PLTW Flight and Space Virtual Learning

8th Grade/Airfoils

May 7, 2020

8th Grade/Flight and Space
Lesson: May 7, 2020
Day 1 of 2

Objective/Learning Target:
Students will understand the shape of airfoils and how they affect the lift of an aircraft.

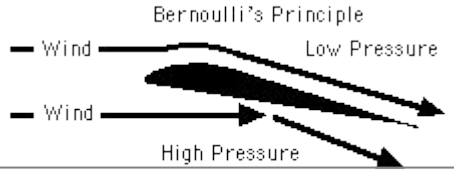
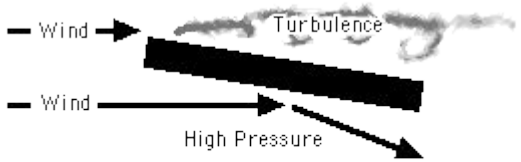
Warm-Ups:

Complete the following diagram on your Cornell Notes or notebook paper.

- Draw a picture of an airfoil
- Label the 4 forces of flight: lift, thrust, drag, weight

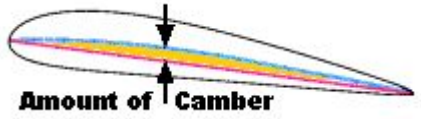
Lesson Introduction/Background Information:

In previous activities, you learned some of the basic concepts of aerodynamics, including definitions, Newton's Laws of Motion, and **forces** acting on an airplane during flight. Daniel Bernoulli, an eighteenth-century Swiss scientist, discovered that as the **velocity** of a **fluid** increases, its pressure decreases. leading to Bernoulli's law of pressure differential for fluids.

In general, a curved wing is more efficient than a flat wing.	A flat wing is inefficient because the air becomes turbulent as it flows over the top.
	
Air moves cleanly over the top, which causes lower pressure to develop with less drag.	Turbulence results in more drag and ultimately, less lift.

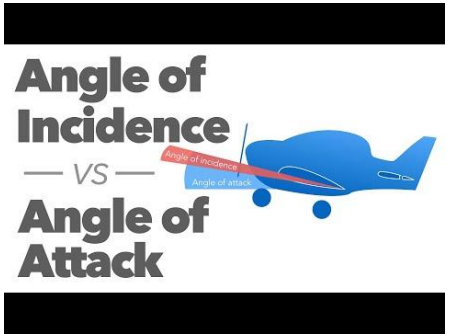
Lesson Introduction/Background Information:

What is camber? Most people think of camber as the top surface of the wing, however this is incorrect. Actually, the amount of camber is the difference between the *mean camber line* and the *chord line*. See the diagrams below. This means that a symmetrical wing has no camber.



Why are wings designed with camber? An efficient camber reduces the effect of drag, a force that acts against thrust. Therefore, a wing with an efficient camber does not require as much thrust to achieve lift. Thus, lift is easier to generate and maintain with an efficient camber.

In contrast, an inefficient camber results in a wing with a great deal of drag; more thrust is needed to compensate for the increased drag.

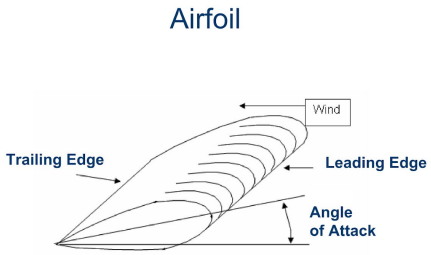


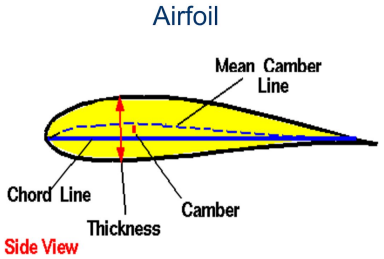
Practice:

Complete the following on your notes or use this Airfoil Cornell Notes.

Define:

Angle of Attack-
Camber-
Chord-
Leading Edge-
Mean Camber Line-
Thickness-
Trailing Edge-
Angle of Incidence-





Practice:

Complete the following on your notes or use this Airfoil Cornell Notes.

1. What is the difference between a wing and an airfoil?
2. Why is air considered a fluid?
3. Bernoulli proved that when fluids move_____, their pressure _____, So the air pressure above the wing is _____ than the air pressure below the wing. Lift occurs because there is _____ pressure below the wing.
4. Will any shape work for an airfoil?
5. Airfoil shapes are designed to generate as much _____ as possible while incurring as little _____ as possible.
6. Describe 3 situations that would cause the airplane to lose lift or stall.

Self-Assessment:

In your notes, describe what you learned about the design of a wing and how it’s shape helps planes fly.

Extend Your Learning/Continued Practice:

Learn more about airfoils.

[Aviation and Airfoils]