Version posted Aug. 28, 2022 (Please see http://eclipse.montana.edu/syllabus.html to make sure this is the most current version). Note space below for institution-specific content to include. For any questions, contact nebp@montana.edu

Introduction to Scientific Ballooning: The Nationwide Eclipse Ballooning Project (NEBP) Engineering Track

1-credit special topics course

Course description

This course offers an introduction to academic scientific ballooning and a NASA-funded project called the Nationwide Eclipse Ballooning Project (NEBP). The course previews an upcoming field campaign during which teams across the nation will launch weather balloons into the stratosphere and collect data during two solar eclipses: an annular eclipse on Oct. 14, 2023, and a total solar eclipse on April 8, 2024. Students in this course will study past eclipse ballooning flight campaigns and learn about common engineering platforms and payloads; sensors, electronics and data loggers; communication with ground stations; FAA regulations related to uncrewed balloon flights; and how to collect, analyze, and share eclipse ballooning data. Additionally, students will acquire complementary skills that support a future STEM career including teamwork, project management, communication, and how to support Diversity, Equity, Inclusion, and Access in STEM.

Prerequisites: None.

Learning objectives

Students who complete this course will:

- Identify the details of planning a scientific stratospheric ballooning field campaign
- Understand foundational information about eclipses, balloon flight trajectories, Earth's atmosphere, and meteorology
- Be able to design experiments and investigations for a ballooning field campaign
- Know how to carry out science/engineering balloon-launch campaigns during eclipses
- Apply best practices for collecting, analyzing, and disseminating results
- Develop and apply STEM career skills such as communication, teamwork, and project management.
- Exemplify foundational principles of Diversity, Equity, Inclusion, and Access in STEM.

Materials

No textbook is required for this course. Students will access scientific papers, multimedia modules, NASA websites, and other resources. All materials are open source and will be provided electronically/online. Internet access is required.

Institution-specific information:
Instructor, time of class and location, office hours and location, communication, expectations, grading, attendance, drop/add dates, student code of conduct, institutional policies., etc.

We recommend your syllabus include resources on how you create an inclusive learning environment; links to resources for student well-being and disability accommodations; and a land acknowledgement that is appropriate for your institution.

Tentative Schedule:

Week 1:

- Introduction to Scientific Ballooning, NASA SciAct, and the Nationwide Eclipse Ballooning Project (NEBP).
- Overview of how the course also includes non-technical STEM career skills, such as teamwork, communication, project management; and diversity, equity, inclusion and access.

Week 2:

- How to plan a field campaign – teamwork, roles, materials, scheduling.
- Introduction to Diversity, Equity, Inclusion and Access in STEM; STEM identity.

Week 3:

- Eclipses and heliophysics – historical, contemporary, and worldviews.
- Citizen science and other SciAct projects.

Week 4:

- Introduction to flight, Earth's atmosphere and meteorology.
- Introduction to WRF (Weather Research and Forecasting Model)

Week 5:

- Mission planning – Project management, constraints, risks, safety, and operations.
- Balloon trajectory predictions.

Week 6

Ballooning and payloads: Lift, launch, retrieval, payload stringing

Week 7

NEBP Big Picture: What happens on the Atmospheric Science track.

Week 8

Ballooning path prediction, tracking, and contingency planning

Week 9

- FAA requirements, cut down system, power supply use: battery charging, handling and safety

Week 10

- Payloads and ground stations Part 1: Single board computers, attached sensors, and data loggers;
- GPS and camera systems.

Week 11

- Payloads and ground stations Part 2: Radios and antennas on the payloads and ground stations
- Internet requirements for streaming data and balloon tracking

Week 12

Fundamental electronics, programming, and mechanics

Week 13

Final launch preparation — Logistics, tracking, weather forecasting, data acquisition.

Week 14:

- Launch conclusion: Chase and recovery, wrapping up a field campaign.
- Data analysis.
- Communicating science to peers and to the public.

Week 15/16:

- Final assessments, project report, debriefs.
- STEM career exploration – next steps.