



Aerospace Engineering 7-9 Syllabus

Course Goals

1 Engineering Design

Students build a variety of aerospace engineering projects and use the engineering design process as a framework to reflect on their designs to improve performance.

2 Creativity & Problem Solving

Students gain experience working in teams as they collaborate to build and test their projects.

3 Physics Concepts

Students are introduced to Newton's 1st and 3rd Laws and learn how they describe the 4 primary forces acting on aircraft: thrust, lift, drag and weight.

4 Connection with History

Students learn about the history of aerospace engineering as a series of key developments from air balloons to satellites.

5 Computer Assisted Design

Students use computer assisted design technology to design their own modern aircraft.

Course Topics

1 Newton's First Law

Students design helicopters and discuss Newton's First Law, gravity, lift, thrust, and drag.

2 Weather Balloons

Students collect and analyze data from a weather balloon launch.

3 Airfoil Testing

Students build a wind tunnel and test airfoils.

4 Gliders

Students create, test, and iterate on the design of gliders made with household supplies.

5 Propeller Planes

Students learn how propellers generate thrust and design a propeller plane.

6 Jets

Students learn how jets produce thrust through Newton's 3rd Law and then design jets using Tinkercad.

7 Rockets

Students learn how rockets work and then build, launch, and revise the design of their own paper rockets.

8 Satellites

Students learn about satellite applications, satellite history, GPS, and the international space station.

9 GPS

Students learn how GPS works and how GPS coordinates are used to determine the precise area of objects.

10 Space Exploration

Students learn about space exploration by designing solar sails with household supplies and researching novel missions around our solar system.

Course Schedule

Day 1

Relationship Building

Students build community with each other through get-to-know activities that familiarize them with the 4 primary forces acting on something in flight.

Designing Helicopters

Students explore the concept of gravity and lift by designing paper helicopters.

Helicopters Lesson

Students learn about helicopters and how they rise up, fly, hover, and generate lift.

Newton's First Law

Students learn about Newton's First Law within the context of gravity, lift, thrust, and drag.

Course Outline

Students learn what they will see and do in the course.

Day 2

Layers of the Atmosphere

Students learn about layers of the atmosphere and why scientists want to know information about each layer.

Balloons

Students learn about the two types of large balloons used by humans: hot air balloons and weather balloons.

Building a Weather Balloon

Students build a weather balloon to prepare to launch it to collect atmospheric data.

Launching a Weather Balloon

Students launch a weather balloon to collect atmospheric data.

Atmospheric Data

Students learn about the types of data that scientists record using atmospheric data.

Analyzing Atmospheric Data

Students take down the weather balloon and analyze the atmospheric data gathered over the break.

Engineering Design Process

Students learn about the engineering design process.

Day 3

The Wright Brothers and Wind Tunnels

Students learn about the scientific process the Wright Brothers used to solve the power, control, and lift problems they encountered.

Building a Wind Tunnel

Students build a wind tunnel to test airfoils.

Airfoils Lesson

Students learn about the details of airfoils.

Building Airfoils

Students build airfoils to test in the wind tunnel.

Day 4

Testing Airfoils

Students test their airfoils in the wind tunnel and record data.

Reflecting on Airfoil Testing

Students reflect on their airfoil designs and prepare presentations about results, limitations, errors made, and ideas for improving airfoil design and testing methods.

Presenting Data from Airfoil Testing

Students present their findings from the airfoil design.

Aerospace Engineering Challenge

Students act as aerospace engineers and compete to design an airfoil that maximizes the lift-to-weight ratio.

Day 5

Glider Lesson

Students learn about the different types of gliders, how they fly, and how it is possible for an engineless aircraft to gain altitude.

Build and Test Gliders

Students apply their knowledge of airfoils to build and test gliders using household supplies.

Propeller Plane Lesson

Students learn about propeller planes and apply their new knowledge to predicting how restricted wind flow affects flight.

Propeller Plane Construction

Students create their own propeller plane and test the effect of different propeller blades on flight.

Day 6

Newton's 3rd Law and Jet Engines

Students learn about Newton's 3rd Law and apply it to learning about jet engines.

Tinkercad Introduction

Students learn the basics of 3D Design software in preparation for designing a jet.

Commercial Versus Military Jets

Students research similarities and differences between military jets and commercial jets to prepare to create their own jet in Autocad.

Jet Engines and 3D Design

Students design their own jets using 3D Autocad design software.

Day 7

Rockets Lesson

Students learn how a rocket works.

Rocket Stability

Students learn about rocket stability and perform tests to determine if rockets are stable.

Rocket Testing

Students use a rocket launcher to test their rockets.

Rocket Reflection

Students reflect on their rocket designs.

Day 8

Intro to Satellites

Students learn about satellite history, applications, and current research.

What Satellites Orbit Earth?

Students explore a website with a list of every (known) satellite around earth, research one of them, and prepare a presentation on it.

Launching a Satellite

Students learn what goes into launching a satellite and maintaining its orbit.

GPS Triangulation Activity

Students learn how GPS works and apply it to a triangulation activity.

Latitude and Longitude Coordinates

Students use their Latitude and Longitude coordinates on Google Maps to calculate distances and areas on a map.

Day 9

Latitude and Longitude Coordinates

Students use their Latitude and Longitude coordinates on Google Maps to calculate distances and areas on a map.

International Space Station

Students learn about the history and parts of the international space station. They also track the international space station in real-time.

Problem Simulation with the ISS

Students work in groups to problem solve through a crisis with the ISS. They present their results to the class.

Space Junk!

Students learn about the danger space junk poses to satellites.

Day 10

Solar Sails

Students learn about solar sails and create their own model solar sail.

Space Exploration

Students learn about long-range space missions that send satellites far from earth.

Mission to Mars

Students watch videos on a mission to Mars and discuss how life on Mars could be sustained as a wrap-up to the course.

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