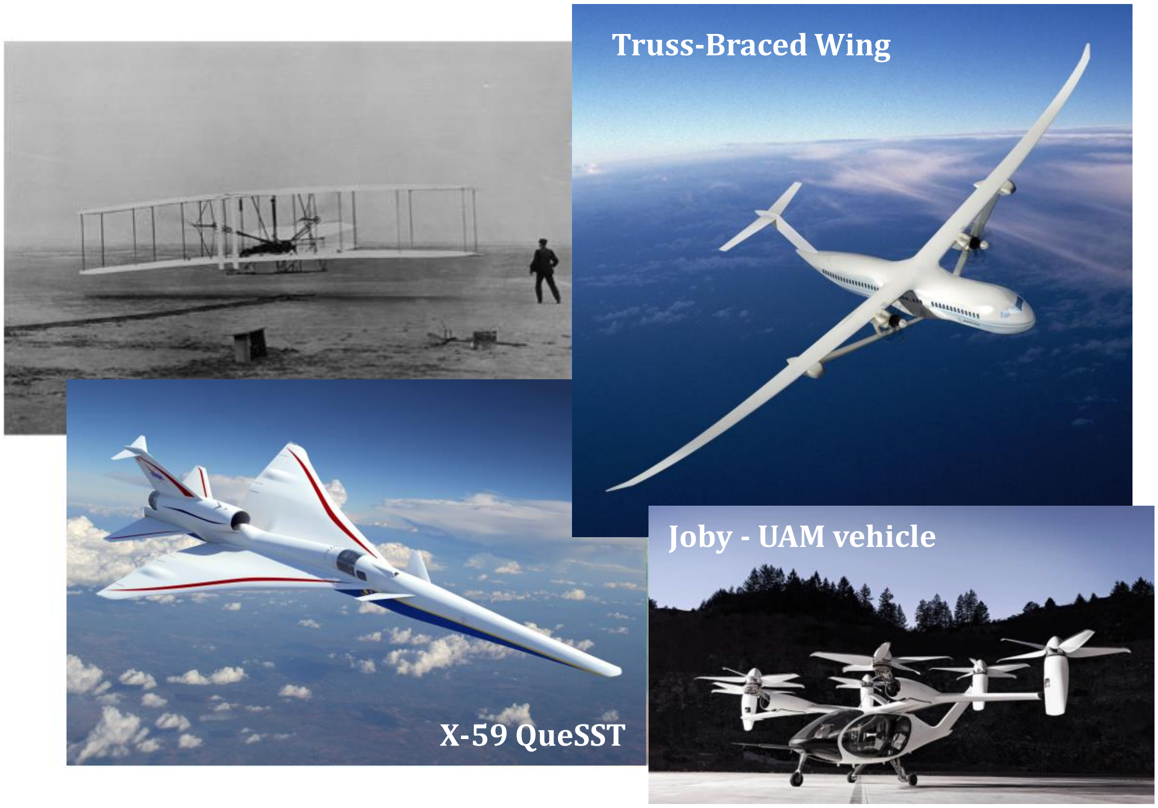
SJSU SAN JOSÉ STATE UNIVERSITY

Department of Aerospace Engineering

AE 165: Flight Mechanics

Spring 2022



INSTRUCTOR: Dr. Thomas Lombaerts
NASA Ames Research Center
(650) 604-0159 (O)
thomas.lombaerts@sjsu.edu

TIME: TTh 6:00 – 7:15pm Virtual on Canvas or In Person, ENG189

OFFICE HOUR: by appointment only TBD / Zoom

TAs: Stephanie Riley (stephanie.riley@sjsu.edu)
James Gonzalez (james.gonzalez@sjsu.edu)

PRE/CO-REQUISITE: "C-" or better in MATH 31/31X (Calculus II) and PHYS 50 (General Physics)

TEXTBOOK: **Class Notes** **(chapters 1 → 8)**
J.D. Anderson, *Introduction to Flight*, McGraw Hill

REFERENCES: R.C. Nelson, *Flight Stability and Automatic Control*, McGraw Hill
Jerry Jon Sellers, *et al*., *Understanding Space: An Introduction to Astronautics*, McGraw-Hill

DESCRIPTION: Trajectory dynamics of atmospheric flight (aircraft and missiles) and spaceflight (orbital mechanics). Influence of vehicle design on trajectory. Aircraft static performance, stability and control. Rocket launch and re-entry dynamics. Computer simulations.

GOALS: The goals of this course are to study:

- Aircraft performance analysis for range and endurance
- Aircraft static stability
- Longitudinal and lateral stability and control derivatives
- Launch vehicles for space missions
- Kepler's laws and orbiting satellites

LEARNING OBJECTIVES: Upon completion of this course, students should be able to:

- Calculate thrust and power required for level flight
- Compute the range and endurance of battery powered propeller-driven aircraft
- Compute aerodynamic coefficients; lift and drag (lift-induced drag)
- Derive basic aircraft stability derivatives
- Analyze aircraft trim conditions
- Identify each element of a space system
- Find elliptical orbit parameters
- Design a Hohmann orbit transfer and compute the total ΔV
- Describe and discuss various design methodologies and their trade-offs.

GRADING: Grading is based on the following:

- Homework: 20% (**NO late HW!)**
- Mid-term: 20%
- Project (Matlab exercise): 20%
- Final: 40%

GRADING SCALE: A+: 100 – 97%; A: 96.9 – 93%; A-: 92.9 – 90%; B+: 89.9 – 87%; B: 86.9 – 83%; B-: 82.9 – 80%; C+: 79.9 – 77%; C: 76.9 – 73%; C-: 72.9 – 70%; D+: 69.9 – 67%; D: 66.9 – 63%; D-: 62.9 – 60%; F: < 59.9%. All exams must be taken to receive a passing grade.

OTHER TECHNOLOGY REQUIREMENTS / EQUIPMENT / MATERIAL:

- A computer with internet connectivity and the video conferencing software ZOOM is required. Please follow this link for more information to set it up: https://ischool.sjsu.edu/zoom
- Basic proficiency with Microsoft Excel, Matlab or any other programming tools is encouraged. Matlab can be freely accessed from the computers in College of Engineering through VPN (for details on how to setup the Cisco VPN client on your PC use the following link: https://www.sjsu.edu/it/services/network/vpn/index.php). Microsoft Excel is part of the Office 365 package that SJSU provides for free to all students (for more details use the following link: https://www.sjsu.edu/it/services/collaboration/software/instructions.php). Additional ways of accessing the software may be available. For more information contact the IT department.
- **Some assignments will require you to have a working webcam. Please make sure you have access to one.**

APPROXIMATE COURSE SCHEDULE:

Course	Lecture Topic(s)	Book chapter	HW
01	Introduction	1	1
	Fundamental thoughts	2	
	Standard Atmosphere	3	
02	Basic Aerodynamics: flow types	4	2
03	Basic Aerodynamics: viscous flow	4	
04	Airfoil, Lift and Drag: basics	5	3
05	Airfoil, Lift and Drag: trans- & supersonic	5	
06	Airfoil, Lift and Drag: finite wings	5	
07	Airfoil, Lift and Drag: swept wings	5	4
08	Aircraft Performance: steady level flight	6	
09	Aircraft Performance: max speed, power req	6	5
10	Aircraft Performance: climb, glide, ceiling	6	6
11	Aircraft Performance: range and endurance	6	
12	Aircraft Performance: takeoff & landing	6	7
	Mid-Term		
13	Aircraft stability & control	7	
14	Aircraft stability & control: moments	7	8
15	Aircraft stability & control: assessment	7	
	Project		
16	Space Flight – Orbital mechanics	8	
17	Space Flight – Orbital geometry	8	
18	Space Flight – Transfer orbits (Hohmann)	8	
19	Space Flight – Introduction to re-entry	8	
20	Space Flight – Re-entry heating + Summary	8	
	Final		