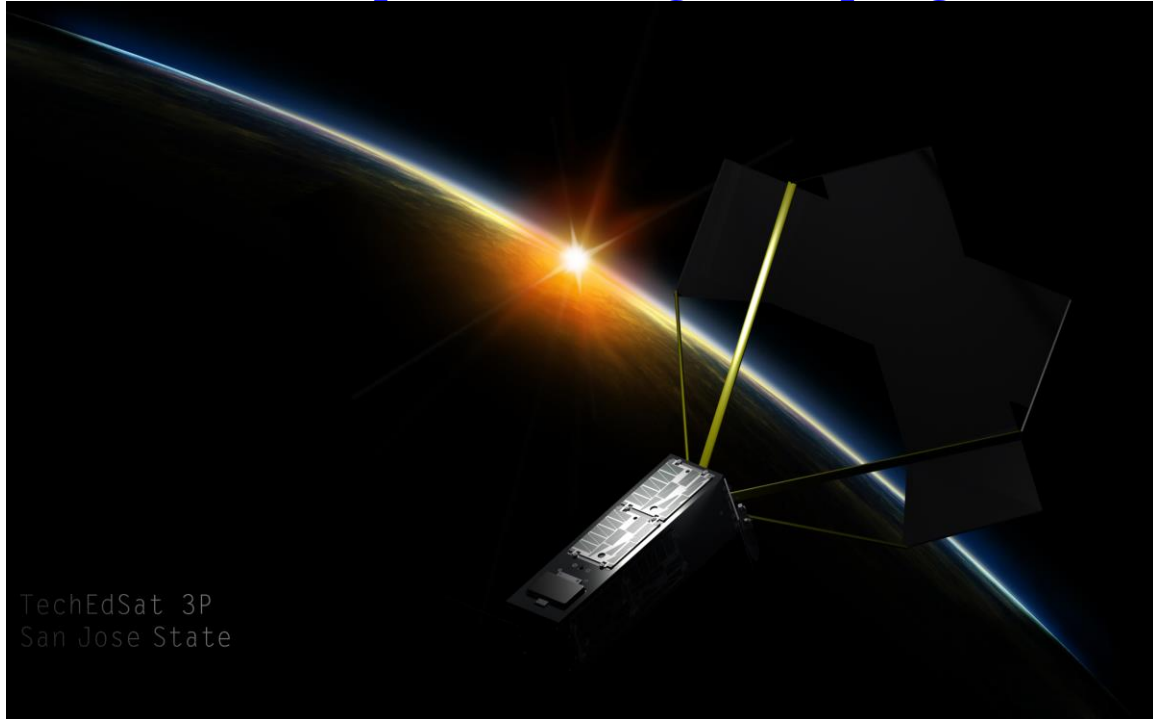


San José State University

# Aerospace Engineering

**AE 172 B – Spacecraft Design II – Spring 2019****INSTRUCTOR INFO**

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Office Hours: TR 16:30 – 18:00

**CREDIT**

3 units

**CLASS DAYS / TIME**

TR 15:00 – 16:15

**CLASSROOM**

E345

**PREREQUISITES**

Grade “C-” or better in: AE164, AE168, AE172A, Engr.195A  
Senior in good standing.

**CO-REQUISITES**

AE167, AE169, Engr.195B

**TEXTBOOK**

Instructor notes

**DESCRIPTION**

This is the second course in a two-semester sequence in which students work in teams to design a spacecraft.

More specifically, students complete the conceptual, preliminary, and detail design of a spacecraft. Students are encouraged to participate in the International Planetary Probe

Workshop and / or the AIAA Student Conference. Furthermore, students integrate general education (GE) student learning outcomes into their design project. Students are challenged to think about and discuss in class as well as in their reports, the relationship of aerospace engineering to the broader community both in the U.S. and worldwide. This discussion includes ethics, safety and liability issues, as well as issues of culture, civilization and global understanding in relationship to aerospace engineering practice.

### ***COURSE GOALS***

1. To provide senior engineering students a capstone experience in spacecraft design.
2. To offer an opportunity for going beyond a paper product (design report) into actual manufacturing and launching of microsatellites.
3. To develop students' creative abilities in solving open-ended, spacecraft design problems.
4. To develop an appreciation of the interrelationships between aerodynamics, propulsion, structures, flight mechanics, stability & control, manufacturing, maintenance, and cost in an integrated spacecraft design.
5. To develop students' engineering judgment as well as their confidence in making and accepting responsibility for design decisions.
6. To develop students' [oral](#) and [written](#) communication skills, necessary to describe the assumptions, methods, and results of engineering analysis, synthesis, and decision making associated with spacecraft design.
7. To make students aware of the importance of [teamwork](#) in the design of a spacecraft and provide them with an opportunity to develop team and leadership skills.
8. To make students aware of their professional and ethical responsibilities as practicing engineers.
9. Discuss the role of culture, civilization, and global understanding in aerospace engineering practice. (Integration of Area V and Engineering.)

### ***COURSE LEARNING OBJECTIVES***

By the end of the course, students should be able to:

***ABET Outcome C:*** *Ability to perform conceptual and preliminary design of aircraft or spacecraft to meet a set of mission requirements within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.*

1. Procure, fabricate, and assemble the various parts of a microsatellite.
2. Evaluate their design through testing and identify any modifications / improvements needed to meet the mission requirements.
3. Evaluate and describe accurately the environmental impact of their spacecraft.
4. Evaluate and describe accurately any health / safety issues related to their spacecraft.

***ABET Outcome D:*** *Ability to collaborate with people from different cultures, abilities, backgrounds, and disciplines to complete aerospace engineering projects.*

5. Work harmoniously and effectively in a team to solve engineering problems related to the design of a spacecraft and communicate the results in technical reports and oral briefings.
6. Communicate effectively in a team environment, negotiate and resolve conflicts, motivate and coach others in your team, organize and delegate work as needed, develop a team vision and set team goals, and manage resources.
7. Evaluate your own performance as well as that of your teammates using specific criteria, such as the quality of their work, their commitment to the team / project, leadership skills, responsibility, abilities, communication skills, and personality.

***Project Management***

8. Develop a milestone schedule (timeline) for an engineering project and follow it.

***ABET Outcome F: Understanding of professional and ethical responsibility.***

9. Identify possible courses of action, discuss the pros and cons of each one, and decide on the best one, given a job-related scenario that requires a decision with ethical implications.

***ABET Outcome E: Ability to communicate effectively through technical reports, memos, and oral presentations as well as in small group settings.***

10. Write high quality design reports (i.e., using correct language and terminology, correct technical information, and professionally prepared graphs and tables).
11. Give clear, informative, technically correct oral presentations using professionally prepared visual aids.

***ABET Outcome G: Broad education to understand current events, how they relate to aerospace engineering, as well as the impact of engineering solutions in a global and societal context.***

***ABET Outcome H: Recognition of the need for, and ability to engage in life-long learning.***

12. Describe regional, national or global contemporary problems related to spacecraft design (ex. transportation, environmental and safety issues, energy conservation, etc.) and identify possible solutions as well as any limitations of these solutions.

**GE / SJSU STUDIES LEARNING OUTCOMES**

Upon successful completion of this course, students will be able to:

**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.*

**ABET Outcome G:** *Broad education to understand current events, how they relate to aerospace engineering, as well as the impact of engineering solutions in a global and societal context.*

**ABET Outcome H:** *Recognition of the need for, and ability to engage in life-long learning.*

- Engr195B – Essay 3 (1,000 words): Write an essay that compares the ideas, values, attitudes, and technological developments of people from at least two different countries outside the US. Focus your essay on technological developments relating to aerospace engineering. One of the countries in your essay must be from your article.
- AE172B – **Reflection Paper 1** (500 words): Assume that your spacecraft will go into production. Using the studies provided in Engr195A&B as a background, write about how you will take into account at least two aspects (e.g. ideas, values, images, cultural artifacts, economic structures, or technological developments) while evaluating your decision to manufacture your spacecraft in two other countries.

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

**ABET Outcome G:** *Broad education to understand current events, how they relate to aerospace engineering, as well as the impact of engineering solutions in a global and societal context.*

**ABET Outcome H:** *Recognition of the need for, and ability to engage in life-long learning.*

- Engr195B – Essay 1 (500 words): Choose one of the following technological developments that were discussed in the web tutorial: the mechanical clock, gunpowder, the Great or Jersey wheel, printing, or the compass. Write an essay that addresses the following topics. When you respond to these topics, you should be specific and cite specific details either from the web tutorial or your own research. You should cite specific events and/or cultures as you answer these questions.
  - Discuss the history of the technology from its early beginnings to the Renaissance. Please discuss at least three different events in the history of the mechanical clock.
  - Describe one force (e.g., historical, cultural, social, economic, political) that affected the development of the technology?
  - How did the development and use of the technology affect Europe in the Middle Ages?
  - Overall, how did the technology affect the United States?
- AE172B – **Reflection Paper 2** (250 – 500 words). Consider an aerospace engineering technology invented outside of the U.S. (a) Describe the cultural and social factors that led to the invention of this technology. (b) Describe how this invention has evolved and influenced the culture in the U.S.

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

**ABET Outcome G:** *Broad education to understand current events, how they relate to aerospace engineering, as well as the impact of engineering solutions in a global and societal context.*

**ABET Outcome H:** *Recognition of the need for, and ability to engage in life-long learning.*

- Engr195B – Essay 2 (1,000 words): Imagine you are part of a group of engineers to Guatemala at the request of Habitat for Humanity. You have been hired to come up with a plan that will alleviate or at least mitigate the effects of Hurricane Stan on the Mayan communities in the Highlands. When thinking about your plan, you must consider all angles of the problem (for example, language barriers, culture, disease, landforms, seasonal weather, transportation, building materials, distrust and fear, etc.) .
- AE172B – **Reflection Paper 3** (250 – 500 words): Using the social and cultural processes introduced in Engr195A&B, describe how non-US farmers have responded to the pressure from US farmers’ enhanced ability in growing food using advances in aerospace engineering technology (UAVs, satellites, GPS).
- AE172B – **Reflection Paper 4** (500 – 750 words): Assume your spacecraft will go into production in the US. Describe how your product will put pressure on a culture outside the U.S. (choose a specific country.) Use the social and cultural processes introduced in Engr195A&B to guide your answer.

**COURSE RELATIONSHIP TO BSAE PROGRAM OUTCOMES**

	3A	3B	3C	3D	3E	3F	3G	3H	3I
<i>Learning Objectives</i>									
1 – 4			C				C	C	C
5 – 8				C				C	
9						C		C	
11 – 11					C				
12, V – LO1, V – LO2, V – LO3					C		C	C	

*NB: The letters inside the table indicate the highest level of skill achieved by the LOs on the lefthand side. C refers to levels 5 or 6 in Bloom’s Taxonomy.*

**GRADING**

Grade	Minimum Score
A+	950
A	900
A-	850
B+	800
B	750
B-	700
C+	675
C	650
C-	625
F	624 or lower

- 70% based on team performance (design reports); individual scores are determined by peer evaluations.
- 20% based on additional assignments:
  - GE Area V / ABET Outcome 3H: Reflection Papers 1, 2, 3, and 4.
  - ABET Outcome 3F: Case studies on safety, ethics, and liability issues: Reflection Papers on Space Shuttle accidents and Apollo 13.
  - ABET Outcome 3G: Reflection Papers 1, 2, 3, and 4.
  - **NB: Even if you score 100% on the technical (design) part of the course, you will NOT receive a passing grade UNLESS you also average 70% or higher on all assignments within each of the following categories:**
    1. Assignments that address ABET Outcome 3F
    2. Assignments that address ABET Outcome 3G
    3. Assignments that address Student Outcome 3H
    4. Assignments that address GE / SJSU Studies Area V
- 10% based on your collaboration with and mentoring of AE20 and AE30 students. In particular, you are expected to:
  - Explain your design project to AE20 / AE30 student teams assigned to you.
  - Assign simple CAD and programming tasks related to your project to each AE20 / AE30 team.
  - Be available to meet with AE20 / AE30 student teams assigned to you and provide mentoring to them as needed.

## TOPICS

Week Topics (AE 172B)

- 01 Spacecraft subsystem design
- 02 Spacecraft subsystem design
- 03 Spacecraft subsystem design
- 04 Spacecraft subsystem design
- 05 **Discussion:** Outsourcing aerospace engineering: considering ideas, values, images, cultural artifacts, economic structures, and technological developments abroad while evaluating your decision to manufacture your airplane in other countries.
- 06 **Discussion:** Cultural and social factors, which led to the invention of aerospace technology outside the U.S.
- 07 ***1<sup>st</sup> oral presentation and oral examination.***
- 08 Spacecraft subsystem testing
- 09 Spacecraft subsystem testing
- 10 **Discussion:** Effects of US aerospace technology around the world – part 1
- 11 Case study on ***spacecraft safety, ethics & liability issues:*** Space Shuttle accidents
- 12 **Discussion:** Effects of US aerospace technology around the world – part 2
- 13 Case study on ***spacecraft safety, ethics & liability issues:*** Apollo 13
- 14 Field trip: NASA Ames RC
- 15 Preparation for International Planetary Probe Workshop
- 16 ***2<sup>nd</sup> oral presentation and oral examination.***

**University Policies**

*Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' [Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo/) at <http://www.sjsu.edu/gup/syllabusinfo/>.*

**AE Department and SJSU policies are also posted at**  
<http://www.sjsu.edu/ae/programs/policies/>