminology while describing experiments, projects or solutions to engineering problems.

Assessment Summary: The performance target is met for OPI – 3.1.2.

Course Activities

AE172B – Students present their work in the form of reports as well as through presentation packages. They are required to use proper terminology to describe their design process with clarity in correct English.

Assessment Tools

AE172B – Assessment is performed using the interim and final design reports.

Student Performance Results

AE172B

Students who scored 70% or higher
Interim and Final Reports as well as PDR and CDR Presentations
100%

Analysis

AE172B – 10% of the grade of the course is based on a formal design reviews. The initial review is performed ahead of article testing, and the final review summarizes the entire project at the end of the semester. The course included individual discussions and technical debates on student selected ethics, safety, and/or liability topics in aerospace engineering. Student performance is generally good in this area. Sometimes students need help to articulate clearly their methods and approach. Overall, under guidance students submit adequate reports, which appropriately reflect their projects.

Recommendations: None

Implementation: N/A

Outcome Performance Indicator 3.1.3: Describe accurately in a few paragraphs a project / experiment performed, the procedure used, and the most important results (abstracts, summaries).

Assessment Summary: The performance target is met for OPI – 3.1.3.

Course Activities

AE172B – Student are required to submit abstracts to the International Planetary Probe Workshop (IPPW). They are guided in the preparation and submission of their abstracts, which are professionally reviewed by the IPPW organizing committee.

Assessment Tools

AE172B – IPPW abstract submissions.

Student Performance Results

AE172B

Students who performed at 70% or higher	
IPPW - Abstract Submissions	Final Report (S18)
90%	100%

Analysis

Overall most student abstracts were accepted and accurately reflected the work performed.

Recommendation: None

Implementation: N/A

Outcome Performance Indicator 3.2.1: Give well-organized presentations, following guidelines.

Assessment Summary: The performance target is met for OPI – 3.2.1.

Course Activities

AE172B – The students are required to present several times in class. They present multiple status quad-charts and participate in a Preliminary Design Review and Critical Design Review.

Assessment Tools

AE172B – PDR and CDR presentation packages.

Student Performance Results

AE172B

Students who scored 70% or higher
PDR and CDR Presentations
100%

Analysis

AE172B – Students are given prescribed organizational guidelines to follow and by enlarge are able to follow the ground rules set forth in their presentation packages.

Recommendations: None

Implementation: N/A

Outcome Performance Indicator 3.2.2: Make effective use of visuals.

Assessment Summary: The performance target is met for OPI – 3.2.2.

Course Activities

AE172B – The students are required to present several times in class. They present multiple status quad-charts and participate in a Preliminary Design Review and Critical Design Review.

Assessment Tools

AE172B – PDR and CDR presentation packages.

Student Performance Results

AE172B

Students who scored 70% or higher
PDR and CDR Presentations
100%

Analysis

AE172B – Students are typically capable of making effective presentations with the appropriate visuals that accurately describe their design process and related analysis.

Recommendations: None

Implementation: N/A

BSAE.PLO-7: Ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Assessment Summary: Overall, Outcome 7 is satisfied in the BSAE Program.

Outcome Performance Indicators:

7.1: Access information effectively and efficiently from a variety of sources.

7.2: Develop a systematic approach to acquiring new knowledge.

7.3: Reflect regularly on the effectiveness of this approach (i.e. determine what works and what doesn't).

7.4: Make any necessary adjustments to improve the effectiveness and the efficiency of this process.

Course Activities

OPI – 7.1: Students performed five experiments in the aerodynamics lab and wrote an extensive lab report for each experiment. They researched the relevant theory and previously published data in various references for each of the five experiments. They summarized this theory in their lab reports as part of

their design-of-experiment. They also presented any previously published data they found in the literature in the form of graphs or tables, giving appropriate citations. In their discussion, they compared their own experimental results with theoretical predictions as well as previously published data and gave reasons for any discrepancies.

OPI – 7.2, 7.3, 7.4: Students reflected on their learning process and in particular on the effectiveness of this process, using their performance on tests as a measure. They identified strengths and weaknesses, pointed out what worked and what didn't work in this process, and finally, they proposed ways to improve the effectiveness of their learning process. Effective models of learning were discussed in class.

Assessment Tools

- OPI – 7.1: The “theory” and “previously published data” sections of 5 lab reports.
- OPI – 7.2, 7.3, 7.4: Student reflection.

Student Performance Results

Enrolled	Passed	Scored 70% or higher on their reflection	Scored 70% or higher on “researching theory” and “previously published data” in their lab reports
89	74 (83%)	40 (54%)	64 (86%)

Analysis

OPI – 7.1: In general, students demonstrated an adequate ability to locate appropriate sources for each of their experiments. More importantly, 86% of the students demonstrated an adequate understanding of the information they accessed in various references as well as the relevance of this information to their experiments, as shown by their summaries and discussion of this information in their lab reports.

OPI – 7.2, 7.3, 7.4: Although a smaller percentage of students (54%) took the time to reflect thoroughly on their learning process, the connection between writing a “good reflection” of your learning process vs. being a master of this learning process, as demonstrated by test performance in AE162, is not straightforward, as the results below indicate.

Overall, 44 students (49%) came to class entirely unprepared, while the other 45 students (51%) did not report any time preparing for class beforehand.

Table 1 – Student self-reported learning activities before class (AE162, N=89)

<i>Students who indicated they prepare before coming to class, in one or more of the ways listed below:</i>	44 (49%)
Read the relevant sections of the instructor’s notes.	28 (31%)
Go over the slides to be presented and discussed in class.	28 (31%)
Read the relevant sections of the text.	25 (28%)
Attempting (solo) to solve workout problems to be assigned during class in small groups.	10 (11%)
Make notes based on their reading of the relevant sections of the text.	7 (8%)
Attempting (in teams) to solve workout problems to be assigned during class in small groups.	6 (7%)
Reach out to their teammates for help if they have questions.	4 (5%)
Making notes based on their reading of the slides.	3 (3%)
Writing down questions to be asked during class.	2 (2%)
Search online for help if they have questions, (e.g. watch videos, etc.)	2 (2%)

Table 1a – Of the students who did not prepare before class...(n=44)

Failed the course	13 (30%)
C-, C, C+	4 (9%)
B-, B, B+	19 (43%)
A-, A, A+	8 (18%)

Table 1b – Of the students who prepared before class...(n=45)

Failed the course	9 (20%)
C-, C, C+	2 (4%)
B-, B, B+	13 (29%)
A-, A, A+	20 (44%)

- More students who prepared before class earned “A”s (44%) than students who did not prepare before class (18%).
- The number of students who failed was slightly lower (20%) among students who prepared before class, compared with students who did not (30%).

Table 2 – Student self-reported learning activities during class (AE162, N=89)

Did not indicate any type of engagement during class	72 (80%)
Take notes	10 (11%)
Ask questions	3 (3%)
Listen carefully, not taking notes	2 (2%)
Discuss concepts w. other students	2 (2%)
Attempt the assigned workout problems	2 (2%)

Table 2a – Of the students who did not indicate any engagement during class...(n=72)

Failed the course	16 (22%)
C-, C, C+	6 (8%)
B-, B, B+	27 (38%)
A-, A, A+	23 (32%)

Table 3 – Student self-reported learning activities after class (AE162, N=89)

Rework workout problems attempted in class (solo, in teams or both).	17 (19%)
Read the relevant sections of the text.	16 (18%)
Rework example problems presented in class (solo, in teams or both).	15 (17%)
Review the lecture slides.	15 (17%)
Study in groups.	12 (13%)
Search the internet (including YouTube) for example problems.	10 (11%)
Practice problem solving in teams.	9 (10%)
Review the relevant sections of the instructor’s course notes.	7 (8%)
Review their own class notes.	7 (8%)
Review example problems presented in class.	7 (8%)
Review workout problems attempted in class.	7 (8%)
Bring questions to office hours	1 (1%)

Only 18% of the students mentioned that they read the text after class, highlighting, taking notes, summarizing key ideas, etc. Some only read sections related to material they did not understand during the lecture.

Table 4 – Student self-reported learning activities in preparation for a test (AE162, N=89)

Rework example and workout problems (solo, in teams or both).	17 (19%)
Review everything (text, instructor notes, lecture slides, problems)	14 (16%)
Study in groups.	12 (13%)
Review relevant sections of instructor notes.	6 (7%)
Review relevant sections of instructor's notes and lecture slides.	4 (5%)
Practice problem solving in teams.	4 (5%)
Review example problems from the text and instructor's notes.	3 (3%)
Review the relevant sections of the text.	1 (1%)
Practice on the board.	1 (1%)
Watch videos on YouTube.	1 (1%)

Table 5 – Student perception of the effectiveness of their learning process in general and their test preparation in particular (AE162, N=89)

No	46 (52%)
Yes	35 (39%)

Students were asked to identify any issues, which contributed to the ineffectiveness of their learning process. Table 6 summarizes their responses.

Table 6 – Student perception of why their learning process was ineffective (AE162, N=89)

Did not study sufficiently.	31 (35%)
Inadequate math skills.	16 (18%)
Did not prepare before each class.	14 (16%)
Course load; time management.	9 (10%)
Did not study all the material.	8 (9%)
Insufficient problem-solving practice.	7 (8%)
Did not study with team.	5 (6%)
Lack of confidence; giving up too early.	4 (5%)
Poor test-taking skills.	4 (5%)
Did not know how to study.	3 (3%)
Difficulty learning from the text.	3 (3%)

Not surprisingly, the number one reason students gave for performing poorly on tests was inadequate time-on-task (study). Responses included comments like *did not study all the material* (9%), *did not read the text* (6%), *did not study in depth* (6%), *studied problem solving but not theory* (5%), *cramming before the test* (3%) and *studied theory but not problem solving* (2%).

Difficulty with the math was the second most frequently given reason. While 18% of the students mentioned inadequate math skills, by contrast, only one student mentioned difficulty with the physics involved. Two students did not even have the text ☹

Table 7 – Student self-reported changes they planned to implement during the course to improve their learning (AE162, N=89)

Spend more time practicing problem solving.	35 (39%)
Spend more time studying; spread over more days.	17 (19%)
Spend more time studying the text.	15 (17%)
Prepare before each class (read text, instructor's notes, example problems, etc.).	13 (15%)
Spend more studying theory in depth, make sure I understand the concepts.	11 (12%)
Spend more time studying example and workout problems.	9 (10%)
Go to office hours.	8 (9%)
Look for more problem-solving videos online.	6 (7%)
Study all the material.	6 (7%)
Practice math (doing it quickly).	5 (6%)

Ask questions during class.	5 (6%)
Study earlier.	5 (6%)
Order the text.	3 (3%)
Study instructor's notes.	3 (3%)

Recommendation:

Using student input from AE162 (Spring 2018), the reflection assignment has been reorganized to include a more systematic collection of data from freshman, sophomore, junior, senior, and graduate level courses. Data have now been collected from AE30, AE162, AE164, AE167, AE200, AE243, and AE280. These data are currently being analyzed to examine if students' self-reported learning process matures as they progress from their freshman to their senior year and on to graduate studies.

Implementation: Fall 2018, Spring 2019

Part C

9. Program Learning Outcomes

What are your proposed closing-the-loop action items and completion dates?

Proposed Changes	Status Update
<p>OPI 1.2.3 – Apply principles of mathematics, science and aerodynamics. AE164 – Fall 2018</p> <ul style="list-style-type: none"> ▪ Address the most pressing problems in the following class (AE167–Aerospace Propulsion). Due to the direct application of many of the topics covered in AE164 to aerospace propulsion systems, one lecture at the beginning of AE167 will be dedicated to the review of the most common issues encountered by the students in Aerothermodynamics. ▪ Remove bonus problems and limit extra credit to parts of an exam question. ▪ Provide at least two group workouts on quasi-1D nozzle flows. 	Implementation: Spring 2019 (AE167) and Fall 2019 (AE164)
<p>OPI 1.2.6 – Apply principles of mathematics, science, stability and control. Fall 2018 – AE168:</p> <p>A new approach to teaching controls in AE157 is needed so that students not only master Matlab but more importantly, the conceptual and analytical tools to use the program effectively in their work.</p>	Implementation: Spring 2019 (AE157)
<p>OPI 2.2: Follow a prescribed process to develop the conceptual /</p>	Implementation: Spring 2019 (AE171B)

<p>preliminary design of an aerospace vehicle. Spring 2018 – AE171B AE171B – Conceptual design questions used in the written exams form the basis for excellent discussions following the actual test. Similar exercises will be posed to students during class to facilitate discussion before the test and thus potentially improve the results.</p>	
<p>OPI 2.5: Apply AE principles to design various vehicle subsystems. Spring 2018 – AE171B The development of rational mass models represents an area which requires additional attention. Introduction of practical examples for the estimation of weights for electrically powered aircraft is proposed.</p>	<p>Implementation: Spring 2019 (AE171B)</p>
<p>OPIs: 7.2: Develop a systematic approach to acquiring new knowledge. 7.3: Reflect regularly on the effectiveness of this approach. 7.4: Make any necessary adjustments to improve the effectiveness and the efficiency of this process. Spring 2018 – AE162 Using student input from AE162 (Spring 2018), the reflection assignment has been reorganized to include a more systematic collection of data from freshman, sophomore, junior, senior, and graduate level courses. Data have now been collected from AE30, AE162, AE164, AE167, AE200, AE243, and AE280. These data are currently being analyzed to examine if students’ self-reported learning process matures as they progress from their freshman to their senior year and on to graduate studies.</p>	<p>Implementation: Fall 2018 (AE30, AE164), Spring 2019 (AE30, AE162, AE167, AE200, AE243, AE280)</p>
<p>OP A-1.3 (linear algebra) Spring 2016 – AE157: <ul style="list-style-type: none"> ▪ Perform diagnostic assessment in the beginning of the semester to test students’ skills in linear algebra. ▪ Create reference material (e.g. notes, videos, etc.) to help students review fundamental linear algebra concepts and bring lagging students up to speed. </p>	<p><u>Implemented in Spring 2017</u> 2 books were introduced: Kreyszig, Engineering Mathematics and Beer & Johnston, Engineering Mechanics Several examples were provided on how to locate video tutorials on youtube, (which, it turns out, students were already familiar with), to address student needs in ODEs, calculus, linear algebra and classical mechanics & dynamics. In hw # 02, students were assessed in regards to their ability to: - Formulate and solve a set of equations using matrix algebra. - Use linear algebra, calculate matrix inverse and evaluate matrices based on algebraic manipulations (addition, subtraction,etc)</p>

<p>OPI A-3.2 (rigid body dynamics) Spring 2016 – AE140</p> <ul style="list-style-type: none"> ▪ Develop rigid body dynamics visualization tools as project topics. 	<p>60/75 (80%) of the students performed @ 70% or higher in this assignment.</p> <p><u>Implemented in Spring 2017</u> Spring 2016 – AE140</p> <p>In AE138, students built a hardware project with which they validate an analytical model of their choice. Planar rigid body motion is taught briefly at the end of AE138 and Euler angles are introduced. In F16, one of the project teams built a custom tripod for a purchased high-quality gyroscope (gyro rotor speed = 12,000 rpm). With their experimental set-up, they demonstrated the precession, nutation and spin degrees of freedom which are common to spinning spacecraft. Although the theory for this hardware experiment was not learnt until AE140, the students correctly explained the complex motions in their class presentation. This project is now part of the demonstration hardware for AE140, enabling visualization of these degrees of freedom by all rigid body dynamics students.</p> <p><i>Results:</i> Spring 2016: 90% of students passed class Spring 2017: 95% of students passed class</p>
<p>OPI A-3.6 (stability & control) Fall 2016 – AE168</p> <ul style="list-style-type: none"> ▪ Present more example problems in class. ▪ Provide better student mentoring. ▪ More problems will be solved in problem solving sessions outside of class. ▪ Encourage collaborative learning to enhance students' analytical skills. 	<p><u>Implemented in Fall 2017</u></p> <p>Several example problems were presented in class in:</p> <ol style="list-style-type: none"> 1. Deriving stability & control derivatives from aircraft geometry 2. Estimating derivatives from both time response and frequency response data 3. Modeling statically and dynamically unstable aircraft, e.g., the Wright Flyer 4. Improving aircraft handling qualities by changing aircraft geometry 5. Meeting the specifications for improving aircraft performance using classical and modern feedback control methods 6. Modeling spacecraft open- and closed-loop dynamics <p>Solving these problems in class provided the understanding of a wide range of tools available to an aerospace dynamics & controls engineer. Office hours were also used to solve example problems of the types listed above. In addition, students collaborate on a semester-long project involving their senior design vehicle. In this project, the students bring their modest knowledge of stability and control to bear of the design of a real hardware problem. They collaborate with their teammates with the goal of a functioning, stable vehicle which meets its mission requirements. This process has been quite successful in integrating their course knowledge.</p> <p><i>Results:</i> Fall 2016: 91% of students passed class Fall 2017: 94% of students passed class</p>
<p>Outcome Element A-4 (open-ended problem solving) Spring 2016 – AE162</p> <ul style="list-style-type: none"> ▪ Present and discuss case studies in class to demonstrate the different requirements of airfoils designed for different airplanes. ▪ Present a parametric study in class, involving wing parameters, to illustrate how such studies can be used to optimize wing design. ▪ Add a step-by-step process to the class notes to guide students in their estimation of drag polars for an airplane in cruise, takeoff, and landing configurations, allowing 	<p><u>Implemented in Spring 2017</u></p> <ul style="list-style-type: none"> ▪ Case studies demonstrating different airfoil characteristics, depending on the type of airplane, have been added to the AE162 Course Notes and presented in class. ▪ A wing parametric study was presented in class to illustrate how to optimize wing design for a specific airplane mission. ▪ Step-by-step process describing how to estimate the grad polar of an airplane in cruise, takeoff, and landing configurations has been added to the AE162 Course Notes and presented in class. <p><i>Result:</i> 87% of the students met the 70% target score in their open-ended problem.</p>

also for compressibility drag if the plane operates at high speeds.	
<p>Outcome Element B-1 (design of experiments) Fall 2016 – AE160 Provide a summary of the relevant theory for separated flows around delta-winged aircraft and bodies of revolution at high angles of attack during lecture as well as in notes, along with references for further study.</p>	<p><u>Implemented in Fall 2017</u> As a result of this improvement, 90/95 students (95%) earned 70% or higher in their first lab report, which involved the flow visualization experiment.</p>
<p>Outcome Element B-4 (data interpretation) Fall 2016 – AE160 Provide more guidance in class on how to interpret the flow patterns observed in the water tunnel experiments.</p>	<p><u>Implemented in Fall 2017</u> As a result of this improvement, 90/95 students (95%) earned 70% or higher in their first lab report, which involved the flow visualization experiment.</p>
<p>Outcome E-1 (report writing) Fall 2016 – AE172</p> <ul style="list-style-type: none"> ▪ Implement an enhanced review of documentation standards. Minimum requirements are spelled out in the provided guidelines; however, additional discussion, with pertinent examples, should improve initial report outcomes. Review should focus on use of technical language and introductory to charting data in Excel & Matlab. ▪ All students produce a 3D printed part related to the overall system/project through rapid prototyping. 	<p><u>Implemented in Fall 2017</u></p> <ul style="list-style-type: none"> • Students followed standardized reporting formats and developed multiple subsystem analysis reports. Performance target (70%) was met. • The NASA Project Management Handbook (NASA/SP-2007-6105) was used to guide assignments. • 40% of students were able to perform 3D printed prototyping. Will continue to improve knowledge of currently available prototyping equipment. • Weekly project updates were required and all students performed well in this area. Weekly quad-charts will also be used in F18, to improve traceability of this objective. • Strict timelines on presentations were enforced to prevent excessive information being presented and ensure that only important project highlights are presented.
<p>Outcome E-2 (oral presentations) Fall 2016 – AE171 / AE172</p> <ul style="list-style-type: none"> ▪ Increase the proportion of the oral presentation grade allotted to individual performance. 	<p>Implemented in Fall 2017</p>

10. Program Planning Action Items

What is the direct web link to the program’s latest action plan? (You can find it by selecting the relevant college in [Program Records](#) to locate your program.)

Describe the action items and the status in the table below.

Action item description	Status Update (what’s being done and results observed)	Date reported
Take steps to advance assessment of student learning in the undergraduate program. Improvements to	Following implementation of a series of improvements (2017	June 2017

<p>achievement of Outcome A should be demonstrated. The department should identify courses of concern and inform the home department of issues being found with students not meeting outcomes as outlined.</p>	<p>BSAE SSR) Outcome A (current Outcome 1) is now fully satisfied.</p>	<p>In BSAE Self-Study Report for ABET</p>
<p>Continue to improve graduation rates for first-time freshman and graduate students using implementation plan developed. Graduation rates have been lower in the past compared to the college and university rates. However, improvements have been noticed. Graduation rates should improve and remain steady at college and university rates.</p>	<p>Graduation rates for the BSAE Program have been increasing dramatically since AE became independent in 2013:</p> <ul style="list-style-type: none"> • Six-year graduation rate for first-time freshmen: <ul style="list-style-type: none"> ○ 33.3% (F'07 cohort) ○ 60% (F'09 cohort – highest in the College) ○ 51.6% (F'10 cohort) • Three-year graduation rate for transfer students: <ul style="list-style-type: none"> ○ 14.3% (F'09 cohort) ○ 56.8% (F'13 cohort) 	<p>Annually.</p>
<p>Establish a sustainable profile for the program within college limits in consultation with the dean that develops a successful model for growth of faculty, recruitment and course offerings.</p>	<p>Established. AE Department currently has four FT tenured/tenure-line faculty members and recruiting two more. Student demand for the BSAE program remains strong. Efforts are underway to recruit BSAE students from Amity University Rajasthan. Class size in junior and senior level courses has gone up to ~90. The BSAE Program received a 6-year accreditation (through Fall 2023) from ABET with no concerns or weaknesses.</p>	<p>Fall 2018 Program Planning Report</p>

Last updated: January 7, 2018 by Thalia Anagnos