

San José State University
Aerospace Engineering
AE273 – Aircraft Subsystems - Spring, 2020



Course and Contact Information

Instructor:	Professor Sean Montgomery
Email:	sean.montgomery@sjsu.edu or sean5montgomery@gmail.com
Office Hours:	Mondays and Wednesdays after class
Class Days/Time:	Mondays and Wednesdays 6:00 pm to 7:15 pm
Classroom:	Engr. 327
Prerequisites:	Graduate standing in AE or instructor consent
Credit:	3 units
GWAR:	This course satisfies the Graduate Writing Assessment Requirement

Textbooks (both are required):

Lessons Learned in Aircraft Design: The Devil is in the Details, by Jan Roskam, 2017.

Aircraft Systems: Mechanical, electrical and avionics systems integration, 3rd ed., by Ian Moir and Allan Seabridge. The SJSU library has a digital copy available for students.

Course Description

Aircraft subsystem analysis and design: flight controls; avionics and electrical systems; cabin systems; landing gear and other mechanical systems; systems safety analysis.

Course Goals

1. To familiarize students with aircraft subsystems operation, analysis, design, safety, and interdependencies.
2. To study design implementations of aircraft subsystems in a variety of aircraft types including historic and modern aircraft.
3. To develop design skills by designing all the subsystems for an aircraft.
4. To develop technical writing ability.

Course Learning Outcomes (CLO)

Students completing AE273 should be able to analyze and design the following subsystems for various types of aircraft:

1. Flight control systems.
2. Avionics and electrical systems.
3. Cabin systems.
4. Landing gear systems.
5. Fuel systems.
6. Hydraulic systems.
7. Environmental systems.
8. Analyze system safety for the above subsystems.

Students must also communicate the results of their design in a comprehensive, well written final report, following AIAA guidelines.

Course Requirements and Assignments

The course will be divided into two parts. During the first part, students will conduct detailed research on the subsystems for one or two aircraft. Students will share their research with the class through presentations. For the second part of the course, students will individually design the subsystems for an entire aircraft. Students will write intermediate reports for their design, culminating in a final comprehensive report and presentation. The final report must be a minimum of 4,000 words (not including figures, tables, appendices) and follow the format guidelines.

Reports will be graded for **English** (grammar, spelling, punctuation, etc.) as well as for technical content. Please see the general guidelines for professional reports below.

Written reports not meeting minimum writing proficiency standards will be returned without a grade.

If your report is returned for English please seek help from the **SJSU Writing Center**

<http://www.sjsu.edu/writingcenter/tutoring/index.html>

Grading Weights:

30% Research presentations

10% Research reports

10% Quizzes

20% Design presentations
10% Intermediate design reports
20% Final design report (4,000 words minimum)

Grading Scale:

A+ >97%
A >92%
A- 90% - 92%
B+ 88% - 90%
B 82% - 88%
B- 80% - 82%
C+ 78% - 80%
C 72% - 78%
C- 70% - 72%
D 60% - 70%
F < 60%

For issues related to Canvas, please contact the eCampus Help Desk.

Phone: (408) 924-2337

Submit a help ticket using the following URL: <https://isupport.sjsu.edu/ecampus/ContentPages/Incident.aspx> .

While logged into Canvas, click on the word Help on the upper right corner of the screen.

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 at <http://www.sjsu.edu/gup/syllabusinfo/>
AE Department Policies and SJSU policies are posted at <http://www.sjsu.edu/ae/programs/policies/>

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Course Schedule

Tentative schedule, subject to change.

Course Schedule

Week	Date	Topics, Readings, Assignments, Deadlines
1		Fuel systems
2		Hydraulic systems
3		Landing gear systems
4		Miscellaneous systems
5		Electrical systems
6		Avionics systems
7		Cabin systems
8		Environmental systems
9		Flight control systems
10		System safety
11		Flight control systems design due
12		Landing gear and hydraulic systems design due
13		Cabin and environmental systems design due
14		Intermediate design presentations
15		Electrical and avionics systems design due
16		Fuel and miscellaneous systems design due
Final Presentations	Thursday, May 13 th	5:15 pm to 7:30 pm

GENERAL GUIDELINES ON PROFESSIONAL REPORT WRITING

Each report must meet minimum standards of professionalism. Unprofessional reports will be **severely downgraded even if** the technical content is correct. The following items explain some of the features of a professional report.

1. All reports must be prepared with a **word processor**.
2. Organize reports using a **decimal numbering system**. The chapters, Sections, Sub-Sections should be indicated as follows:
 4. **TITLE OF CHAPTER**
 - 4.1 **TITLE OF SECTION**
 - 4.1.1 Title of Sub-Section
 - 4.1.1.1 Title of sub-sub-section
3. Many reports require **calculations**. At least one “hand” calculation **must** be performed and documented for each case in a separate sub-section. These hand-calculations do not have to be typed but should be clearly written and well organized. **If they are lengthy (i.e. more than 2 pages)**, they should be placed in a separate appendix but the results should be discussed in the main body of the report.
4. **All** pages must be numbered. Start the introduction at page 1. Pages in the main body of the report are numbered: 1, 2, 3, etc. Preliminary pages such as Table of Contents, List of Symbols etc. are numbered sequentially: i, ii, iii, iv, etc.
5. A minimum **margin of one inch** must be observed on all pages including graphs, figures, tables, computer print-outs, etc.
6. The report must be written in good **English**. All words must be properly spelled. You are expected to proofread your reports before handing them in.
7. Avoid using sentences longer than 2 lines. If you do not, your report will have a high "**Fog Index**" (i.e. it will be difficult to read).
8. **Do not** use I, You, We, They, etc. in a technical report. Also, **do not** treat an airplane or airplane components as persons, i.e., **DO NOT** write: *the airplane's landing gear is of the retractable type*. Instead, write: *the landing gear of the Cessna 182 is of the retractable type* or, even better, *the airplane has a retractable landing gear*.
9. **Do not use** the words: '**in order to ...**'. Remember, the words 'in order' are nearly always out of order!
10. Make use of the technique called "**bulletizing**".
Instead of: *in this chapter, the results of calculations of wing-loading, maximum lift coefficients, thrust-to weight ratio, lift-to-drag ratio and cruise lift coefficients are presented.*
Write: *In this chapter the following characteristics of the Spartan Jet are presented:*
 - *Wing Loading*
 - *Maximum Lift Coefficients*
 - *Thrust-to-Weight Ratio*
 - *Lift-to-Drag Ratio*
 - *Cruise Lift Coefficient*
11. Make sure that no **symbols** are **omitted** from your equations. Again, it is important to proofread your reports before handing them in!
12. All **equations** must be numbered and numbered sequentially. Within a chapter use a decimal numbering system. For example:
$$X = Y + Z \qquad (4.17)$$
13. **References** must follow APA rules, found here: < <http://www.apastyle.org/learn/faqs/index.aspx>>
14. All **figures** and **graphs** must be **numbered** and numbered sequentially. They must also have descriptive **titles**. Titles must appear **below** the figure. All **axes** must have scale and descriptive **labels** including **units** whenever appropriate. **Curves** must also have descriptive **labels**. All lettering must be at least 3 mm high to be legible! For example:

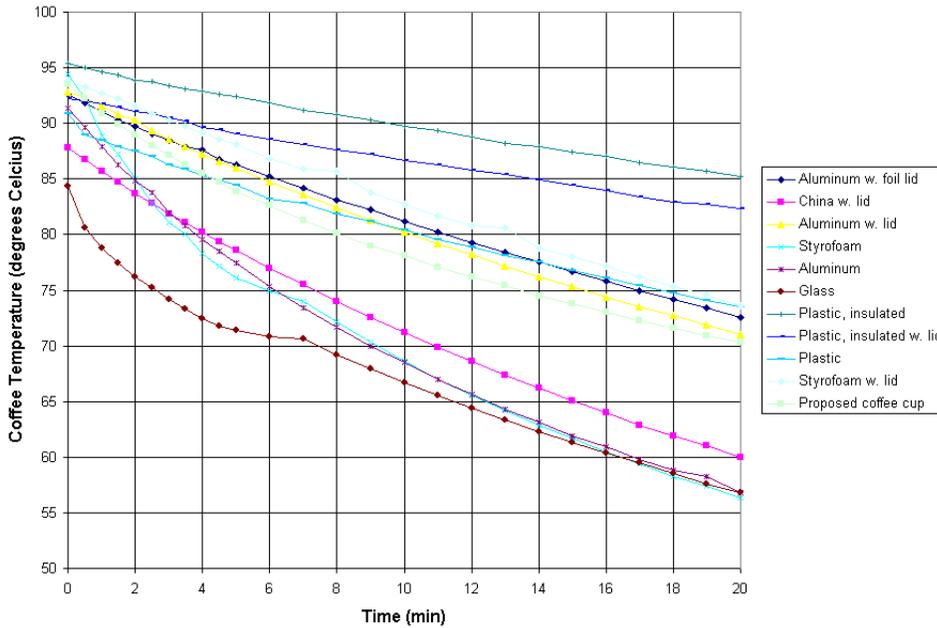


Figure 3.1 – Coffee temperature decline in various cups.

15. All **tables** must be **numbered** and numbered sequentially. They must also have descriptive **titles**. Titles must appear **above** the table. Again, all lettering must be at least 3 mm high to be legible!

Table 5.1 - The heaviest ten airplanes. MTOW = Maximum take-off weight, MLW = Maximum landing weight, TOR = Take-off run (SL, ISA+15°, MTOW), LR = Landing run (SL, ISA+15°, MLW)

Type	MTOW [tons]	MLW [tons]	TOR [m]	LR [m]
Antonov An-225	640			
Airbus A380-800F	590	427		
Boeing 747-8I	439.985	306.175		
Antonov An-124	405			
Airbus A340-500	368	240	3050	2010
Boeing 777-300ER	351.535	251.29		
MD-11	273.314	195.04	3115	2118
Ilyushin IL-96M	270	175		
Boeing 787-9	244.94			
L-1011-500	231.54	166.92	2636	

16. When presenting **aerodynamic data** in a table, graph or figure it is mandatory that you include the following information:

- Reference geometries: S, c and b in ft (or inches) and m (or cm).
- Moment center information in fractions of the m.g.c.
- Airplane weight consistent with the presentation of the data.
- Airplane configuration information, such as:
 - Clean
 - Flaps down, gear up
 - Flaps down, gear down
 - Thrust or power setting
 - Speed brake deployment
 - Flight condition
 - Cg location in fractions of the mgc

17. Remember: **tables, graphs** and **figures** are much easier to understand than **prose** so use

them as much as possible.

18. Do not put **lengthy derivations** in the main body of the report. Put such material in an appendix (or appendices) and **summarize** the result in the main part of the report.
19. **Plagiarism** will result in **total loss of credit for the entire report!** If you decide to use material, which was not generated by you, clearly identify the source of such material.
20. A **list of symbols** must be included in your report. This list must define all symbols used anywhere in the report (including figures, appendices, etc.). Do not include symbols which are not used in your report! Do not copy a list of symbols from another reference! The list of symbols must be presented in the following manner:

Symbol	Definition	Units (SI)
W	Weight	lbs (N)
Greek Symbols		
α	Angle of attack	deg or rad
Subscripts		
() _{TO}	Takeoff	-----
Acronyms		
APU	Auxiliary Power Unit	-----

21. Never make an **unsubstantiated claim!** Example: if you claim that you have optimized airplane weight, you are expected to prove it. If you cannot, do not make the claim!
22. **Avoid** the use of **superlatives**, (e.g. *this is the best airplane ever designed* or *the wing area selected is the smallest possible for this type of airplane*).
23. If you **extrapolate** data or if you extrapolate existing technology, discuss the consequences to your design of not being able to achieve the extrapolated characteristics.
24. Include **units** (both systems) with all your results.
25. Appendices must be sequenced using capital letters and must have specific titles. For example:
 Appendix A - Hand Calculations
 Appendix B - Design Parameters of Comparable Aircraft