

Glossary

Absolute altitude. The actual distance an object is above the ground.

Advancing blade. The blade moving in the same direction as the helicopter. In helicopters that have counterclockwise main rotor blade rotation as viewed from above, the advancing blade is in the right half of the rotor disk area during forward movement.

Agonic Line. An isogonic line along which there is no magnetic variation.

Air density. The density of the air in terms of mass per unit volume. Dense air has more molecules per unit volume than less dense air. The density of air decreases with altitude above the surface of the earth and with increasing temperature.

Aircraft pitch. The movement of the aircraft about its lateral, or pitch, axis. Movement of the cyclic forward or aft causes the nose of the helicopter to pitch up or down.

Aircraft roll. The movement of the aircraft about its longitudinal axis. Movement of the cyclic right or left causes the helicopter to tilt in that direction.

Airfoil. Any surface designed to obtain a useful reaction of lift, or negative lift, as it moves through the air.

Airworthiness Directive. When an unsafe condition exists with an aircraft, the FAA issues an Airworthiness Directive to notify concerned parties of the condition and to describe the appropriate corrective action.

Altimeter. An instrument that indicates flight altitude by sensing pressure changes and displaying altitude in feet or meters.

Angle of attack. The angle between the airfoil's chord line and the relative wind.

Antitorque pedal. The pedal used to control the pitch of the tail rotor or air diffuser in a NOTAR® system.

Antitorque rotor. See tail rotor.

Articulated rotor. A rotor system in which each of the blades is connected to the rotor hub in such a way that it is free to change its pitch angle, and move up and down and fore and aft in its plane of rotation.

Autopilot. Those units and components that furnish a means of automatically controlling the aircraft.

Autorotation. The condition of flight during which the main rotor is driven only by aerodynamic forces with no power from the engine.

Axis of rotation. The imaginary line about which the rotor rotates. It is represented by a line drawn through the center of, and perpendicular to, the tip-path plane.

Basic empty weight. The weight of the standard helicopter, operational equipment, unusable fuel, and full operating fluids, including full engine oil.

Blade coning. An upward sweep of rotor blades as a result of lift and centrifugal force.

Blade damper. A device attached to the drag hinge to restrain the fore and aft movement of the rotor blade.

Blade feather or feathering. The rotation of the blade around the spanwise (pitch change) axis.

Blade flap. The ability of the rotor blade to move in a vertical direction. Blades may flap independently or in unison.

Blade grip. The part of the hub assembly to which the rotor blades are attached, sometimes referred to as blade forks.

Blade lead or lag. The fore and aft movement of the blade in the plane of rotation. It is sometimes called "hunting" or "dragging."

Blade loading. The load imposed on rotor blades, determined by dividing the total weight of the helicopter by the combined area of all the rotor blades.

Blade root. The part of the blade that attaches to the blade grip.

Blade span. The length of a blade from its tip to its root.

Blade stall. The condition of the rotor blade when it is operating at an angle of attack greater than the maximum angle of lift.

Blade tip. The furthestmost part of the blade from the hub of the rotor.

Blade track. The relationship of the blade tips in the plane of rotation. Blades that are in track will move through the same plane of rotation.

Blade tracking. The mechanical procedure used to bring the blades of the rotor into a satisfactory relationship with each other under dynamic conditions so that all blades rotate on a common plane.

Blade twist. The variation in the angle of incidence of a blade between the root and the tip.

Blowback. The tendency of the rotor disk to tilt aft in transition to forward flight as a result of unequal airflow.

Calibrated airspeed (CAS). Indicated airspeed of an aircraft, corrected for installation and instrumentation errors.

Center of gravity. The theoretical point where the entire weight of the helicopter is considered to be concentrated.

Center of pressure. The point where the resultant of all the aerodynamic forces acting on an airfoil intersects the chord.

Centrifugal force. The apparent force that an object moving along a circular path exerts on the body constraining the object and that acts outwardly away from the center of rotation.

Centripetal force. The force that attracts a body toward its axis of rotation. It is opposite centrifugal force.

Chip detector. A warning device that alerts you to any abnormal wear in a transmission or engine. It consists of a magnetic plug located within the transmission. The magnet attracts any metal particles that have come loose from the bearings or other transmission parts. Most chip detectors have

warning lights located on the instrument panel that illuminate when metal particles are picked up.

Chord. An imaginary straight line between the leading and trailing edges of an airfoil section.

Chordwise axis. For semirigid rotors, a term used to describe the flapping or teetering axis of the rotor.

Coaxial rotor. A rotor system utilizing two rotors turning in opposite directions on the same centerline. This system is used to eliminate the need for a tail rotor.

Collective pitch control. The control for changing the pitch of all the rotor blades in the main rotor system equally and simultaneously and, consequently, the amount of lift or thrust being generated.

Coning. See blade coning.

Coriolis effect. The tendency of a rotor blade to increase or decrease its velocity in its plane of rotation when the center of mass moves closer to or farther from the axis of rotation.

Cyclic feathering. The mechanical change of the angle of incidence, or pitch, of individual rotor blades, independent of other blades in the system.

Cyclic pitch control. The control for changing the pitch of each rotor blade individually as it rotates through one cycle to govern the tilt of the rotor disk and, consequently, the direction and velocity of horizontal movement.

Delta hinge. A flapping hinge with an axis skewed so that the flapping motion introduces a component of feathering that would result in a restoring force in the flap-wise direction.

Density altitude. Pressure altitude corrected for nonstandard temperature variations.

Deviation. A compass error caused by magnetic disturbances from the electrical and metal components in the aircraft. The correction for this error is displayed on a compass correction card placed near the magnetic compass of the aircraft.

Direct control. The ability to maneuver a helicopter by tilting the rotor disk and changing the pitch of the rotor blades.

Direct shaft turbine. A single-shaft turbine engine in which the compressor and power section are mounted on a common driveshaft.

Disk area. The area swept by the blades of the rotor. It is a circle with its center at the hub and has a radius of one blade length.

Disk loading. The total helicopter weight divided by the rotor disk area.

Dissymmetry of lift. The unequal lift across the rotor disk resulting from the difference in the velocity of air over the advancing blade half and the velocity of air over the retreating blade half of the rotor disk area.

Drag. An aerodynamic force on a body acting parallel and opposite to relative wind.

Dual rotor. A rotor system utilizing two main rotors.

Dynamic rollover. The tendency of a helicopter to continue rolling when the critical angle is exceeded, if one gear is on the ground, and the helicopter is pivoting around that point.

Feathering. The action that changes the pitch angle of the rotor blades by rotating them around their feathering (spanwise) axis.

Feathering axis. The axis about which the pitch angle of a rotor blade is varied. Sometimes referred to as the spanwise axis.

Feedback. The transmittal of forces, which are initiated by aerodynamic action on rotor blades, to the cockpit controls.

Flapping. The vertical movement of a blade about a flapping hinge.

Flapping hinge. The hinge that permits the rotor blade to flap and thus balance the lift generated by the advancing and retreating blades.

Flare. A maneuver accomplished prior to landing to slow a helicopter.

Free turbine. A turboshaft engine with no physical connection between the compressor and power output shaft.

Freewheeling unit. A component of the transmission or power train that automatically disconnects the main rotor from the engine when the engine stops or slows below the equivalent rotor rpm.

Fully articulated rotor system. See articulated rotor system.

Gravity. See weight.

Gross weight. The sum of the basic empty weight and useful load.

Ground effect. A usually beneficial influence on helicopter performance that occurs while flying close to the ground. It results from a reduction in upwash, downwash, and bladetip vortices, which provide a corresponding decrease in induced drag.

Ground resonance. Selfexcited vibration occurring whenever the frequency of oscillation of the blades about the lead-lag axis of an articulated rotor becomes the same as the natural frequency of the fuselage.

Gyroscopic procession. An inherent quality of rotating bodies, which causes an applied force to be manifested 90° in the direction of rotation from the point where the force is applied.

Human factors. The study of how people interact with their environment. 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 other participants in the aviation community, such as other crew members and air traffic control personnel.

Hunting. Movement of a blade with respect to the other blades in the plane of rotation, sometimes called leading or lagging.

In ground effect (IGE) hover. Hovering close to the surface (usually less than one rotor diameter distance above the surface) under the influence of ground effect.

Induced drag. That part of the total drag that is created by the production of lift.

Induced flow. The component of air flowing vertically through the rotor system resulting from the production of lift.

Inertia. The property of matter by which it will remain at rest or in a state of uniform motion in the same direction unless acted upon by some external force.

Isogonic line. Lines on charts that connect points of equal magnetic variation.

Knot. A unit of speed equal to one nautical mile per hour.

$L_{D_{MAX}}$. The maximum ratio between total lift (L) and total drag (D). This point provides the best glide speed. Any deviation from the best glide speed increases drag and reduces the distance you can glide.

Lateral vibration. A vibration in which the movement is in a lateral direction, such as imbalance of the main rotor.

Lead and lag. The fore (lead) and aft (lag) movement of the rotor blade in the plane of rotation.

Licensed empty weight. Basic empty weight not including full engine oil, just undrainable oil.

Lift. One of the four main forces acting on a helicopter. It acts perpendicular to the relative wind.

Load factor. The ratio of a specified load weight to the total weight of the aircraft.

Married needles. A term used when two hands of an instrument are superimposed over each other, as on the engine/rotor tachometer.

Mast. The component that supports the main rotor.

Mast bumping. Action of the rotor head striking the mast, occurring on underslung rotors only.

Navigational aid (NAVAID). Any visual or electronic device, airborne or on the surface, that provides point-to-point guidance information, or position data, to aircraft in flight.

Night. The time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the American Air Almanac.

Normally aspirated engine. An engine that does not compensate for decreases in atmospheric pressure through turbocharging or other means.

One-to-one vibration. A low frequency vibration having one beat per revolution of the rotor. This vibration can be either lateral, vertical, or horizontal.

Out of ground effect (OGE) hover. Hovering a distance greater than one disk diameter above the surface. Because induced drag is greater while hovering out of ground effect, it takes more power to achieve a hover out of ground effect.

Parasite drag. The part of total drag created by the form or shape of helicopter parts.

Payload. The term used for the combined weight of passengers, baggage, and cargo.

Pendular action. The lateral or longitudinal oscillation of the fuselage due to its suspension from the rotor system.

Pitch angle. The angle between the chord line of the rotor blade and the reference plane of the main rotor hub or the rotor plane of rotation.

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.

Profile drag. Drag incurred from frictional or parasitic resistance of the blades passing through the air. It does not change significantly with the angle of attack of the airfoil section, but it increases moderately as airspeed increases.

Resultant relative wind. Airflow from rotation that is modified by induced flow.

Retreating blade. Any blade, located in a semicircular part of the rotor disk, in which the blade direction is opposite to the direction of flight.

Retreating blade stall. A stall that begins at or near the tip of a blade in a helicopter because of the high angles of attack required to compensate for dissymmetry of lift.

Rigid rotor. A rotor system permitting blades to feather, but not flap or hunt.

Rotational velocity. The component of relative wind produced by the rotation of the rotor blades.

Rotor. A complete system of rotating airfoils creating lift for a helicopter.

Rotor brake. A device used to stop the rotor blades during shutdown.

Rotor disk area. See disk area.

Rotor force. The force produced by the rotor, comprised of rotor lift and rotor drag.

Semirigid rotor. A rotor system in which the blades are fixed to the hub, but are free to flap and feather.

Settling with power. See vortex ring state.

Shaft turbine. A turbine engine used to drive an output shaft, commonly used in helicopters.

Skid. A flight condition in which the rate of turn is too great for the angle of bank.

Skid shoes. Plates attached to the bottom of skid landing gear, protecting the skid.

Slip. A flight condition in which the rate of turn is too slow for the angle of bank.

Solidity ratio. The ratio of the total rotor blade area to total rotor disk area.

Span. The dimension of a rotor blade or airfoil from root to tip.

Split needles. A term used to describe the position of the two needles on the engine/rotor tachometer when the two needles are not superimposed.

Standard atmosphere. A hypothetical atmosphere based on averages in which the surface temperature is 59 °F (15 °C), the surface pressure is 29.92 "Hg (1013.2 Mb) at sea level, and the temperature lapse rate is approximately 3.5 °F (2 °C) per 1,000 feet.

Static stop. A device used to limit the blade flap, or rotor flap, at low rpm or when the rotor is stopped.

Steady-state flight. The type of flight experienced when a helicopter is in straight-and-level, unaccelerated flight, and all forces are in balance.

Symmetrical airfoil. An airfoil having the same shape on the top and bottom.

Tail rotor. A rotor turning in a plane perpendicular to that of the main rotor and parallel to the longitudinal axis of the fuselage. It is used to control the torque of the main rotor and to provide movement about the yaw axis of the helicopter.

Teetering hinge. A hinge that permits the rotor blades of a semirigid rotor system to flap as a unit.

Thrust. The force developed by the rotor blades acting parallel to the relative wind and opposing the forces of drag and weight.

Tip-path plane. The imaginary circular plane outlined by the rotor blade tips as they make a cycle of rotation.

Torque. In helicopters with a single, main rotor system, the tendency of the helicopter to turn in the opposite direction of the main rotor rotation.

Trailing edge. The rearmost edge of an airfoil.

Translating tendency. The tendency of the single-rotor helicopter to move laterally during hovering flight. Also called tail rotor drift.

Translational lift. The additional lift obtained when entering forward flight, due to the increased efficiency of the rotor system.

Transverse-flow effect. The condition of increased drag and decreased lift in the aft portion of the rotor disk caused by the air having a greater induced velocity and angle in the aft portion of the disk.

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

Turboshaft engine. A turbine engine transmitting power through a shaft as would be found in a turbine helicopter.

Twist grip. The power control on the end of the collective control.

Underslung. A rotor hub that rotates below the top of the mast, as on semirigid rotor systems.

Unloaded rotor. The state of a rotor when rotor force has been removed, or when the rotor is operating under a low or negative G condition.

Useful load. The difference between the gross weight and the basic empty weight. It includes the flight crew, usable fuel, drainable oil, if applicable, and payload.

Variation. The angular difference between true north and magnetic north; indicated on charts by isogonic lines.

Vertical vibration. A vibration in which the movement is up and down, or vertical, as in an out-of-track condition.

Vortex ring state. A transient condition of downward flight (descending through air after just previously being accelerated downward by the rotor) during which an appreciable portion of the main rotor system is being forced to operate at angles of attack above maximum. Blade stall starts near the hub and progresses outward as the rate of descent increases.

Weight. One of the four main forces acting on a helicopter. Equivalent to the actual weight of the helicopter. It acts downward toward the center of the earth.

Yaw. The movement of a helicopter about its vertical axis.

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