



# Flight and Space (PLTW)

<b>Primary Career Cluster:</b>	Science, Technology, Engineering, and Mathematics (STEM)
<b>Consultant:</b>	Deborah Knoll, (615) 532-2844, <a href="mailto:Deborah.Knoll@tn.gov">Deborah.Knoll@tn.gov</a>
<b>Course Code:</b>	0887
<b>Prerequisite(s):</b>	None
<b>Credit:</b>	N/A
<b>Grade Level:</b>	8
<b>Graduation Requirement:</b>	N/A
<b>Coursework and Sequence:</b>	This is a course in the <i>Project Lead the Way (PLTW)</i> middle school sequence of coursework.
<b>Necessary Equipment:</b>	Visit <a href="http://www.pltw.org">www.pltw.org</a> for more information.
<b>Aligned Student Organization(s):</b>	Technology Student Association (TSA): <a href="http://www.tntsa.org">http://www.tntsa.org</a> Tracy Whitehead, (615) 532-2804, <a href="mailto:Tracy.Whitehead@tn.gov">Tracy.Whitehead@tn.gov</a>
<b>Coordinating Work-Based Learning:</b>	N/A
<b>Available Student Industry Certifications:</b>	N/A
<b>Dual Credit or Dual Enrollment Opportunities:</b>	N/A
<b>Teacher Endorsement(s):</b>	001, 007, 013, 014, 015, 016, 017, 018, (042 and 043), (042 and 044), (042 and 045), (042 and 046), (042 and 047), (042 and 077), (042 and 078), (042 and 079), (043 and 044), (043 and 045), (043 and 046), (043 and 047), (043 and 077), (043 and 078), (043 and 079), (044 and 045), (044 and 046), (044 and 047), (044 and 077), (044 and 078), (044 and 079), (045 and 046), (045 and 047), (045 and 077), (045 and 078), (045 and 079), (046 and 047), (046 and 077), (046 and 078), (046 and 079), (047 and 077), (047 and 078), (047 and 079), (077 and 078), (077 and 079), (078 and 079), 070, 081, 105, 121, 122, 123, 124, 125, 126, 127, 128, 129, 144, 145, 147, 157, 210, 211, 212, 213, 214, 230, 231, 232, 233, 400, 401, 402, 407, 413, 414, 415, 416, 417, 418, 440, 460, 461, 470, 477, 480, 481, 482, 483
<b>Required Teacher Certifications/Training:</b>	Teachers who have never taught this course MUST attend the training provided by PLTW and receive PLTW certification. This course has an associated fee through the vendor.
<b>Teacher Resources:</b>	<a href="https://tn.gov/education/article/cte-cluster-middle-school-cte-coursework">https://tn.gov/education/article/cte-cluster-middle-school-cte-coursework</a>

## Course Description

This is a course in the series of *Project Lead the Way (PLTW)* curriculum. For more information, visit the PLTW website at <http://www.pltw.org/>.

## Program of Study Application

These courses build knowledge and skills related to the following career clusters:

- 1) Architecture & Construction
- 2) Information Technology (IT)
- 3) Manufacturing
- 4) Science, Technology, Engineering & Mathematics (STEM)
- 5) Transportation, Distribution, & Logistics

## Course Standards

The course standards outlined below are the copyrighted property of *Project Lead the Way*. Teachers must participate in *Project Lead the Way* training in order to be able to teach this course. This course is one in a series of PLTW middle school courses. The lesson numbers below reflect the recommended sequence.

### Lesson 4.1 History of Flight and Space (15 days)

#### *Understandings*

- 1) The aerospace industry uses engineers who specialize in many different types of engineering careers.
- 2) The history of aerospace studies has influenced how people meet the challenges of traveling through the atmosphere or in space.
- 3) Engineering designs in aerospace exploration evolve as they are developed.
- 4) Different types of vehicles result in different types of flight.

#### *Knowledge and Skills*

It is expected that students will:

- Describe the roles and responsibilities of STEM professionals for high demand technological careers, especially in the aerospace industry.
- Apply their knowledge of research techniques to investigate an aerospace topic.
- Describe the flight characteristics of kites, whirly gigs, model airplanes, hot air balloons, and model rockets.
- Write a script and develop a storyboard to explain an aerospace concept.

### Lesson 4.2 Aeronautics (19 days)

#### *Understandings*

- 1) Forces working on an airplane in flight are lift, gravity, thrust, and drag.
- 2) In order to fly, an airplane must overcome gravity with sufficient lift and must overcome drag with sufficient thrust.
- 3) Newton's three laws of motion are observed in both spacecraft and aircraft.
- 4) Bernoulli's principle, which states that as the speed of a fluid increases, its pressure decreases, explains in part how an airfoil gains lift.

- 5) Changing a wing's angle of attack affects the speed of the air flowing over the wing and the amount of lift the wing creates.
- 6) Airfoils are tested for performance in a wind tunnel.
- 7) Aircraft have different purposes, but the majority of their components are similar.
- 8) Propulsion systems provide the thrust so aircraft can fly.

### *Knowledge and Skills*

It is expected that students will:

- Describe how center of gravity affects an aerospace vehicle in distributing weight.
- Recognize the tools and purpose of aeronautic design and testing.
- Distinguish between the forces of lift, drag, weight, and thrust that affect an object moving through a fluid.
- Explain the importance of the forces that affect an object moving through a fluid.
- Explain how Newton's laws apply to flight and space.
- Explain how Bernoulli's principle affects flight.
- Identify the characteristics of an airfoil and how they compare and contrast with the characteristics of wings.
- Analyze the features and benefits of different types of wings.
- Research and design an airfoil that will create lift using a wing tester.
- Calculate fuel consumption and range of an airplane given speed and fuel capacity.
- Describe the major parts (fuselage, empennage, high lift devices, wings, undercarriage, propulsion, instruments, and controls) of aircraft and how they can affect the overall balance of an airplane during flight

## **Lesson 4.3 Traveling and Living in Space (11 days)**

### *Understandings*

- 1) Reliable, inexpensive rockets are the key to enabling humans to travel, work, visit, and commercially develop space.
- 2) There are many reasons for going into space, including colonization, intelligence surveillance, international diplomacy, natural resources, research, satellites, and advancing technology.
- 3) Humans must adjust their diets, hygiene, clothing, recreation, and sleep patterns in order to survive in space.
- 4) Engineers use technology on the moon to research, design, and build appropriate equipment to solve problems related to the topography and atmosphere found on the moon.

### *Knowledge and Skills*

It is expected that students will:

- Discuss the history and development of rocketry, space flight, and living in space.
- Know that a rocket must overcome the forces of gravity and drag in order to escape the atmosphere.
- Explain the basic principles of flight and rocketry.
- Investigate how changes in various design characteristics of a rocket will affect the rocket's performance.

- List challenges that engineers face to provide safe travel and optimum living conditions in space.
- Explain how gravity relates to an object's orbit.
- Use a simulation to select optimal components for a lunar robot to save stranded astronauts on the moon.