

Syllabus

ASEN 3036 Introduction to Human Space Flight

This course introduces students to the challenges and rewards of human space flight. Historical and current space programs and spacecraft will be discussed, along with the motivation, cost and rationale for human space exploration. An overview of the space environment will be presented in the context of what is needed to sustain human life and health, including physiological and psychological concerns, in a space habitat. Current events including space research will also be highlighted. Students will learn about the astronaut selection and training processes. Finally, anomalies, mission operations and future program directions, with some insight into career planning, will be covered. The emphasis on learning will be to understand the way humans approach the exploration of space and how such a bold endeavor affects us individually and as humans. Students will be encouraged to explore through readings and research different perspectives of spaceflight to include political, scientific, historical, economic, cultural, and social as well as to consider the impact on our future.

Complete course information is available on the University of Colorado Boulder CANVAS learning management system.

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Prerequisites: *none*, open to all majors at any level

Space Minor: This class is one of the elective courses for the CU Space Minor that is open to any undergraduate student from any major. For more information on the CU Space Minor see: <http://www.colorado.edu/spaceminor/learn-more>

Textbook: Harrison, A., “*Spacefaring - The Human Dimension*”, University of California Press, Los Angeles, CA, 2001. **The book is available online for free to students through the CU Library** at: <https://www.colorado.edu/libraries/>

Grading Breakdown: Homework (20%), Quizzes (30%), Project (15%), Exam 1 (15%), Exam 2 (20%).

Required Readings:

- Harrison, A., “*Spacefaring - The Human Dimension*”, University of California Press, Los Angeles, CA, 2001
- NASA Strategic Plan, NASA Journey to Mars, various NASA reports
- Various articles provided on the course website

Suggested Readings:

- O'Neill, G. K., *The High Frontier - Human Colonies in Space*, Space Studies Institute Press, Princeton, NJ, 1989
- Hurt, H., *For All Mankind*, The Atlantic Monthly Press, New York, NY, 1988
- Kranz, G. *Failure Is Not an Option*, Simon and Schuster, New York, NY, 2000
- Burrough, B., *Dragonfly – NASA and the Crisis Aboard Mir*, Harper Collins, New York, NY, 1998
- Jones, T., *Sky Walking – An Astronaut's Memoir*, Harper Collins, New York, NY, 2006
- Mullane, M., *Riding Rockets – The Outrageous Tales of a Space Shuttle Astronaut*, Scribner, New York, NY, 2006
- Any science fiction by H.G. Wells, Jules Verne, Isaac Asimov, Robert Heinlein, Arthur C. Clark

Essay / Project / Case Study:

Students will research and write about topics associated with human spaceflight and the social, political, and technical implications. Essays or case study format is used to explore complex human spaceflight issues to extend the students knowledge and allow detailed contextual analysis of specific topics or events. Students will be asked to write about current topics associated with human spaceflight. Examples are:

- Future human space exploration
- Political and budget implications to human spaceflight
- Human spacecraft and their systems systems
- US space accidents

A project assignment is used to have students develop a plan for an exploration spacecraft using all information learned in the semester about human spacecraft systems. Result of the project will be a written report or a verbal presentation.

Lecture Topics:

Introduction and Course Overview. Why Space?

History of Human Spaceflight

Spacecraft Overview

Space Environment

Life Support Requirements

Physiological Effects and Countermeasures

Operational Space Medicine

Spaceflight Analogs and Human Factors

Life Support Systems

Habitability and Crew Accommodations

Astronaut Selection and Training

Psychology of Spaceflight - Group Dynamics, Stress, and Coping

Space Accidents and Anomalies
Working in Space
Robotics
Extra Vehicular Activity - Physiology and Space Suit Design
Special Topic – Guest Lecture
Mission Operations and Planning
Surface Elements
Space Research
Space Tourism
Next Human Spacecraft Systems
Space Future – Settlements, Migration
Space Career Planning
Space Policy and Funding

ASEN 3036 Detailed Lecture Topics:

Introduction and Why space? (1 hour)

- Administration for the class, background information
- Philosophical perspective
- Reasons for going to space
- NASA and our national space policy

History of human spaceflight and U.S. Exploration plans(1 hour)

- US Space Program goals and plans
- History of human spaceflight
 - People
 - Programs
 - Spacecraft

Space environment (1 hour)

- Hazards
- Space operational medicine
- Countermeasures

Physiological effects of spaceflight (2 hour)

- Human response
- Long term health
- Biomedical aspects

Psychological and sociological aspects of human spaceflight (2 hours)

- Crew interactions and international crew aspects
- Habitability
- Group dynamics
- Stress and coping

Life support systems (2-3 hours)

- Environmental control and life support systems
- Spacecraft systems examples

Human factors for spaceflight (1 hour)

Current and recent spacecraft overview and space flight analogs (3 hours)

- Space Shuttle
- International Space Station
- Russian Soyuz
- Commercial spacecraft
- Analogs for space and interplanetary destinations

Living in space (2 hours)

- Hygiene
- Recreation
- General performance factors
- Living and working on the ISS

Space Programs (1 hour)

- NASA
- International programs
- Programmatic structure
- Historical perspectives

- Philosophical considerations
- Astronaut selection and training (1-2 hours)
 - Selection process and advice
 - Astronaut Candidate training
 - Crew training
- Extra Vehicular Activity (2 hours)
 - Physiology of space walking
 - Space suit design
- Robotics (1 hour)
 - Human interface
 - Autonomous vs. controlled
- Surface Elements (1 hour)
 - Human habitats
 - Surface vehicles
- Space mission accidents and anomalies (1 hours)
 - Spaceflight case studies
 - Apollo 1
 - Challenger
 - Columbia
 - Russian mishaps
 - Technical aspects
 - Ethical and moral aspects
 - Management decision making
- Space Mission Operations and Planning (1 hour)
- Space research (1 hour)
 - Humans as subjects
 - Current topics
- Space current events and projects (1 hour)
- Space tourism plans (1 hour)
 - Past and current activities
 - Future
- Future of Spaceflight (1 hour)
 - US future programs
 - Moon and Mars
 - Space settlements – when, where, how
 - Interstellar migration challenges
- Space Policy and Funding (1 hour)
 - Funding
 - Public opinion
 - Politics
- Career planning insight (1 hour)
 - Bioastronautics classes and study opportunities
 - Engineering challenges
 - Biomedical challenges
 - Career opportunities
- Guest Lectures (0-2 hours)

Invited lecturers from NASA, aerospace companies, former astronauts
Examples: Chief Scientist USAF Space Command, and NASA International
Space Station managers, Astronauts, Under Secretary of the AF for Space, Aerospace
Industry executives
Lectures on special topics of current interest