



HIGH SCHOOLS
POWERED BY **AOPA**

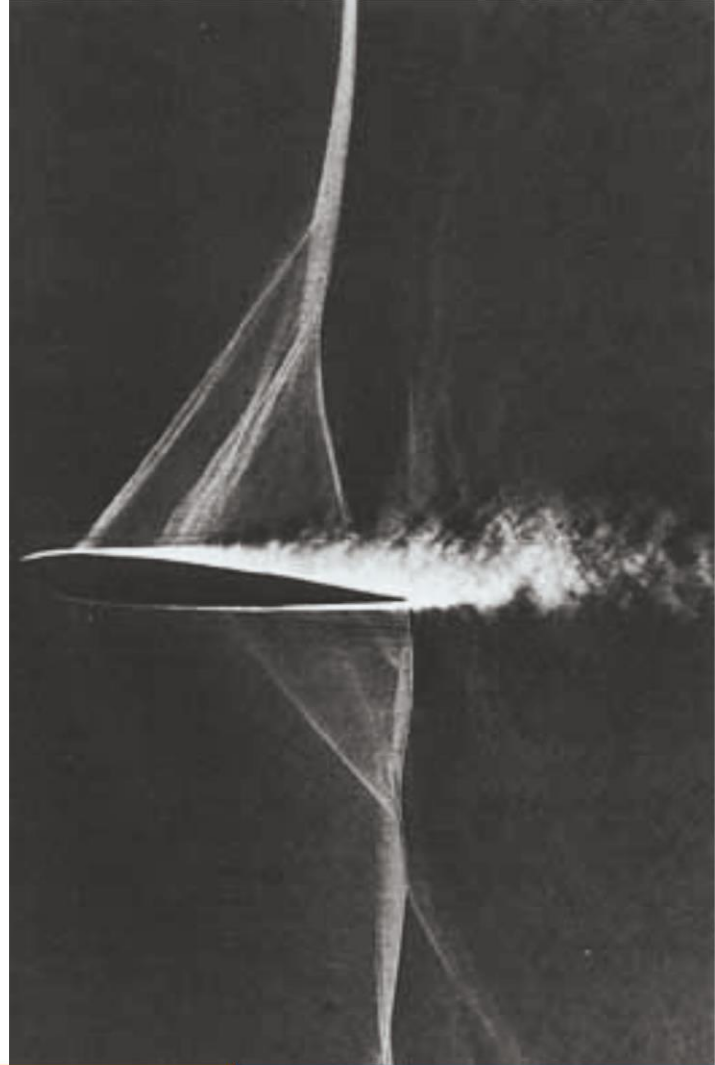
UNIT 2.D. | Day 3-7 | POWERPOINT 1

AIRFOILS



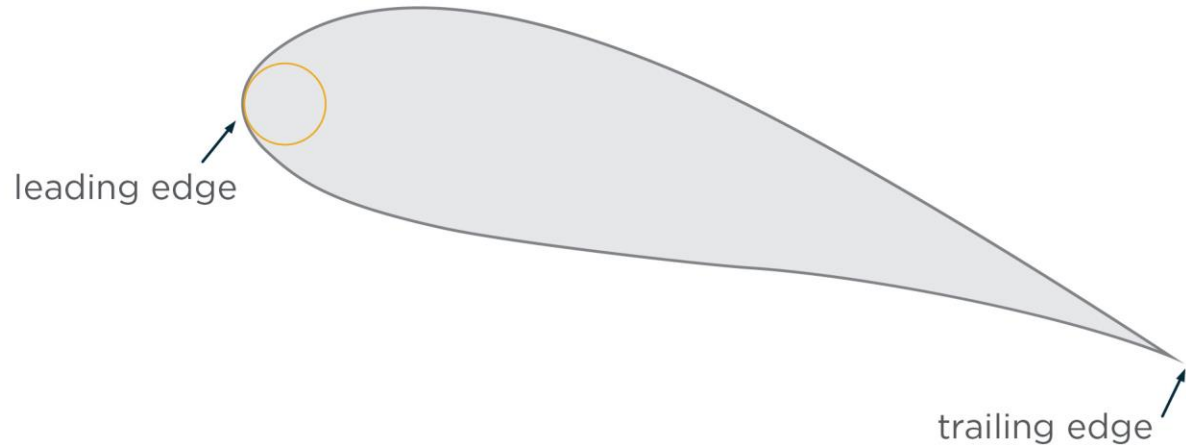
WHAT IS AN AIRFOIL?

- A wing shape that when moved through a fluid (air) produces an aerodynamic force



AIRFOIL TERMINOLOGY

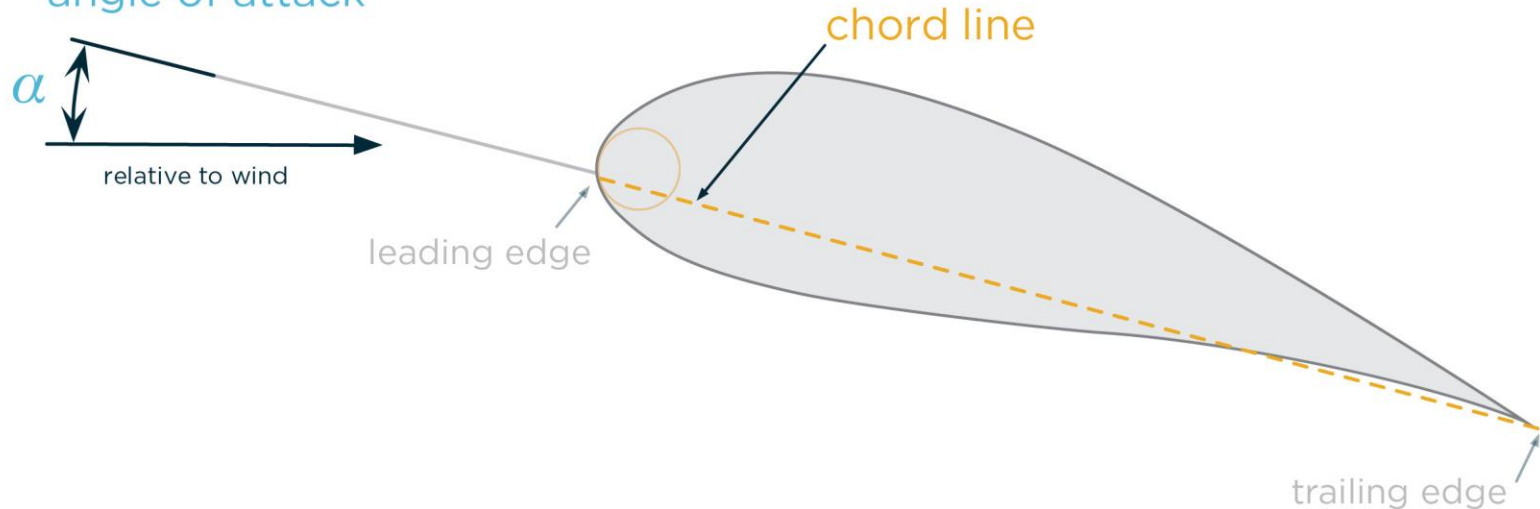
- **Leading Edge** - first place air makes contacts with the airfoil
- **Trailing Edge** - last place air makes contact with the airfoil



AIRFOIL TERMINOLOGY

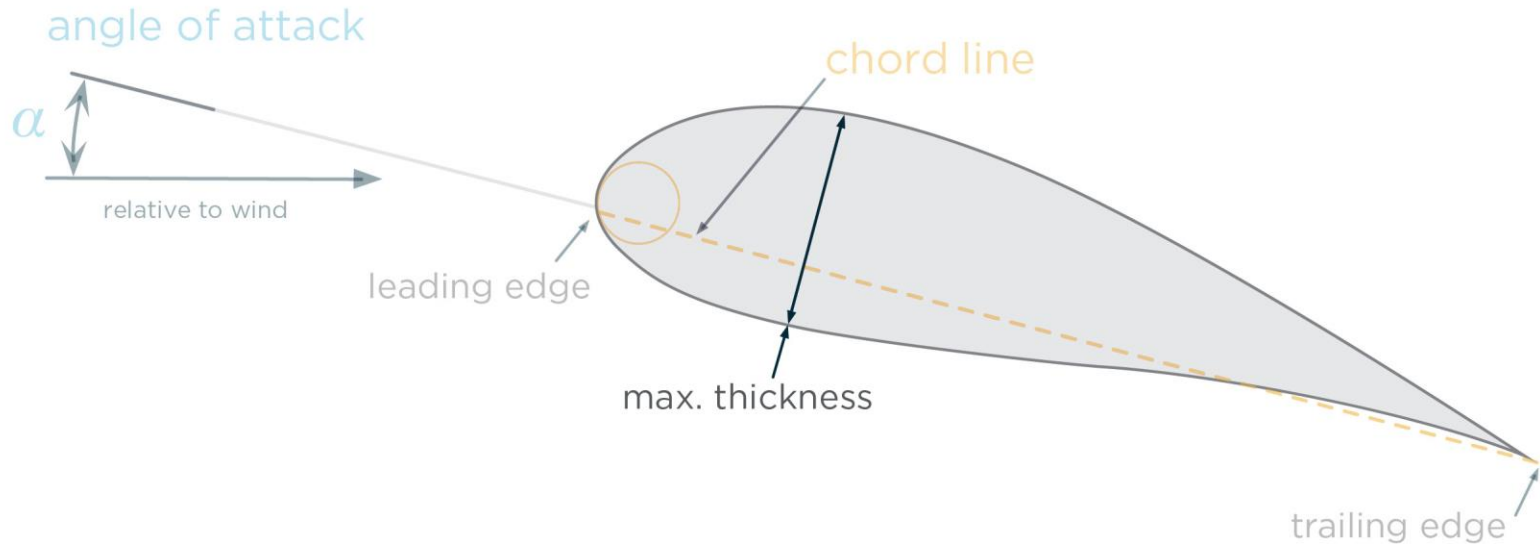
- **Chord** - straight line that connects the leading edge to the trailing edge
- **Angle of Attack** - angle between the chord line and the relative wind flow. If the leading edge of the airfoil is higher than the trailing edge, then the airfoil has a positive angle attack

angle of attack



AIRFOIL TERMINOLOGY

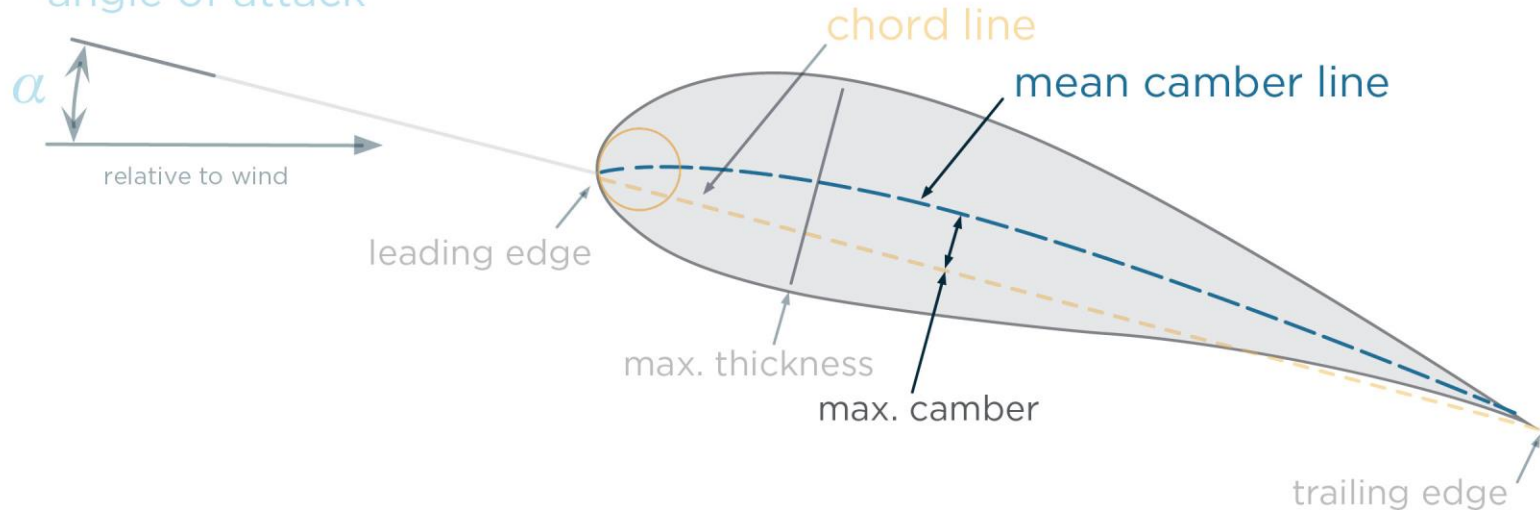
Thickness - maximum distance between the upper and lower wing surfaces



AIRFOIL TERMINOLOGY

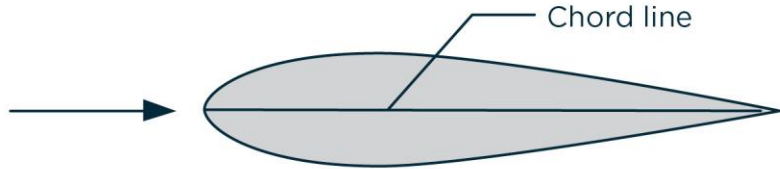
- **Camber** - the curve of the wing
 - The mean camber is a line drawn between the leading and trailing edge so that the distance between the upper and lower surfaces is equal
- **Max Camber** - measured where there is maximum distance between the chord line and the mean camber line

angle of attack



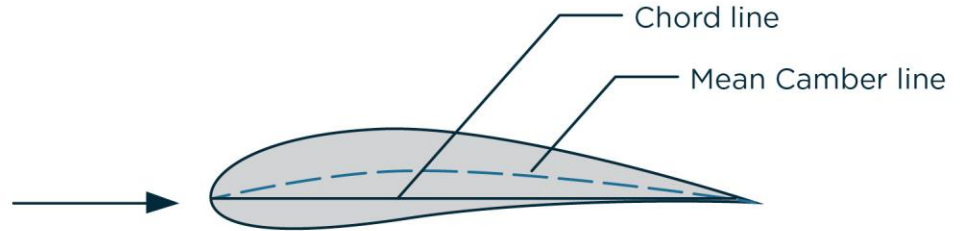
AIRFOIL TERMINOLOGY

Symmetrical Airfoil - the upper and lower surfaces of the airfoil are identical. The chord line and the mean camber line directly overlap one another



Symmetric airfoil
Camber line = chord line

Asymmetrical Airfoil - the upper surface is more curved. The mean camber line is above the chord line



Asymmetric airfoil
Camber line above chord line

 Bonus Question!

**ASYMMETRICAL OR CAMBERED AIRFOILS
GENERALLY PRODUCE MORE LIFT.
BUT WHAT KIND OF AIRPLANE WOULD BENEFIT
FROM A SYMMETRICAL WING?**



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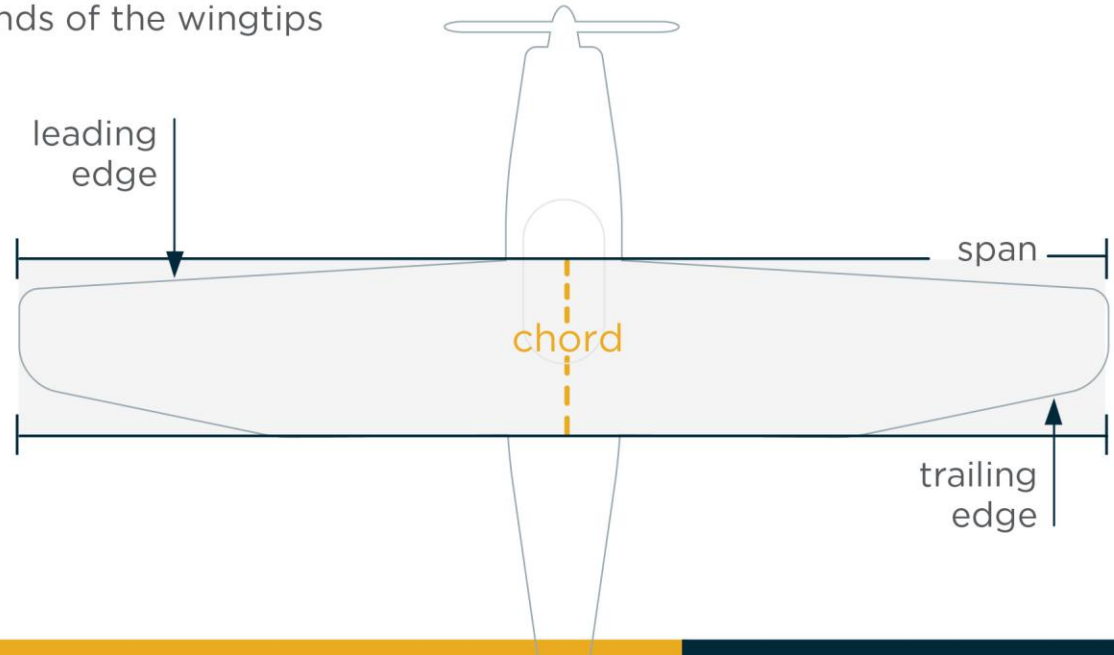


AIRFOIL TERMINOLOGY

Planform - the shape of the airfoil when viewing from above

Chord - the length from the trailing edge to the leading edge

Span - the length between the ends of the wingtips



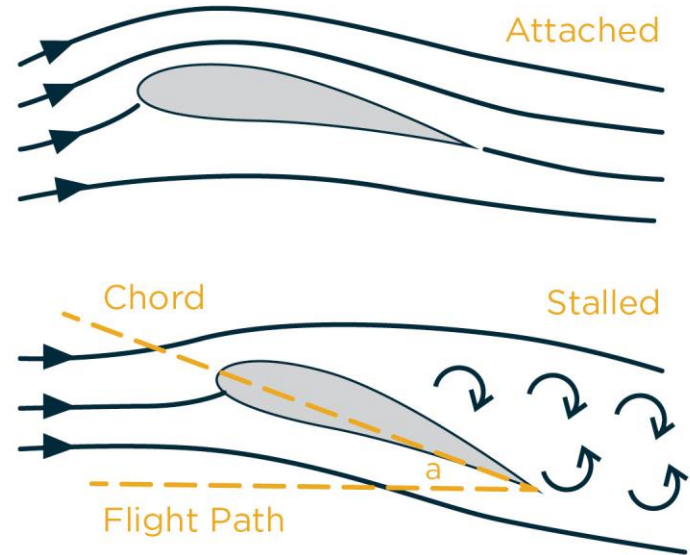
WHAT THE WRIGHT BROTHERS LEARNED

- **By testing more than 200 airfoils, the brothers learned very important factors that influence lift**
 - Curved surfaces produce more lift than flat surfaces
 - Curved surfaces also produce more drag; they learned that a curved surface with a small camber was ideal for maximizing lift
 - Airfoils with the curve closer to the leading edge produce more lift
 - Airfoils that are thin and long create more lift
 - Cambered airfoils will create lift at zero angle of attack



HOW DOES ANGLE OF ATTACK AFFECT LIFT?

- **Lift is directly affected by angle of attack**
 - As the angle of attack increases, so too does the lift produced by the airfoil
 - This is true until the critical angle of attack is reached
- **At the critical angle of attack, the boundary layer of air separates from the airfoil and creates drag**
 - This is called an “aerodynamic stall”



BUILDING YOUR OWN AIRFOILS

- **Working in small groups, you will build two airfoils of a predetermined span and chord**
 - One symmetrical airfoil
 - One asymmetrical airfoil
- **Then you will test your airfoils to determine which produces more lift**
 - If time allows, you can use the engineering design process to design and test your own airfoil design



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