

Model Helicopter World Magazine Glossary Of Terms

3-D Flying: A general description used for a style of advanced aerobatics that includes full inverted, backward and pirouetting flight.

AHA: Aerobatic Helicopter Association

ANTI-TORQUE TAIL ROTOR: Small diameter, variable pitch rotor located at the rear of the model which provides a thrust which in turn balances out the tendency for the fuselage to turn the opposite way to which the main rotor is turning.

ARTF: Almost Ready To Fly – a partially built or almost completely built model which normally only requires the radio to be installed before it can be flown.

Autorotation: Helicopter descent and landing without the use of the engine.

Autorotation Unit: A one-way bearing fitted into the helicopter transmission which enables the main rotor to turn freely if the engine stops. Initially developed to allow the helicopter to be landed safely in the event of an engine failure. Sometimes placed in the transmission so that the tail rotor is also driven with the engine stopped – thus also providing directional control.

Ball Sizing Tool: After market tool used to ream out ball links for a precise fit.

Battery: made of one or more cells soldered together.

Battery Capacity: Measured in mAh (milli-amp hour). 1000 mAh means if the equipment is consuming electricity at the rate of one amp, then the battery will last one hour. If it consumes current at two amps, then the battery will last half an hour. If it consumes electricity at 0.5 amps, then it will last two hours.

BEC: Battery Elimination Circuit, an electronic device which takes power from the flight pack for the receiver and servos etc. Available as a separate unit or can be incorporated within Speed controllers for up to 10-cell operation.

Bell and Hiller Mixing: Messrs Bell and Hiller were pioneers in the full size helicopter world who developed parts of the main rotor control system used in most full size and models today. Essentially the degree of Hiller control is related to the authority of the Flybar and the Bell input is related to the main rotor blades.

Brushless Motor: In very basic terms, an electric motor has 2 major components, the stator and the rotor. The 'stator' is in effect a permanent magnet(s) while the 'rotor' has a number of electrical windings which, when electricity is passed through them, become magnets. A brushed motor has the rotor inside the stator and electricity is passed through brushes to the windings creating magnetic fields. The electricity is 'phased' to each winding in such a way that the 'rotor' part of the motor turns as a result of the changing magnetic fields. A brushless motor is the other way round in that the permanent magnet(s) are inside the electrical windings. With this layout, the permanent magnets rotate on the shaft while the windings are stationary round them. Thus the electrical winding do not rotate and so are permanently hard wired to the controller which 'phases' power to the windings to make the permanent magnets on the shaft turn. The advantages are primarily in efficiency as the brushes cause friction and limit how much power can be passed to the windings. A brushless motor doesn't have these limitations and can also run at higher speeds which again helps efficiency. A typical brushless motor efficiency can be as high as 85% giving a 25% gain over a brushed motor.

C: Capacity of a battery cell measured in milli-Amp or Amp (mA or A). Used to calculate a suitable rate of charge for the cell. i.e. to fast charge an RC2400 cell pack at 4C: $4 \times 2400 \text{ mA} = 9.6 \text{ A}$.

CA: Cyano Acrylate glue, known as 'super glue' or 'cyano'. Available in various grades and types from thin to thick and sets instantaneously or within a few seconds. Special types are available for plastics etc. Beware: some will melt plastics and all will instantly bond skin and should be used in a ventilated area as the fumes can be harmful.

CCPM: Cyclic Collective Pitch Mixing whereby the swashplate tilts for cyclic controls and moves vertically for collective pitch control. Ewald Heim developed a system whereby 2 cyclic servos were electronically mixed to produce changes in collective pitch. This 2-servo electronic CCPM has been developed to use 2, 3, or 4 servos in a number of configurations. Many modern transmitters offer various configurations. Now known as eCCPM.

Cells: Battery cells; 2 types are in popular use with electric models. NiCd (Nickel Cadmium) and NiMH (Nickel Metal Hydride). Usual size is Sub-C. Capacity is measured in mA (milli-amp-hour) and nominal voltage is 1.2 v per cell. NiCd are generally better for high power, while NiMH have greater capacity but do not provide such high power and therefore are better suited where longer flights are preferred or current draw is lower.

Centrifugal Clutch: A device which is fitted between the engine and helicopter transmission to allow the engine to be started without the rotors turning. When the engine speed is increased the clutch engages allowing the engine to drive the rotor system.

Clutch: Usually a one piece machined item that features hinged shoes. These open out and engage with the clutch drum due to centrifugal force.

Collective Pitch: A variable pitch system used to control the angle of the main rotor blades and thus the amount of lift generated. The higher the angle, the faster the model is capable of climbing. The lower the angle, the faster the model can descend.

Current: The flow of electricity. It is measured in amp. One amp equals 1000 milli-amps.

Cyclic Control: This is the name used for directional control over the main rotor blades. Cyclic control is available in all four directions; fore, aft, left and right.

Differential Throw: When more movement is required in one direction than the other. Commonly used on aircraft where it may be necessary to have more up aileron movement than down. Can be achieved by off-setting the servo output away from the centre, or by using radio programming (end points and pitch curves etc.)

Driven Tail: The tail rotor continues to turn when the helicopter is in an autorotation allowing full yaw control.

Duration: Flight time! usually used when talking about electric powered models. Depends on choices made of motor and gear ratios which also affect the best choice of battery cells used. The best advice is decide your favoured flying style and then discuss options with your supplier.

eCCPM: Electronic Cyclic and Collective Pitch Mixing system programmed in most computer transmitters. Three or four servos are connected to the aileron, elevator and pitch channels (plus a 4th for 4-servo), these servos are connected to the swashplate. Many current models use 3 servos with the links to the swashplate spaced at 120° (3-servo 120° CCPM). All 3 servos move together in the same direction to move the swashplate up and down. The right and left servo move in opposite directions to tilt the swashplate left/right. The front servo moves up and down for elevator with both the left and right servos moving half the distance in the opposite direction. 3 or 4 servo 90° eCCPM system are similar in operation whereby only the elevator servo (and 4th servo if used) is used for fore/aft control.

FAI Square: A 10 metre x 10 metre square where competition manoeuvres are flown in front of judges.

Fast Charger: Special battery charger designed to rapid charge flight packs from a 12 volt source. It is important to choose a charger which will charge all types of cells you intend to use as well the number of cells in your flight pack. Modern chargers will detect when the pack is fully charged and switch to a trickle charge rate. NiCd and NiMH cells require a different charge routine - the best chargers will charge both types.

Fixed Pitch: An early design of main rotor system in which the main blade pitch is not moved by the radio control system. Climbing flight is induced by speeding the rotor up and descent by reducing rotor speed.

Flapping System: Part of the design of some main rotor systems which allows each rotor blade to move up and down independently of the other blades and thus provide additional stability.

Flybar Alignment: Making sure the flybar is central in the flybar seesaw and that the flybar control arms are perfectly in line with the paddles.

Flybar & Paddles: Part of the main rotor which provides both stability and control responses – usually located at 90° to the main blades and consisting of a rod (flybar) and two small aerofoil section blades (paddles).

Formatting (battery packs): A simple process to ensure all cells in a pack are in the same state of charge which reduces losses within the pack.

Gear ratio: A term for describing the amount of reduction gearing between the rotor head and engine. As an example, a 10:1 ratio would give 10 revolutions of the engine for every revolution of the rotor head.

Governor: An electronic device that senses engine rpm and adjusts the throttle function to retain a constant pre-selected main rotor-blade rpm.

GRP: An abbreviation used to describe the type of plastic material used. This simply means 'glass-reinforced-plastic'.

Gyro: An electromechanical device which uses gyroscopic principles to stabilise the yaw control. The gyro senses unwanted yaw movements and inputs an opposing movement to stabilise the heading. It is inserted into the airborne radio control system between the receiver and the rudder/yaw/tail rotor servo. Recent advances in computer and gyroscope technology have led to a 'heading hold' capability which essentially locks the tail into a certain direction.

Gyro Gain: This is how much the gyro reacts to unwanted movements and how much opposing movement is applied. Too little gain and the tail will not feel very stable. Too much gain and the tail end will continuously wag from side to side.

Header tank: Small fuel tank fitted between engine and carburettor that helps to smooth out fuel flow and ensure a constant supply of fuel in aerobatic manoeuvres.

Heading-hold: Gyro function whereby the gyro maintains the chosen heading of the model. With many gyros this function is selectable via the transmitter.

Idle up: A switch on the transmitter which activates programming so that the throttle and collective movements can be set to suit particular flying styles. Various 'points' are provided for both throttle and pitch range relating to the Tx stick position (known as 'curves'). Thus the collective pitch range can be chosen and the throttle set to maintain rotor rpm when zero or negative pitch values are used.

In Parallel: When cells are connected together to make up a battery pack to increase the storage capacity but with the same voltage. i.e. 4 off 1.2 V 2400 mAh cells connected in parallel = 1.2 V 9600 mAh battery.

In Series: When cells are connected together to make up a battery pack to achieve a higher total voltage. i.e. 4 off 1.2 V 2400 mAh cells connected in series = 4.8 V 2400 mAh battery.

Main Gear: The large diameter toothed gear usually made of GRP and is sited on the main rotor shaft.

Main Rotor: Generic term encompassing the rotorhead, main rotor blades and flybar assembly.

Matched Cells: Term used with electric powered models whereby the battery cells have been chosen to have the same internal resistance and capacity. A 'Matched Pack' will provide better power by reducing internal losses.

Negative Pitch: A term used for reversing the main rotor blade pitch to a negative value. This is used for fast descents, aerobatics or auto-rotations.

PCM Pulse Code Modulation: This is a type of radio transmission where the Tx sends a code with the signal and the Rx will not use the information sent unless the code is correct.

Pinion Gear: A smaller diameter toothed gear, usually of metal construction and drives a larger gear.

Piston Lock: A threaded tool inserted into the engine through the glowplug hole to lock the piston at BDC and so prevent the crankshaft rotating. Many prefer to remove the carb. and insert a plastic handle (toothbrush) into the crankshaft thus locking it place while the nut is tightened.

Pulley Gear: Name given to a toothed gear that drives (or is driven by) toothed drive-belts.

Pushed Cells: Term used with electric powered models whereby cells have had a very high current passed through them to reduce the internal resistance and thus improve performance.

Radio Installation: Task of installing the radio components into a model. The best way to go about installing the servos and connecting the various pushrods is to first install the servos as shown in the manual. Next, connect the servos, switch and battery to the receiver as shown in the radio manual. Now turn on the radio and check that the servos rotate in the correct direction by referring to model manual. If the direction is wrong, the radio manual will tell you how to reverse the rotation. With the Tx sticks in their centre position, the servos are at their neutral position and so the appropriate discs and arms can be installed with the balls attached at the stated positions - the aim is that the push rods will be at 90° to the servo arm. Small adjustments of the neutral position can be made with sub-trims!

Revolution Mixing: This is where the collective pitch can be mixed to the rudder channel so that the tail does not swing when collective pitch is increased or decreased (not used with Heading-Hold gyros).

Rotorhead: generic term for the assembly which carries the main rot blades. Includes the flybar assembly.

RPM: A common form of measurement used to show how fast an engine or rotor system is turning, i.e. Revolutions Per Minute.

Simulator: Computer program that allows model helicopter flight to be simulated.

Speed Controller: Controls the speed of an electric motor via throttle channel. Many now have a governor function whereby it maintains a constant motor rpm which can be set from the Tx. Usually includes a circuit which cuts power to the motor when voltage drops below safe level for BEC operation.

Symmetrical Blades: Rotor blades that have an identical shape to both the top and bottom sections of the blade.

Tail Rotor: Counteracts the torque induced by applying main rotor blades pitch and allows for directional control over which way the helicopter points.

Tail Rotor Linkage: The mechanism which connects the tail rotor servo arm to the tail rotor blade pitch arms. It is important that the linkage moves as freely as possible and without any slop.

Thread Lock: A type of 'glue' used to prevent nuts/screws/bolts loosening. Available in a number grades ranging from 'easy to release' to permanent. Best practice is to de-grease all metal to metal surfaces with methylated spirit or similar before applying small amount of thread lock. Can be used as a bearing lock for bearings. To undo, carefully apply heat which softens the agent.

Throttle-hold: A transmitter function that holds the engine at a predetermined position but allows collective pitch to be applied to the blades. This is used for practising Autorotations.

Thrust Races: Three part bearings that carries end loads with the minimum of friction. Used in rotor blade grips and occasionally on main rotor shafts. Ensures accurate control of the rotating part under loads.

Training Undercarriage: Usually straps onto the existing undercarriage and these days consists of 4 rods held in a cruciform configuration and fitted with large hollow balls at the end of these rods. This provides a large 'footprint' and allows the model to slide about on or near the ground without tipping over.

Voltage: A measure of electromotive force or potential difference. Measured in volts.

'Y' Lead: A servo extension lead with one plug and two sockets so 2 servos can be driven from the same channel. Commonly used with early pre-helicopter transmitters days, when both the throttle and collective pitch servos were powered from the throttle channel.