

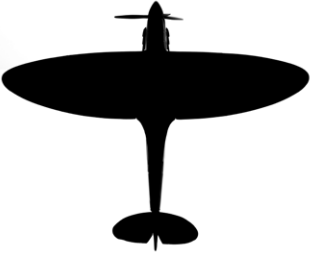
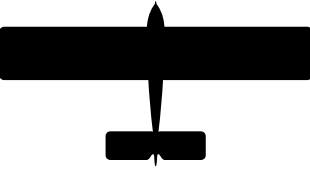
AERODYNAMIC STALLS





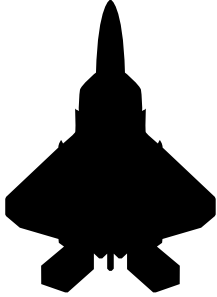
DESIGNED TO FLY

The shape of a wing when viewed from above is called a planform. In small groups, use Internet research (search the name of the wing planform) to learn about the wing planform shape you've been assigned. Fill out the table below to include a textual description of your wing planform's design characteristics, a textual description of its stall characteristics, and a list of several airplanes that employ the planform shape.

Be prepared to make a short group presentation about your planform. Complete this graphic organizer by filling out the information for the other planforms as other groups present their information.

PLANFORM SHAPE	PLANFORM DESIGN CHARACTERISTICS	PLANFORM STALL CHARACTERISTICS	AIRCRAFT TYPES
<p>Elliptical</p> 	<p>Leading and trailing edges approximate two segments of an ellipse. The leading and trailing edges are curved such that the chord length varies elliptically with respect to span.</p> <p>These wings are efficient because they have low drag; however, manufacturing time was high because each wing spar had to be made by hand.</p>	<p>Stalls suddenly and uniformly across the wing because the angle of attack is constant along the wing span.</p>	<ul style="list-style-type: none"> • Supermarine Spitfire • Republic P-47 Thunderbolt • German Heinkel He-112B
<p>Rectangular (Straight)</p> 	<p>Constant-width geometry, sometimes referred to as the Hershey-bar planform.</p>	<p>Stalls progressively from the wing root to the tip.</p> <p>Significant surface area at the tips creates a lot of drag towards the tips.</p>	<ul style="list-style-type: none"> • Piper Cherokee • Piper Tomahawk • Piper J-3 Cub



PLANFORM SHAPE	PLANFORM DESIGN CHARACTERISTICS	PLANFORM STALL CHARACTERISTICS	AIRCRAFT TYPES
<p>Tapered</p> 	<p>Reduced chord from the wing root toward the wing tip. To taper means to make something gradually smaller at one end.</p>	<p>Tapered wings stall at the tip before the roots which is undesirable. Wing washout is usually used to mitigate this problem.</p> <p>Reduced surface area at the tips results in reduced drag when compared to rectangular wings.</p>	<ul style="list-style-type: none"> • C-172 • P-51 Mustang
<p>Sweptback</p> 	<p>Wing angles backward from its root to its tip and has decreasing chord length from the wing root toward the wing tip.</p> <p>Found primarily on transonic jet airplanes (airliners and business jets).</p>	<p>These wings stall at the tips before the roots, meaning you lose aileron control at the onset of the stall.</p> <p>Because they have poor low-speed performance, they typically need lift-enhancing devices like flaps and slats for takeoff and landing.</p>	<ul style="list-style-type: none"> • Boeing 787 • Airbus A380 • CRJ200 • Gulfstream G650
<p>Delta</p> 	<p>Shaped in the form of a triangle; similar to sweptback wing, except the trailing edge of wing extends spanwise from the fuselage, as opposed to backward like the leading edge.</p> <p>Best wing shape for going very fast - supersonic.</p>	<p>These wings have lower coefficients of lift which enable them to stall at very high angles of attack.</p>	<ul style="list-style-type: none"> • Dassault Mirage 2000 • F106 Delta Dart • Chengdu J-7

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QUESTION

Which wing planform shape has the most desirable stall characteristics and why?

A rectangular wing stalls at the root first. This means there's enough airflow over the tips of the wings to prevent a rapid rolling motion during a stall, which makes the airplane more stable. It also makes an airplane more resistant to entering a spin. In addition, a root stall also guarantees some aileron effectiveness during the stall, giving the pilot greater control of the airplane, especially if the stall occurs in a banked turn.