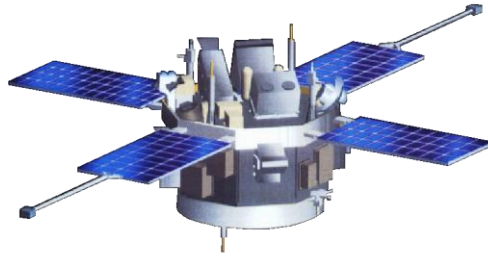


San José State University

# Aerospace Engineering

## AE 172 A – Spacecraft Design I – Fall 2018



<b>INSTRUCTOR INFO</b>	Dr. Periklis Papadopoulos Office: Engr. 187 (408) 924-7168 periklis.papadopoulos@sjsu.edu Office Hours: TBA
<b>CLASS DAYS / TIME</b>	TBA
<b>CLASSROOM</b>	TBA
<b>PREREQUISITES</b>	Grade “C-” or better in: AE20, AE114, AE162, AE165, Engr.100W Senior in good standing.
<b>CO-REQUISITES</b>	AE164, AE168, Engr195A
<b>TEXTBOOK</b>	Instructor Notes
<b>DESCRIPTION</b>	This is the first course in a two-semester sequence in which students work in teams to design a spacecraft.

More specifically, students complete the conceptual and preliminary design of a spacecraft. 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 include ethics, safety and

liability issues, as well as issues of identity, equality, social actions, and culture 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 identity, equality, social actions, and culture in aerospace engineering practice. (Integration of Area S and Engineering.)

### **COURSE LEARNING OBJECTIVES**

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

***ABET Outcome 3C:*** 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. Define an appropriate set of mission requirements for a spacecraft.
2. Define, calculate, and evaluate measures of merit (MOM) for a spacecraft.
3. Perform a literature search and collect data to show the need for a particular spacecraft. (***ABET Outcome 3H:*** Recognition of the need for, and ability to engage in life-long learning.)
4. Design spacecraft hardware.
5. Apply the complete product development cycle: basic idea / societal need / market study / economic and budget analysis.
6. Create the baseline design of a spacecraft.
7. Establish the final design of a spacecraft.
8. Evaluate / analyze the operation of a spacecraft as well as any data relayed.

***ABET Outcome 3D:*** Ability to collaborate with people from different cultures, abilities, backgrounds, and disciplines to complete aerospace engineering projects.

9. Work harmoniously and effectively in a team to solve engineering problems related to the design of a spacecraft and to communicate the results in technical reports and oral briefings.
10. 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.
11. 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***

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

***ABET Outcome 3F: Understanding of professional and ethical responsibility.***

13. 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 3E: Ability to communicate effectively through technical reports, memos, and oral presentations as well as in small group settings.***

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

### **GE / SJSU STUDIES LEARNING OUTCOMES**

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

**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.*

**ABET Outcome 3G:** *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 3H:** *Recognition of the need for, and ability to engage in life-long learning.*

- Engr195A – Testimony 1 (250-500 words): Discuss and provide examples of how your identities (i.e., religious, gender, ethnic, racial, class, sexual orientation, disability and/or age, among others) are shaped by cultural and societal influences within contexts of equality and inequality.
- Engr195A – Testimony 2 (250-500 words): How does language affect our identities? How do we use language and labels to authenticate our identities to others and ourselves?

- AE172A – **Reflection Paper 1** (250-500 words): Based upon your response to Engr195A Testimony 1, *consider your identity as a future aerospace engineer. How is your identity 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.*

**ABET Outcome 3G:** *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 3H:** *Recognition of the need for, and ability to engage in life-long learning.*

- Engr195A – Reflection Paper 2 (250-500 words): “Secrets of Silicon Valley”
- AE172A – **Reflection Paper 2** (500 – 750 words): Using the case studies provided in Engr195A, describe how spacecraft in general and your project in particular, fit into the 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).*

**ABET Outcome 3G:** *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 3H:** *Recognition of the need for, and ability to engage in life-long learning.*

- Engr195A – Reflection Paper 1 (750-1250 words): Describe social actions within the borders of the United States that have led to greater equality and social justice in your life (i.e., religious, gender, ethnic, racial, class, sexual orientation, disability, and/or age). Discuss how your current or past projects have or will contribute to social justice in the United States.
- Engr195A – Reflection Paper 2 (250-500 words): In his essay, Dyson gives historical examples of technological innovations, which he claims have increased social justice. Consider the technological innovations in AE and describe another example, indicating how it has increased social justice in the U.S.
- AE172A – **Reflection Paper 3** (250-500 words): Consider the technological innovations in aerospace engineering in general and spacecraft design in particular, describe a historical example and indicate how it has increased social justice in the U.S. and the world.

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

**ABET Outcome 3D:** *Ability to collaborate with people from different cultures, abilities, backgrounds, and disciplines to complete aerospace engineering projects.*

**ABET Outcome 3H:** *Recognition of the need for, and ability to engage in life-long learning.*

- Engr195A Website Analysis (750 words): Organization Website Analysis  
Environmental and social justice issues are addressed at many different levels and in different ways by groups and organizations. This assignment addresses the broad GE learning objective of “recognizing and appreciating constructive interactions between people from different cultural, racial, and ethnic groups in the U.S.” and the specific course learning objective to “Identify, compare, and contrast how local community organizations, groups, and agencies address social issues relevant to the environment and quality of life in the Santa Clara Valley.
- AE172A – **Reflection Paper 4** (500 words): Consider a negative side effect of aerospace technology: noise. Read the following articles and research the procedures regarding airplane noise in your own town or region. What civic organizations promote the reduction of airplane noise in your community? Either visit one of these groups’ websites or visit the group in person and describe the interactions between this group and the larger community. Your paper must cite your sources, including the ones listed below.

Articles:

Swift, H. (2010, July). A review of the literature related to potential health effects of aircraft noise. Partner Project 19 Final Report. Partnership for Air Transportation Noise and Emissions Reduction: an FAA / NASA / Transport Canada – sponsored Center-of-Excellence.

Morrison, S.A., Watson, T. & Winston, C. (1998, September). Fundamental Flaws of Social Regulation: The Case of Airplane Noise. AEI-Brookings Joint Center, Available: <http://www.brookings.edu/research/papers/1998/09/airplane-winston>

FAA Advisory Circulars, Noise Standards: Aircraft Type and Airworthiness Certification, Available:  
[http://www.faa.gov/regulations\\_policies/advisory\\_circulars/index.cfm/go/document.list/parentTopicID/112](http://www.faa.gov/regulations_policies/advisory_circulars/index.cfm/go/document.list/parentTopicID/112)

ICAO, Environmental Protection, Aircraft Noise, Available:  
<http://www.icao.int/environmental-protection/Pages/noise.aspx>

**COURSE RELATIONSHIP TO BSAE PROGRAM OUTCOMES**

	3A	3B	3C	3D	3E	3F	3G	3H	3I
<i>Learning Objectives</i>									
1 – 8	B		C					C	C
9 – 12				C	C			C	
13						C		C	
14 – 15					C				
S – LO1, S – LO2, S – LO3							C	C	

*NB: The letters inside the table indicate the highest level of skill achieved by the LOs on the left hand side. “B” corresponds to levels 3 or 4 in Bloom’s Taxonomy; “C” corresponds 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 S / ABET Outcome 3H: Reflection Papers 1, 2, 3, and 4.
  - ABET Outcome 3F: Case studies on safety, ethics, and liability issues: Reflection Paper on V-Tail Bonanza, Reflection Paper on AA
  - ABET Outcome 3G: Reflection Papers 1, 2, and 3.
  - **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 S
- 10% based on my personal evaluation of each student. Elements to be considered: attitude, class attendance, participation in class activities and professional societies.

## TOPICS

### Week Topics (AE 172A)

- |    |  |
|----|--|
| 01 | Introduction to spacecraft design.   |
| 02 | Mission requirements.  |
| 03 | Systems specification documentation.   |
| 04 | System decomposition.  |
| 05 | Subsystem design.  |
| 06 | Subsystem specification documentation.   |
| 07 | Subsystem design review.   |
| 08 | System design and integration.   |
| 09 | System / subsystems coupling.  |
| 10 | <b>Discussion:</b> How spacecraft fit into the historical, social, political, and economic processes producing diversity, equality, and structured inequalities in the U.S. and the world. |
| 11 | Case study on <i>aircraft safety, ethics and liability issues</i> : V-Tail Bonanza   |

- 12 **Discussion:** Consider the technological innovations in spacecraft design, describe a historical example, and indicate how it has increased social justice in the U.S. and the world.
- 13 Subsystems design review.
- 14 Detailed design review.
- 15 Case study on *aircraft safety, ethics and liability issues*: The Crash of AA191
- 16 Final design review.

## POLICIES

### AE Program Policies

#### Faculty Web Page and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on the instructor's web page. You are responsible for regularly checking with the messaging system through MySJSU (or other communication system as indicated by the instructor) to learn of any updates.

#### Attendance

Attendance will not be taken during class but will be taken during lab. If you miss a class you are still responsible for any material discussed or assignments given. A large portion of each class will be used for problem solving in small groups. All students are expected to participate in class discussions and problem solving. Students who are often absent will find themselves at a disadvantage during the tests. If you miss a lab session, you will get zero score on this lab.

#### Teamwork

- You are required to work in teams for a number of assignments. Please make yourself available to meet and work with your teammates outside of class.
- Instructor will normally form all the teams.
- At the end of each project or team assignment, each team must submit along with their report each member's [peer evaluation](#) of the other members in a separate, sealed envelope. All peer evaluation forms must be included in the team report. If you disagree with the scores you receive from your peers, you may provide an explanation to your instructor in writing and request an individual exam on the assignment. To get full credit on a team assignment, your teammates must give you at least 85% in all areas of peer review (see [team member report card](#)). Otherwise, your score for this assignment will be your team's score multiplied by the average peer review score.
- If your name appears on a team paper, you are expected to be able to explain whatever answer / solution / derivation is on the paper. Failure to explain the team's answer by any individual is considered a violation of academic integrity (see University Policies below) and will result in a grade of zero for the team.

## University Policies

### Academic Success

Success in this course is based on the expectation that students will spend, for each unit of credit, a **minimum of** forty-five hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/studying or course related activities including but not limited to internships, labs, clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus.

### Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's [Catalog Policies](http://info.sjsu.edu/static/catalog/policies.html) section at <http://info.sjsu.edu/static/catalog/policies.html>. Add/drop deadlines can be found on the current academic year calendars document on the [Academic Calendars webpage](http://www.sjsu.edu/provost/services/academic_calendars/) at [http://www.sjsu.edu/provost/services/academic\\_calendars/](http://www.sjsu.edu/provost/services/academic_calendars/). The [Late Drop Policy](http://www.sjsu.edu/aars/policies/latedrops/policy/) is available at <http://www.sjsu.edu/aars/policies/latedrops/policy/>. Students should be aware of the current deadlines and penalties for dropping classes. Information about the latest changes and news is available at the [Advising Hub](http://www.sjsu.edu/advising/) at <http://www.sjsu.edu/advising/>.

### Consent for Recording of Class and Public Sharing of Instructor Material

[University Policy S12-7](http://www.sjsu.edu/senate/docs/S12-7.pdf), <http://www.sjsu.edu/senate/docs/S12-7.pdf>, requires students to obtain instructor's permission to record the course.

- Common courtesy and professional behavior dictate that you notify someone when you are recording him/her. You must obtain the instructor's permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material.”
- In classes where active participation of students or guests may be on the recording, permission of those students or guests should be obtained as well.
- Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor generated material for this course such as exam questions, lecture notes, or homework solutions without written instructor consent.

### Academic integrity

- Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The [University Academic Integrity Policy S07-2](http://www.sjsu.edu/senate/docs/S07-2.pdf) at <http://www.sjsu.edu/senate/docs/S07-2.pdf> requires you to be honest in all your academic course work.

- Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development.
- The [Student Conduct and Ethical Development website](http://www.sjsu.edu/studentconduct/) is available at <http://www.sjsu.edu/studentconduct/>.
- Instances of academic dishonesty will not be tolerated. Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University. Assignments are to be completed by the individual student unless otherwise specified. If your name appears on a team paper, you are expected to be able to explain whatever answer / solution / derivation is on the paper. Failure to explain the team's answer by any individual will result in a grade of zero for the team.
- If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Integrity Policy S07-2 requires approval of instructors.
- For help with paraphrasing and referencing please see the [SJSU Library Tutorial on Plagiarism](#). The following websites also show you how to paraphrase properly and avoid plagiarism:

<http://www.indiana.edu/~wts/pamphlets/plagiarism.shtml> <http://owl.english.purdue.edu/handouts/research/index.html>

### **Campus Policy in Compliance with the American Disabilities Act**

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with the [Accessible Education Center](#) (AEC) at <http://www.sjsu.edu/aec> to establish a record of their disability.

### **Student Technology Resources**

Computer labs for student use are available in the [Academic Success Center](#) at <http://www.sjsu.edu/at/asc/> located on the 1st floor of Clark Hall and in the Associated Students Lab on the 2nd floor of the Student Union. Additional computer labs may be available in your department/college. Computers are also available in the Martin Luther King Library. A wide variety of audio-visual equipment is available for student checkout from Media Services located in IRC 112. These items include DV and HD digital camcorders; digital still cameras; video, slide and overhead projectors; DVD, CD, and audiotape players; sound systems, wireless microphones, projection screens and monitors.

### **SJSU Peer Connections**

Peer Connections, a campus-wide resource for mentoring and tutoring, strives to inspire students to develop their potential as independent learners while they learn to successfully navigate through their university experience. You are encouraged to take advantage of their services which include course-content based tutoring, enhanced study and time management skills, more effective critical thinking strategies, decision making and problem-solving abilities, and campus resource referrals. In addition to offering small group, individual, and drop-in tutoring for a number of undergraduate courses, consultation with mentors is available on a drop-in or by appointment basis. Workshops are offered on a wide variety of topics including preparing for the Writing Skills Test (WST), improving your learning and memory, alleviating procrastination, surviving your first semester at SJSU, and other related topics. A computer lab and study space are also available for student use in Room 600 of Student Services Center (SSC). Peer Connections is located in three locations: SSC, Room 600 (10th Street Garage on the corner of 10th and San Fernando Street), at the 1st floor entrance of Clark Hall, and in the Living Learning Center (LLC) in Campus Village Housing Building B. Visit [Peer Connections website](http://peerconnections.sjsu.edu) at <http://peerconnections.sjsu.edu> for more information.

### **SJSU Writing Center**

The SJSU Writing Center is located in Clark Hall, Suite 126. All Writing Specialists have gone through a rigorous hiring process, and they are well trained to assist all students at all levels within all disciplines to become better writers. In addition to one-on-one tutoring services, the Writing Center also offers workshops every semester on a variety of writing topics. To make an appointment or to refer to the numerous online resources offered through the Writing Center, visit the [Writing Center website](http://www.sjsu.edu/writingcenter) at <http://www.sjsu.edu/writingcenter>. For additional resources and updated information, follow the Writing Center on Twitter and become a fan of the SJSU Writing Center on Facebook. (Note: You need to have a QR Reader to scan this code.)

### **SJSU Counseling Services**

The SJSU Counseling Services is located on the corner of 7th Street and San Fernando Street, in Room 201, Administration Building. Professional psychologists, social workers, and counselors are available to provide consultations on issues of student mental health, campus climate or psychological and academic issues on an individual, couple, or group basis. To schedule an appointment or learn more information, visit [Counseling Services website](#)