

# Glossary

## A

**Advection.** The transport of an atmospheric variable due to mass motion by the wind. Usually the term as used in meteorology refers only to horizontal transport.

**Ailerons.** The hinged portion of the trailing edge of the outer wing used to bank or roll around the longitudinal axis.

**Air density.** The mass of air per unit volume.

**Airfoil.** The surfaces on a glider that produce lift.

**Air mass.** A widespread mass of air having similar characteristics (e.g., temperature), that usually helps to identify the source region of the air. Fronts are distinct boundaries between air masses.

**Amplitude.** In wave motion, one half the distance between the wave crest and the wave trough.

**Angle of attack.** The angle formed between the relative wind and the chord line of the wing.

**Angle of incidence.** The angle between the chord line of the wing and the longitudinal axis of the glider. The angle of incidence is built into the glider by the manufacturer and cannot be adjusted by the pilot's movements of the controls.

**Aspect ration.** The ratio between the wing span and the mean chord of the wing.

**Asymmetrical airfoil.** One in which the upper camber differs from the lower camber.

**Atmospheric sounding.** A measure of atmospheric variables aloft, usually pressure, temperature, humidity, and wind.

**Atmospheric stability.** Describes a state in which an air parcel resists vertical displacement or, once displaced (for instance by flow over a hill), tends to return to its original level.

## B

**Bailout bottle.** Small oxygen cylinder connected to the oxygen mask supplying several minutes of oxygen. It can be used in case of primary oxygen system failure or if an emergency bailout at high altitude became necessary.

**Ballast.** Term used to describe any system that adds weight to the glider. Performance ballast employed in some gliders increases wing loading using releasable water in the wings (via integral tanks or water bags). This allows faster average cross-country speeds. Trim ballast is used to adjust the flying CG, often necessary for light-weight pilots. Some gliders also have a small water ballast tank in the tail for optimizing flying CG.

**Barograph.** Instrument for recording pressure as a function of time. Used by glider pilots to verify flight performance for badge or record flights.

**Best glide speed (best L/D speed).** The airspeed that results in the least amount of altitude loss over a given distance. This speed is determined from the performance polar. The manufacturer publishes the best glide (L/D) airspeed for specified weights and the resulting glide ratio. For example, a glide ratio of 36:1 means that the glider will lose 1 foot of altitude for every 36 feet of forward movement in still air at this airspeed.

## C

**Camber.** The curvature of a wing when looking at a cross section. A wing has upper camber on its top surface and lower

camber on its bottom surface.

**Cap cloud.** Also called a foehn cloud. These are clouds forming on mountain or ridge tops by cooling of moist air rising on the upwind side followed by warming and drying by downdrafts on the lee side.

**Centering.** Adjusting circles while thermalling to provide the greatest average climb.

**Center of pressure.** The point along the wing chord line where lift is considered to be concentrated.

**Centrifugal force.** The apparent force occurring in curvilinear motion acting to deflect objects outward from the axis of rotation. For instance, when pulling out of a dive, it is the force pushing you down in your seat.

**Centripetal force.** The force in curvilinear motion acting toward the axis of rotation. For instance, when pulling out of a dive, it is the force that the seat exerts on the pilot to offset the centrifugal force.

**Chord line.** An imaginary straight line drawn from the leading edge of an airfoil to the trailing edge.

**Cloud streets.** Parallel rows of cumulus clouds. Each row can be as short as 10 miles or as long as a 100 miles or more.

**Cold soaked.** Condition of a self-launch or sustainer engine making it difficult or impossible to start in flight due to long-time exposure to cold temperatures. Usually occurs after a long soaring flight at altitudes with cold temperatures (e.g., a wave flight).

**Convection.** Transport and mixing of an atmospheric variable due to vertical mass motions (e.g., updrafts).

**Convective condensation level (CCL).** The level at which cumulus forms from surface-based convection. Under this level, the air is dry adiabatic and the mixing ratio is constant.

**Conventional tail.** A glider design with the horizontal stabilizer mounted at the bottom of the vertical stabilizer.

**Convergence.** A net increase in the mass of air over a specified area due to horizontal wind speed and/or direction changes. When convergence occurs in lower levels, it is usually associated with upward air motions.

**Convergence zone.** An area of convergence, sometimes several miles wide, at other times very narrow. These zones often provide organized lift for many miles (e.g., a sea-breeze front).

**Critical angle of attack.** Angle of attack, typically around 18°, beyond which a stall occurs. The critical angle of attack can be exceeded at any airspeed and at any nose attitude.

**Cross-country.** In soaring, any flight out of gliding range of the takeoff airfield. Note that this is different from the definitions in the 14 CFR for meeting the experience requirements for various pilot certificates and/or ratings.

**Cumulus congestus.** A cumulus cloud of significant vertical extent and usually displaying sharp edges. In warm climates, these sometimes produce precipitation. Also called towering cumulus, these clouds indicate that thunderstorm activity may soon occur.

**Cumulonimbus (CB).** Also called thunderclouds, these are deep convective clouds with a cirrus anvil and may contain any of the characteristics of a thunderstorm: thunder, lightning, heavy rain, hail, strong winds, turbulence, and even tornadoes.

## D

**Dead reckoning.** Navigation by computing a heading from true airspeed and wind, then estimating time needed to fly to a destination.

**Density altitude.** Pressure altitude corrected for nonstandard temperature variations. Performance charts for many older gliders are based on this value.

**Dewpoint (or dewpoint temperature).** The temperature to which a sample of air must be cooled, while the amount of water vapor and barometric pressure remain constant, in order to attain saturation with respect to water.

**Dihedral.** The angle at which the wings are slanted upward from the root to the tip.

**Diurnal effects.** A variation (may be in temperature, moisture, wind, cloud cover, etc.) that recurs every 24 hours.

**Downburst.** A strong, concentrated downdraft, often associated with a thunderstorm. When these reach the ground, they spread out, leading to strong and even damaging surface winds.

**Drag.** The force that resists the movement of the glider through the air.

**Dry adiabat.** A line on a thermodynamic chart representing a rate of temperature change at the dry adiabatic lapse rate.

**Dry adiabatic lapse rate (DALR).** The rate of decrease of temperature with height of unsaturated air lifted adiabatically (not heat exchange). Numerically the value is 3 °C or 5.4 °F per 1,000 feet.

**Dust devil.** A small vigorous circulation that can pick up dust or other debris near the surface to form a column hundreds or even thousands of feet deep. At the ground, winds can be strong enough to flip an unattended glider over on its back. Dust devils mark the location where a thermal is leaving the ground.

**Dynamic stability.** A glider's motion and time required for a response to static stability.

## E

**Elevator.** Attached to the back of the horizontal stabilizer, it controls movement around the lateral axis.

**Empennage.** The tail group of the aircraft usually supporting the vertical stabilizer and rudder, as well as the horizontal stabilizer and elevator, or on some aircraft, the V-Tail.

## F

**Flaps.** Hinged portion of the trailing edge between the ailerons and fuselage. In some gliders, ailerons and flaps are interconnected to produce full-span flaperons. In either case, flap change the lift and drag on the wing.

**Flutter.** Resonant condition leading to rapid, unstable oscillations of part of the glider structure (e.g., the wing) or a control surface (e.g., elevator or aileron). Flutter usually occurs at high speeds and can quickly lead to structural failure.

**Forward slip.** A slide used to dissipate altitude without increasing the glider's speed, particularly in gliders without flaps or with inoperative spoilers.

## G

**Glider.** A heavier-than-air aircraft that is supported in flight by the dynamic reaction of the air against its lifting surfaces, and whose free flight does not depend on an engine.

**Graupel.** Also called soft hail or snow pellets, these are white, round or conical ice particles  $\frac{1}{8}$  to  $\frac{1}{4}$  inch in diameter. They often form as a thunderstorm matures and indicate the likelihood of lightning.

**Ground effect.** A reduction in induced drag for the same amount of lift produced. Within one wingspan above the ground, the decrease in induced drag enables the glider to fly at a lower airspeed. In ground effect, a lower angle of attack is required to produce the same amount of lift.

## H

**Height band.** The altitude range in which the thermals are strongest on any given day. Remaining with the height band on a cross-country flight should allow the fastest average speed.

**House thermal.** A thermal that forms frequently in the same or similar location.

**Human factors.** The study of how people interact with their environments. In the case of general aviation, it is the study of how pilot performance is influenced by such issues as the design of cockpits, the function of the organs of the body, the effects of emotions, and the interaction and communication with the other participants of the aviation community, such as other crewmembers and air traffic control personnel.

## I

**Induced drag.** Drag that is the consequence of developing lift with a finite-span wing. It can be represented by a vector that results from the difference between total and vertical lift.

**Inertia.** The tendency of a mass at rest to remain at rest or, if in motion, to remain in motion unless acted upon by some external force.

**Instrument meteorological conditions (IMC).** Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling less than the minimum specified for visual meteorological conditions (VMC). Gliders rarely fly in IMC due to instrumentation and air traffic control requirements.

**Inversion.** Usually refers to an increase in temperature with height, but may also be used for other atmospheric variables.

**Isohumes.** Lines of equal relative humidity.

**Isopleth.** A line connecting points of constant or equal value.

**Isotherm.** A contour line of equal temperature.

## K

**Katabatic.** Used to describe any wind blowing down slope.

**Kinetic energy.** Energy due to motion, defined as one half mass times velocity squared.

## L

**Lapse rate.** The decrease with height of an atmospheric variable, usually referring to temperature, but can also apply to pressure or density.

**Lateral axis.** An imaginary straight line drawn perpendicularly (laterally) across the fuselage and through the center of gravity. Pitch movement occurs around the lateral axis, and is controlled by the elevator.

**Lenticular cloud.** Smooth, lens-shaped clouds marking mountain-wave crests. They may extend the entire length of the mountain range producing the wave and are also called wave clouds or lennies by glider pilots.

**Lift.** Produced by the dynamic effects of the airstream acting on the wing, lift opposes the downward force of weight.

**Limit load.** The maximum load, expressed as multiples of positive and negative G (force of gravity), that an aircraft can sustain before structural damage becomes possible. The load limit varies from aircraft to aircraft.

**Load factor.** The ratio of the load supported by the glider's wings to the actual weight of the aircraft and its contents.

**Longitudinal axis.** An imaginary straight line running through the fuselage from nose to tail. Roll movement occurs around the longitudinal axis, and is controlled by the ailerons.

## M

**Mesoscale convection system (MCS).** A large cluster of thunderstorms with horizontal dimensions on the order of 100 miles. MCSs are sometimes organized in a long line of thunderstorms (e.g., a squall line) or as a random grouping of thunderstorms. Individual thunderstorms within the MCS may be severe.

**Microburst.** A small-sized downburst of 2.2 nautical mile or less horizontal dimension.

**Minimum sink airspeed.** Airspeed, as determined by the performance polar, at which the glider achieves the lowest sink rate. That is, the glider loses the least amount of altitude per unit of time at minimum sink airspeed.

**Mixing ration.** The ratio of the mass of water vapor to the mass of dry air.

**Multicell thunderstorm.** A group or cluster of individual thunderstorm cells with varying stages of development. These storms are often self propagating and may last for several hours.

## O

**Olphin flight.** Straight flight following speed-to-fly theory. Glides can often be extended and average cross-country speeds increased by flying faster in sink and slower in lift without stopping to circle.

## P

**Parasite drag.** Drag caused by any aircraft surface that deflects or interferes with the smooth airflow around the airplane.

**Pilotage.** Navigational technique based on flight by reference to ground landmarks.

**Pilot-induced oscillation (PIO).** Rapid oscillations caused by the pilot's overcontrolled motions. PIOs usually occur on takeoff or landings with pitch-sensitive gliders and in severe cases can lead to loss of control or damage.

**Pitch attitude.** The angle of the longitudinal axis relative to the horizon. Pitch attitude serves as a visual reference for the pilot to maintain or change airspeed.

**Pitot-static system.** System that powers the airspeed altimeter and variometer by relying on air pressure differences to measure glider speed, altitude, and climb or sink rate.

**Placards.** Small statements or pictorial signs permanently fixed in the cockpit and visible to the pilot. Placards are used for operating limitations (e.g., weight or speeds) or to indicate the position of an operating lever (e.g., landing gear retracted or down and locked).

**Precipitable water.** The amount of liquid precipitation that would result if all water vapor were condensed.

**Pressure altitude.** The height above the standard pressure level of 29.92 "Hg. It is obtained by setting 29.92 in the barometric pressure window and reading the altimeter.

## R

**Radiant energy.** Energy due to any form of electromagnetic radiation (e.g., from the sun).

**Radius of turn.** The horizontal distance an aircraft uses to complete a turn.

**Rate of turn.** The amount of time it takes for a glider to turn a specified number of degrees.

**Relative wind.** The airflow caused by the motion of the aircraft through the air. Relative wind, also called relative airflow, is opposite and parallel to the direction of flight.

**Rotor.** A turbulent circulation under mountain-wave crests, to the lee side and parallel to the mountains creating the wave. Glider pilots use the term rotor to describe any low-level turbulent flow associated with mountain waves.

**Rotor streaming.** A phenomenon that occurs when the air flow at mountain levels may be sufficient for wave formation, but begins to decrease with altitude above the mountain. In this case, the air downstream of the mountain breaks up and becomes turbulent, similar to rotor, with no lee waves above.

**Rudder.** Attached to the back of the vertical stabilizer, the rudder controls movement about the vertical axis.

## S

**Sailplane.** A glider used for traveling long distances and remaining aloft for extended periods of time.

**Saturated Adiabatic Lapse Rate (SALR).** The rate of temperature decrease with height of saturated air. Unlike the dry adiabatic lapse rate (DALR), the SALR is not a constant numerical value but varies with temperature.

**Self-launching glider.** A glider equipped with an engine, allowing it to be launched under its own power. When the engine is shut down, a self-launching glider displays the same characteristics as a non-powered glider.

**Side slip.** A slip in which the glider's longitudinal axis remains parallel to the original flightpath but in which the flightpath changes direction according to the steepness of the bank.

**Slip.** A descent with one wing lowered and the glider's longitudinal axis at an angle to the flightpath. A slip is used to steepen the approach path without increasing the airspeed, or to make the glider move sideways through the air, counteracting the drift resulting from a crosswind.

**Speed to fly.** Optimum speed through the (sinking or rising) air mass to achieve either the furthest glide or fastest average cross-country speed depending on the objectives during a flight.

**Spin.** An aggravated stall that results in the glider descending in a helical, or corkscrew, path.

**Spoilers.** Devices on the tops of wings to disturb (spoil) part of the airflow over the wing. The resulting decrease in lift creates a higher sink rate and allows for a steeper approach.

**Squall line.** A line of thunderstorms often located along or ahead of a vigorous cold front. Squall lines may contain severe thunderstorms. The term is also used to describe a line of heavy precipitation with an abrupt wind shift but no thunderstorms, as sometimes occurs in association with fronts.

**Stabilator.** A one-piece horizontal stabilizer used in lieu of an elevator.

**Stability.** The glider's ability to maintain a uniform flight condition and return to that condition after being disturbed.

**Stall.** Condition that occurs when the critical angle of attack is reached and exceeded. Airflow begins to separate from the top of the wing, leading to a loss of lift. A stall can occur at any pitch attitude or airspeed.

**Standard atmosphere.** A theoretical vertical distribution of pressure, temperature and density agreed upon by international convention. It is the standard used, for instance, for aircraft performance calculations. At sea level, the standard atmosphere consists of a barometric pressure of 29.92 inches of mercury ("Hg) or 1013.2 millibars, and a temperature of 15 °C (59 °F). Pressure and temperature normally decrease as altitude increases. The standard lapse rate in the lower atmosphere for each 1,000 feet of altitude is approximately 1 "Hg. and 2 °C (3.5 °F). For example, the standard pressure and temperature at 3,000 feet mean sea level (MSL) is 26.92 "Hg. (29.92 – 3) and 9 °C (15 °C – 6 °C).

**Static stability.** The initial tendency to return to a state of equilibrium when disturbed from that state.

**Supercell thunderstorm.** A large, powerful type of thunderstorm that forms in very unstable environments with vertical and horizontal wind shear. These are almost always associated with severe weather, strong surface winds, large hail, and/or tornadoes.

## T

**T-tail.** A type of glider with the horizontal stabilizer mounted on the top of the vertical stabilizer forming a T.

**Thermal.** A buoyant plume or bubble of rising air.

**Thermal index (TI).** For any given level is the temperature of the air parcel having risen at the dry adiabatic lapse rate (DALR) subtracted from the ambient temperature. Experience has shown that a TI should be  $-2$  for thermals to form and be sufficiently strong for soaring flight.

**Thermal wave.** Waves, often but not always marked by cloud streets, that are excited by convection disturbing an overlying stable layer. Also called convection waves.

**Thermodynamic diagram.** A chart presenting isopleths of pressure, temperature, water vapor content, as well as dry and saturated adiabats. Various forms exist, the most commonly used in the United States being the Skew-T/Log-P.

**Thrust.** The forward force that propels a powered glider through the air.

**Total drag.** The sum of parasite and induced drag.

**Towhook.** A mechanism allowing the attachment and release of a towrope on the glider or towplane. On gliders, it is located near the nose or directly ahead of the main wheel. Two types of towhooks commonly used in gliders are manufactured by Tost and Schweizer.

**Trim devices.** Any device designed to reduce or eliminate pressure on the control stick. When properly trimmed, the glider should fly at the desired airspeed with no control pressure from the pilot (i.e., hands off). Trim mechanisms are either external tabs on the elevator (or stabilator) or a simple spring-tension system connected to the control stick.

**True altitude.** The actual height of an object above mean sea level.

## V

**V-tail.** A type of glider with two tail surfaces mounted to form a V. V-tails combine elevator and rudder movements.

**Variometer.** Sensitive rate of climb or descent indicator that measures static pressure between the static ports and an external capacity. Variometers can be mechanical or electrical and can be compensated to eliminate unrealistic indications of lift and sink due to rapid speed changes.

**Vertical axis.** An imaginary straight line drawn through the center of gravity and perpendicular to the lateral and longitudinal axes. Yaw movement occurs around the vertical axis and is controlled by the rudder.

**Visual meteorological conditions (VMC).** Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than a specified minimum. VMC represents minimum conditions for safe flight using visual reference for navigation and traffic separation. Ceilings and visibility below VMC constitutes instrument meteorological conditions (IMC).

## W

**Washout.** Slight twist built in towards the wingtips, designed to improve the stall characteristics of the wing.

**Water vapor.** Water present in the air while in its vapor form. It is one of the most important of atmospheric constituents.

**Wave length.** The distance between two wave crests or wave troughs.

**Wave window.** Special areas arranged by Letter of Agreement (LOA) with the controlling ATC wherein gliders may be allowed to fly under VFR in Class A Airspace at certain times and to certain specified altitudes.

**Weight.** Acting vertically through the glider's center of gravity, weight opposes lift.

**Wind triangle.** Navigational calculation allowing determination of true heading with a correction for crosswinds on course.