

Aeronautics Glossary

accelerate

To speed up. For example, when an [airplane](#) takes off it accelerates down the runway until enough [lift](#) is created by the air flowing over the [wings](#) so that it can fly.

aerodynamics

A field of [fluid dynamics](#) that studies how gases, including air, flow and how [forces](#) act upon objects moving through air.

aeronautics

The study of flight and the science of building and operating an [aircraft](#).

ailerons

[Control surfaces](#) on the [trailing edge](#) of each wing that are used to make the [aircraft roll](#). When flying straight and level, moving the control stick to the right will raise the aileron on the right [wing](#) and lower the aileron on the left [wing](#). This will cause the [aircraft](#) to [roll](#) to the right.

aircraft

A machine used for flying. [Airplanes](#), helicopters, blimps and jets are all aircraft.

airflow

The motion of air [molecules](#) as they flow around an object, such as a [wing](#).

airfoil

An object with a special shape that is designed to produce [lift](#) efficiently when the object is moved through the air. For example, the cross-section of a [wing](#) is an airfoil.

airplane

An [aircraft](#) that uses the [force](#) of air on its [wings](#) (called [lift](#)) to fly.

air pressure

The [force](#) created by air [pushing](#) on a surface.

altitude

The height of an object, like an [airplane](#), above sea level or above the earth's surface.

analyze

To take something apart so it can be examined and studied.

angle of attack

The angle of a wing to the oncoming [airflow](#). A [pilot pulls](#) back on the control stick to raise the [elevator](#). This causes the [aircraft](#) to [pitch](#) which increases the angle of attack.

aviation

The operation of [aircraft](#). There are three types of aviation: [general](#), [commercial](#) and [military](#).

axis

A straight line, through the [center of gravity](#), around which an [aircraft](#) rotates. For example, an [aircraft rolls](#) around its [longitudinal](#) axis which is a straight line that runs through the center of the [aircraft](#) from the nose to the tail.

balanced forces

[Opposing forces](#) that are [pushing](#) or [pulling](#) against each other an equal amount. For example, if you and a friend [pull](#) on a rope, in the opposite direction with the same [force](#), neither of you will move. This is because the [forces](#) are balanced.

<http://quest.arc.nasa.gov/aero/wright/tunnels/glossary.html#engineer>

Bernoulli, Daniel

Daniel Bernoulli was a Swiss mathematician. He was born on February 8, 1700 in Groningen, Netherlands. As a university student he studied philosophy and logic. His favorite subjects were mathematics and mechanics. From 1725 to 1733 he worked as a mathematician with his brother, Nikolaus, at the St. Petersburg Academy of Sciences in Russia. He then worked as a professor at the University of Basel in Switzerland until his death on March 17, 1782.

He is famous for his work in the field of [fluid dynamics](#). In 1738 he wrote a book called *Hydrodynamica*. In this book he explained his theories about how gases and fluids move, and how the speed at which they move affects the pressure they exert on objects they flow around. This is the basis for the explanation of [lift](#). His work helped to lay the foundation for [aeronautics](#) which would be developed many years later.

Bernoulli's Principle

Daniel [Bernoulli](#) explained that the faster [molecules](#) within a fluid move, the less [pressure](#) they exert on objects around them. This applies to all fluids, including water, air and gases. For example, the water in a pond will exert more [pressure](#) on the pond's bottom than a flowing stream with the same amount of water will exert on the streambed.

biplane

An [airplane](#) with two sets of [wings](#). The first [airplane](#) ever built had two sets of [wings](#), one on top of the other.

camber

The curve of an [airfoil](#).

canard

a tail configuration (two small horizontal surfaces on either side of the aircraft) mounted toward the front of the [aircraft](#), rather than at the rear.

center of gravity

The [force](#) of [gravity](#) acts on every individual part of an object, like an [airplane](#). However, [engineers](#) often treat the [force](#) of [gravity](#) on all the parts of an object as a single [force](#) acting on a point in the object called the center of gravity.

chord line

A line from the front of an [airfoil](#) (the [leading edge](#)) to the [trailing edge](#).

cockpit

A compartment in the front of the [airplane](#) where the flight crew performs their job of flying the [aircraft](#).

commercial aviation

The business of operating [aircraft](#) that carry passengers by commercial companies. Airline companies such as American Airlines, United Airlines and many others are examples of commercial aviation. A Boeing 747 is an example of an [airplane](#) that is owned by a company and operated in commercial aviation.

Computational Fluid Dynamics (CFD)

The science of using [supercomputers](#) to solve complex mathematical equations that predict how an object like an [aircraft](#) responds to the air flowing around it. CFD is a [tool](#) of [aeronautics](#) that enables [engineers](#) to "fly an [aircraft](#) in a [computer](#)."

computer

An electronic machine that receives, processes and presents [data](#). A computer can be programmed to perform complicated tasks, like solving complex mathematical equations or controlling a flight [simulator](#).

control surfaces

Parts of an [aircraft](#) that are activated by the [controls](#) to change the [airflow](#) around the surfaces of the [aircraft](#). The changes in [airflow](#) cause the [aircraft](#) to [roll](#), [pitch](#), or [yaw](#). Examples of control surfaces are: [ailerons](#), [elevators](#) and [rudders](#).

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controls

Devices which allow the [pilot](#) to direct the movements of an [aircraft](#). Examples of controls are: rudder pedals that control the [rudders](#) and cause the [airplane](#) to [yaw](#); throttles that control the [engines](#) which generate [thrust](#) for the [airplane](#); and the control stick that controls the [ailerons](#) and [elevators](#) which cause the [airplane](#) to [roll](#) and [pitch](#).

data

Information that is collected from an [experiment](#). For example, an [engineer](#) in a [wind tunnel](#) may collect data about how much [lift](#) is created by a certain [wing](#) shape.

decelerate

To slow down. When an [airplane](#) comes in to land, it decelerates and rolls to a stop.

delta wing

A [sweepback wing](#) that looks like a triangle from above. The [trailing edge](#) of the [wing](#) is the base of the triangle. The XB-70A is an example of an [airplane](#) that has a delta wing. The XB-70A can fly faster than twice the [speed of sound](#) at an [altitude](#) of 70,000 feet.

dihedral angle

The upward angle of the [wings](#) that is formed where the [wings](#) connect to the [fuselage](#).

drag

The [force](#) that resists the motion of the [aircraft](#) through the air. One type of drag is caused by air [molecules](#). As the [aircraft](#) flies through the [molecules](#), they resist the motion of the [aircraft](#). This resistance is due to friction between the air molecules and the surface of the aircraft. [Airplanes](#) are [streamlined](#) to decrease the drag [force](#).

elevators

[Control surfaces](#) on the horizontal part of the tail that are used to make the [airplane pitch](#). [Pulling](#) back on the control stick will raise the elevators. This causes the [aircraft](#) to [pitch](#) and increase the [angle of attack](#).

empennage

The parts of the [airplane](#) located at the tail end. The empennage includes the [horizontal stabilizer](#), the [vertical stabilizer](#), and [elevators](#).

engine

A machine that uses combustion to create energy. An [airplane](#) will normally either have [jet engines](#) or engines that drive one or more [propellers](#). In either case, the engines provide the [thrust force](#) that [pushes](#) the [airplane](#) through the air.

engineer

Someone who designs and builds mechanical or electrical devices. For example, an aeronautical engineer designs and builds [aircraft](#). To do this, an aeronautical engineer must study [aeronautics](#) and understand [fluid dynamics](#) and [aerodynamics](#).

experiment

A set of controlled procedures designed to test an idea or [hypothesis](#). For example, a [flight simulation engineer](#) will design an experiment to test whether or not a [pilot](#) can control an [airplane](#) with a new [wing](#) design.

Federal Aviation Administration (FAA)

The FAA is a government agency, under the Department of Transportation, that oversees all [aviation](#) within the United States. The FAA controls, for example, airport safety, air traffic control, licensing of [pilots](#), inspection of [aircraft](#), and investigates [aviation](#) mishaps.

fin

Another word for the vertical portion of the tail.

flaps

Moveable parts of the [trailing edge](#) of a [wing](#) that are used to increase [lift](#) at slower air speeds. Flaps increase [lift](#) by changing the shape of the [airfoil](#). A [pilot](#) will extend the flaps when the [airplane](#) is landing. By extending the flaps, the [pilot](#) is increasing the [camber](#) of the [wing](#), the size of the [wing](#) and the wing's [angle of attack](#). All of these actions will cause [lift](#) to decrease so the airplane can land more slowly.

flight simulation

A [tool](#) of [aeronautics](#) in which a flight simulator on the ground is used to create an environment where a pilot sees, hears and feels like he or she is in a real [aircraft](#). Flight simulation is used to investigate how an [aircraft](#) responds to a [pilot's](#) movement of the [controls](#).

flight test

A tool of [aeronautics](#) in which a real [aircraft](#) is flown to gather [data](#) which will accurately describe the capabilities of that [aircraft](#). Flight tests are used to investigate how fast, how far and how high an [aircraft](#) can go, and how it handles and performs.

fluid dynamics

The study of how fluids move. Fluids include water and gases (such as air).

force

A [push](#) or a [pull](#) in a certain direction that can be measured. Examples of forces are your hand pushing on a doorknob, and a propeller pulling an airplane through the air.

forward sweep wing

A [wing](#) that is swept toward the front of the [airplane](#), unlike most fast airplanes which have wings that are swept toward the back of the [airplane](#). The X-29 [aircraft](#) is an example of a [supersonic](#) jet that has forward sweep wings. The X-29 is capable of going over one and one-half (1 1/2) times the [speed of sound](#).

fuselage

The part of the [airplane](#) to which the [empennage](#) and [wings](#) are attached. The fuselage is where the passengers and cargo are located. It is [streamlined](#) so that it produces the least possible [drag](#).

general aviation

The operation of [aircraft](#) that belong to the public.

gravity

The natural [force](#) that [pulls](#) an object toward the earth. We experience gravity as weight. An [airplane](#) must generate enough [lift](#) to counteract the weight of the [aircraft](#).

horizontal stabilizer

The horizontal part of the tail. The horizontal stabilizer helps to increase the [stability](#) of the [aircraft](#). It is also known as a [tailplane](#).

hypersonic

Velocity greater than five times the [speed of sound](#). The Hyper-X is a reusable launch vehicle that will fly into space and return. It will fly at hypersonic speeds as it re-enters the atmosphere.

hypothesis

A prediction which needs to be tested to tell if it is correct. An [engineer](#) can offer the hypothesis that a particular [wing](#) shape will not create enough [lift](#) to enable an [airplane](#) to fly. His or her hypothesis must then be tested using one or more of the [tools](#) of [aeronautics](#) to determine if it is correct.

instruments

[Tools](#) used to observe, measure and control . For example, pilots use instruments to measure and observe the altitude, speed and direction of an aircraft.

jet engine

An [engine](#) that works by creating a high-[velocity](#) jet of air to propel the [engine](#) forward.

landing gear

Another word for [undercarriage](#). The landing gear is often retractable - it can be pulled into the fuselage of the aircraft to reduce [drag](#).

lateral axis

The [axis](#) extending through the [center of gravity](#) of an [aircraft](#), and parallel to a line connecting the tips of the [wings](#). The lateral axis is sometimes called the "y" [axis](#). [Pitch](#) is a motion around the lateral axis.

leading edge

The front edge of an [airfoil](#). The leading edge is normally rounded and thicker than the [trailing edge](#).

lift

A [force](#) that is perpendicular to the [airflow](#) around an [aircraft](#). In normal, forward flight, the lift [force](#) "lifts" the [aircraft](#) into the air. [Engineers](#) design [airplanes](#) so that the lift created by the [wings](#) opposes the [weight force](#).

longitudinal axis

The [axis](#) extending through the center of the [fuselage](#) from the nose to the tail. The longitudinal axis is sometimes called the "x" [axis](#). [Roll](#) is a motion around the longitudinal axis.

military aviation

The operation of [aircraft](#) that belong to the Armed Forces. The Air Force YF-23 is an example of an [aircraft](#) that is flown only by the military.

model

A copy of an object that is often times smaller than the original. [Wind tunnel engineers](#) create a model of an [aircraft](#) to put in a [wind tunnel](#). The model is a precise replica of the outside of an [aircraft](#).

molecule

The absolute tiniest part of something that can still be called by that name. For example, two hydrogen atoms and one oxygen atom make up one molecule of water.

monoplane

An [airplane](#) with one set of [wings](#). Most [aircraft](#) built today have only one set of [wings](#) and are classified as monoplanes.

National Advisory Committee for Aeronautics (NACA)

NACA was a government agency that was started in 1917. NACA guided [research](#) in [aeronautics](#) until 1958 when its name was changed to the National [Aeronautics](#) and Space Administration ([NASA](#)).

National Aeronautics and Space Administration (NASA)

In 1958, NASA was created as a government agency to replace [NACA](#). NASA's charter is to expand frontiers in air and space, to inspire and serve America, and to benefit the quality of life on Earth.

<http://quest.arc.nasa.gov/aero/wright/tunnels/glossary.html#engineer>

opposing forces

Forces that are **pushing** or **pulling** in the opposite direction. For example, **lift** is perpendicular to the **airflow** around an **aircraft**. If the **aircraft** is flying straight and level, the **lift force** (which is **pulling** up) will be opposing the **weight force** (which is **pulling** the **aircraft** toward the earth).

payload

The load carried by an **aircraft** that includes passengers and cargo.

pilot

A person who flies an **aircraft**.

pitch

A **rotational motion** in which an **airplane** turns around its **lateral axis**. **Pushing** forward on the control stick will lower the **elevators**, which forces the tail upward. The **pilot** will then see the nose of the **aircraft** fall or pitch.

pressure

A **force** being exerted on part of a surface. When you stand, your feet put pressure on the ground. **Air pressure** refers to air **molecules** pressing against a surface like the bottom of a **wing**.

propeller

A device that consists of blades (shaped like **airfoils**) that spin around a central hub, like a fan. An **engine** causes the blades to turn. When the blades turn, they create **thrust** by biting into the air and forcing it to move back. The amount of **thrust** can be controlled by changing the speed of the propellers.

pull

To use **force** to bring something closer. The **force** of **gravity** pulls objects closer to the Earth.

push

To use **force** to move something ahead or to the side. During takeoff the **thrust force**, created by the **engines**, pushes an **airplane** down the runway.

reconnaissance

In **aviation**, to fly over and look closely at an area below to gather information about it.

research

A carefully planned and performed investigation, searching for previously unknown facts.

regimes of flight

A way of placing **aircraft** into different categories based on their speeds. The regimes of flight are **subsonic**, **transonic**, **supersonic** and **hypersonic**.

roll

A **rotational motion** in which the aircraft turns around its **longitudinal axis**. **Pushing** the control stick to the left will raise the **aileron** on the left **wing** and lower the **aileron** on the right **wing**. This will cause the **airplane** to roll to the left. The **pilot** will see the left **wing** tip fall and the right **wing** tip rise.

rotational motion

The turning of an object, like an **airplane**, around an **axis**, or a **propeller** around a hub. **Pitch**, **roll** and **yaw** are the rotational motions of an **airplane** around the **lateral**, **longitudinal** and **vertical axes**.

rudder

A [control surface](#) on the [trailing edge](#) of the vertical part of the tail that is used to make the [aircraft yaw](#). The rudder is controlled by rudder pedals. [Pushing](#) the left rudder pedal will tilt the rudder to the left. This will cause the nose of the [aircraft](#) to turn to the left.

scientific method

A systematic way of solving a problem or answering a question using observation and measurement. The six steps of the scientific method are: state the problem, create a [hypothesis](#), design an [experiment](#), perform the [experiment](#), organize and [analyze](#) the [data](#), draw conclusions.

simulator

A device that creates an environment that is as close as possible to reality. In flight simulators, [engineers](#) create a [cockpit](#) environment identical to the one in a real [airplane](#). In a flight simulator a [pilot](#) will see, hear and feel like he or she is in a real [aircraft](#).

skids

a sled-like runner used as part of the [landing gear](#) for an [aircraft](#).

speed of sound

The speed at which sound waves travel. If you stand a distance away from a friend and say something to him, the sound waves of your voice will travel very quickly to the ear of your friend. The speed of sound is the speed at which those waves traveled.

spoiler

A device, normally located on the top of the [wing](#), for changing the [airflow](#) around a [wing](#) to reduce [lift](#). [Pilots](#) deploy spoilers when they land so that the [airplane](#) is no longer "[lifted](#)" into the air.

stability

The condition of being steady. A motion of an [aircraft](#) is said to have stability, or be stable, if the [aircraft](#) will return to that motion after a disturbance, without the [pilot](#) having to move the [controls](#).

stabilizer

A surface that helps to provide [stability](#) for an [aircraft](#). An [airplane](#) has two stabilizers: a [vertical stabilizer](#) and a [horizontal stabilizer](#). Stabilizers are like the feathers on an arrow, which keep the arrow pointed in the right direction.

stall

A breakdown of the [airflow](#) over a [wing](#), which suddenly reduces [lift](#). When an [airplane](#) stalls it will usually drop suddenly. [Pilots](#) know how to recover from a stall and smooth out the [airflow](#) over the [wings](#) to produce more [lift](#) again.

straight wing

A [wing](#) that sticks straight out from the [fuselage](#) - it does not slant to the front or the rear. The ER-2 is an example of an [aircraft](#) that has straight wings.

streamline

To shape an object so that it creates less [drag](#) and moves smoothly and easily through the air. [Airfoils](#) are streamlined, as is the [fuselage](#).

subsonic

[Velocity](#) less than the [speed of sound](#). The MD-11 is a subsonic [aircraft](#) because it never flies above the [speed of sound](#).

supercomputer

A [computer](#) that is especially designed to receive, process and present very large amounts of [data](#) very quickly. The Cray Y-MP is an example of a supercomputer that is resident at [NASA](#) Ames Research Center and is used for [CFD](#).

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supersonic

Velocity greater than the speed of sound. The SR-71 is characterized as a supersonic aircraft because it travels from three to four times the speed of sound. A supersonic aircraft can fly from New York to London in less than two hours.

sweepback wing

A wing that is slanted toward the rear of the airplane. The F-18 aircraft is an example of a supersonic jet that has sweepback wings.

tailplane

Another word for a horizontal stabilizer.

takeoff

The process of using the thrust of the engines to accelerate an airplane down a runway until enough lift is generated so that the aircraft begins to fly.

test pilot

A pilot that is specially trained to test aircraft. Test pilots must be exceptional pilots, have a complete understanding of aeronautics and aerodynamics, and be able to accurately write and speak about what they see, feel and hear during the testing of an aircraft.

thrust

A force created by the engines that pushes an aircraft through the air.

tool

A device or process that is used to do some kind of work. A hand-held calculator is a tool for doing mathematics accurately and quickly. The tools of aeronautics (CFD, Wind Tunnel Testing, Flight Simulation and Flight Test) are processes that use special devices to perform research in aeronautics.

trailing edge

The rear edge of an airfoil. The trailing edge is normally thin and sharp. The ailerons are normally located on the trailing edge of the wing.

translational motion

Motion along a straight line, such as an axis. The translational motions of an aircraft are forward and back along the longitudinal axis, side to side along the lateral axis, and up and down along the vertical axis.

transonic

Velocity between nine tenths (.9) and one and four tenths (1.4) times the speed of sound. The X-1 was the first aircraft to fly faster than the speed of sound. Several versions of the X-1 were built. One succeeded at flying twice the speed of sound at an altitude of 90,000 feet.

turbulence

Air flow which is not smooth and steady. When an airplane flies through turbulent air, it can unexpectedly rise, drop, roll, pitch or yaw very abruptly.

undercarriage

The part of an aircraft that provides support while the aircraft is on the ground. It includes wheels, shock absorbers and support struts. There is an undercarriage unit under the nose of the aircraft as well as approximately midway back, under the fuselage. Undercarriage normally includes rubber tires, but may have skis for landing on snow or floats for landing on water.

variable sweep wing

Wings that are hinged so they can be slanted forward or backward during flight. The F-14 aircraft is an example of a supersonic jet with variable sweep wings.

velocity

The speed of an object, in a certain direction.

vertical axis

The axis extending straight up and down through the center of gravity of an aircraft. The vertical axis is perpendicular to the longitudinal and lateral axes. The vertical axis is sometimes called the "z" axis. Yaw is a motion around the vertical axis.

vertical stabilizer

The vertical part of the tail. The vertical stabilizer helps to increase the stability of the aircraft. It is also known as a fin.

weight

The force of gravity acting on an object. The weight force pulls an aircraft toward the Earth and must be overcome by a combination of lift and thrust.

wind tunnel testing

A tool of aeronautics that involves placing a model of an aircraft or part of an aircraft into a wind tunnel and using instruments to gather data while air is blown past the model. Wind tunnel testing is used to investigate and accurately describe the effects of airflow on an aircraft or part of an aircraft.

wind tunnel

A wind tunnel is a tube or cylinder in which a model of an airplane or part of an airplane is placed. Air is blown past the model so that it experiences the same forces as it would if it were actually flying. The struts that hold the model in place measure these forces.

wing

A part of an airplane that is attached to the fuselage. Wings are shaped like airfoils and are used to provide lift for the airplane. There are four basic types of wings: straight, sweep, delta and variable sweep.

wing warping:

a mechanism to provide lateral control of the aircraft through flexible wing tips; wires enabled the wing tips to arch so that the ends of the wings were four inches lower than the center (the concept was devised by the Wrights after observing the wing tips of a hawk in flight).

yaw

A rotational motion in which the aircraft turns around its vertical axis. This causes the aircraft's nose to move to the pilot's right or left. Pushing the right rudder pedal will tilt the rudder to the right. The pilot will see the nose of the aircraft turn to the right.