



INDEPENDENT ASSOCIATION OF ROCKETRY
HOBBY ROCKETRY GLOSSARY

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Please address suggestions by e-mail to cdnrocketeer@geocities.com

3FNC - Slang for a basic rocket: "3 Fins and a Nose Cone".

Ablation - The flaking and vaporization of material undergoing severe heating due to aerodynamic drag.

Abort - Failure of an aerospace vehicle for any reason which prevents completion of its mission. Similar to "**scrub**", which involves a decision not to launch.

Abrasive - Natural or man-made materials used for grinding, sanding or polishing a surface.

Accelerometer - An electronic device for detecting the presence of high acceleration. An accelerometer can be used for flight data gathering, or for controlling flight events.

For example, an accelerometer with a memory chip can record the strength and duration of a rocket's acceleration. This data can be used by a computer to calculate the rocket's approximate altitude at various points of its descent.

An accelerometer can also be combined with a **timer** to determine the proper time for a **deployment charge** or **sustainer** motor to be activated, by counting down a pre-set number of seconds after acceleration ceases (motor burn-out).

Acetate Dope - A liquid material made from cellulose and acetic acid that shrinks, waterproofs and protects flexible coverings such as tissue or silk.

Acetone - An inflammable liquid used as a general solvent for dope, lacquers and epoxy.

Acrylic resin - A transparent, stiff thermoplastic resin sometimes used for body tubing.

Actuator - A mechanical, electrical, or electronic device that sets a mechanism in operation or performs a specific action such as throwing a switch.

Adapter - Part of an airframe that smooths the **airflow** from one airframe component to another of different diameter. Also called a **Transition**.

Additive - Substance added to another to modify its properties such as **microballoons** added to epoxy.

Adhesive - Substance added to two components in order to bond them together.

Advanced Model Rocket - Model rockets either constructed of exotic materials or designed to perform a function that differentiates them from normal models.

Aerial Photography - The study and interpretation of photographs taken from well above the earth's surface.

Aerodynamics - The study of the motion of gases and forces applied by the gases to solid objects around which the gases move.

Aerodynamic Heating - Heating of solid objects in an airflow caused by the friction of the air against the objects.

Aeronautics Act - Canadian law that regulates all use of airspace in Canada. Section 507 applies to hobby rocketry directly. Equiv. to **FAR1101**.

Aerosol - A mixture of fine liquid and/or solid particles suspended in a gas or air, such as paint from a spray can.

AGL - Above Ground Level. The **altitude** a rocket attains, not counting the altitude of the launch site. In the United States, **waivers** are issued by the Federal Aviation Administration (**FAA**), limiting the maximum altitude permitted.

Aileron - hinged portion of a **wing**, designed to impart **roll** to the aircraft.

Aircraft Dope - Liquid material applied to model aircraft to strengthen and seal the covering material. Sometimes used with talcum powder to make a **filler** to seal balsa on a model rocket.

Airflow - the motion of air past and around an object.

Airfoil - A streamlined shape given to **fins** or **wings** for maximum aerodynamic efficiency in flight. A conventional airfoil - optimized for **subsonic** flight - has a rounded leading edge tapering to a pointed trailing edge. See **Cambered, Diamond, Symmetrical**.

Airfoil Section- The cross-section of an **airfoil** in the plane of the common **airflow** around that part.

Airframe - The rocket's main structure, especially the **body tube**.

Airstart - The practice of starting one or more rocket **motors** after the rocket is already in the air; a common technique with **clustered** motors.

Aliphatic Resin - A type of carpenter's glue, that although waterbased, penetrates and bond porous material forming a waterproof joint. Commonly called "yellow glue".

Alignment - Bringing parts into position and orientation as desired.

Altimeter - A device that measures **altitude**. Altimeters can be used simply to document a rocket's **apogee**, but they are also commonly used to control electrical devices for **airstarting** motors or deploying recovery devices.

Altitude - Height above the ground. There are several methods of measuring or expressing altitude:

- Pressure - Read from an altimeter when it is adjusted to 29.92 inches of mercury. All US aircraft flying above 18,000 AGL use pressure altitudes.
- Actual (also called True) - Height above mean sea level
- Density - Pressure reading corrected for temperature and humidity. Example: at 2850 feet actual altitude, at 100 degrees F. with 60% humidity and standard pressure, the density altitude is over 6500 feet.
- Indicated - The altitude indicated by an altimeter.

Altitude can be expressed as either Above Mean Sea Level (MSL), or Above Ground Level (**AGL**).

Amateur Rocketry - Any and all rocketry activities other than **model**, **mid-power** or **high-power**, which is not funded by a professional entity, and not conducted for monetary purposes.

Ammonium Perchlorate - (NH_4ClO_4) The **oxidizer** used in most composite rocket motors.

AN - Ammonium Nitrate: a solid rocket **oxidizer**.

Anemometer - instrument used to measure the speed of an **airflow**.

Angle of Attack - The angle between the long **axis** of a rocket and the direction of the air flowing past it.

AP - See **Ammonium Perchlorate**

Apogee - In rocketry, the highest point a rocket achieves before beginning its descent.

ARS - American Rocket Society; an early amateur rocketry group. Now called the American Institute of Aeronautics and Astronautics.

Aspect Ratio - The ratio of length to width. In rocketry, a rule of thumb is that the aspect ratio of a model rocket's length to its body diameter must be at least 10:1.

Asymmetric Fins - A set of fins that are not identical in size, shape and relative position on an airframe.

ATF - See **BATF**

Attitude - The position and orientation of an object relative to a fixed line, plane of axes or reference.

Autogyro - A vehicle whose **blades** rotate in a horizontal plane due to aerodynamic forces alone, creating lift.

Average Chord - The **chord** at the middle of a wing's **span**.

Average Thrust - The **total impulse** (in **Newton-seconds**) divided by the length of burn time. Example; a K185 motor has a total impulse of approximately 1400 Newton-seconds, and burns for 7.5 seconds. 1387.5 Newton-seconds divided by 7.5 equals 185 **newtons** average thrust.

Axis - One of the three lines of reference around which an aircraft can rotate. The three movements an aircraft can make (other than moving straight ahead) all involve rotation around some central point. That point is called an axis. These movements are: **Roll** - rotation around the longitudinal (front-to-back) axis (nose remains pointed forward, but the rocket spins), **Pitch** - rotation around the horizontal axis (nose moves up or down), and **Yaw** - rotation around the vertical axis (nose moves left or right.)

Azimuth - An angle on a horizontal plane. See **Elevation**.

Ballast - Mass added to a model to bring the model into balance.

Ballistics - Study of objects moving through the air that have been given a short lived acceleration.

Ballistic Trajectory - The path a rocket takes when descending without benefit of **parachute**. Normally, unless acted upon by wind a rocket's ballistic trajectory continues to describe a parabolic arc, bringing it to earth nose-first in a relatively predictable location.

BALLS - Big A** Load Lifting Suckers: A popular annual launch for amateur and large **HPR** rocket flyers.

Balsa Wood - Fast growing wood from Central America known for strength, low density, and a very porous grain. Frequently used for model rocket **fin**s.

BAR - Born Again Rocketeer. A person who once pursued rocketry as a hobby, and returned to it at a later time in life.

Barrowman Method - A mathematical technique for calculating the **center of pressure** of a **subsonic** rocket at low **angles of attack**. Named for James S. Barrowman, who developed the method in 1966.

Base Drag - Drag produced by the airflow moving from the sides to the rear of a model.

Baseline - The line between the tracker and the launcher in the single tracker method for finding altitude, or the line between to the tracking stations in the two tracker method.

Basswood - North American hardwood known for very tight even grain and fairly good ease of working.

BATF - Bureau of Alcohol Tobacco and Firearms; a federal regulatory agency. Sometimes called **ATF**.

Bay - part of a model set aside for a specific purpose such as the **payload bay**.

Beam , Structural - A rigid body designed to transmit loads in shear or bending transversely to its point of support. A fin is actually a structural beam.

Beeper - A device that produces an auditory signal, assisting searchers to find a rocket after it has landed.

B/G - Boost Glider

Bernoulli's Principle - A physics principle that states the pressure exerted by air perpendicular to its direction of travel decreases with an increase in velocity.

This is the theoretical principle upon which airplane wings work. An airplane wing's **airfoil** is unsymmetrical, its upper surface having a greater curve than its lower surface. This causes air flowing across the upper portion of the wing to speed up, since it must cross a greater surface area in the same length of time. The increase in air velocity on the upper surface causes the air pressure in the region just above the wing to be reduced. The higher pressure below the wing presses upward on it, creating lift.

Birch - North American hardwood known for its pliancy and tight grain.

Black Powder - The original explosive, said to come from China. A mixture of carbon, (charcoal), sulfur and ammonium nitrate (saltpeter).

Blackshaft[®] - A trademarked name for thin-walled body tubing made from phenolic-impregnated paper and used with model rockets built for competition, especially **superrocs**. It was prized by some competition rocket flyers because it was stronger than ordinary cardboard tubing, but lighter than fiberglass. Blackshaft tubing - so called because it was black in color - was sold by Apogee Components. In some circles it earned the derogatory name "blackshatter" due to its inability to absorb any

lateral shock without breaking. Manufacture of blackshaft tubing was discontinued in 1994.

Blade - Long thin **wing**, rotated around a central hub, such as on a propeller.

Blade Twist - The pitch angle variation on a helicopter blade from root to tip.

Blast Deflector - A plate or other device that protects flammable materials like grass - surrounding a launch pad, from being ignited by rocket exhaust.

Blister, Paint - Air bubble formed under a skin of paint. Usually caused by heat applied to that spot or improper/incomplete preparation before paint.

Blockhouse - A building used for the preparation and launching of a commercial or military rocket, usually heavily reinforced. Not needed in hobby rocketry.

Blowthrough - The physical ejection of propellant through the front of the rocket body. See **CATO**.

Boat-Tail - A tapering section which reduces a rocket's tail diameter, to improve aerodynamic efficiency through the reduction of **base drag**.

Body Tube - A cylindrical tube that makes up the body of the rocket. Typically made of cardboard, fiberglass or carbon fiber. See **Airframe**.

Bonus Delay - Slang for an unexpectedly long delay, sometimes resulting in **airframe** damage or parachute **stripping**. See **Zippering**.

Boost Glider - A winged aircraft which is powered into flight by a rocket motor, then returns to the ground as a glider after ejecting its motor or motor assembly. See **Rocket Glider**.

Boost Phase - That part of a rocket's flight in which the **propellant** is generating **thrust**.

Booster - In a multi-stage rocket, the first stage. In a **parallel staged** rocket, the pods containing the motors with the shortest **burn time**. In a complex single-stage rocket, the term sometimes refers to the part that contains the motor assembly.

BOR- Big Obnoxious Rocket

Boundary Layer - The very thin layer of fluid close to the surface of a solid in an airflow.

BP - See **Black Powder**.

BSMA - British SpaceModeling Association

Buckle - A bend or kink formed by overstressing the **airframe**.

Buffeting - Repeated forces experienced by a model due to disturbed unsteady **airflow**.

Built-Up - a hollow component, such as a **fin**, made up of a number of structural parts.

Bulkhead - A solid partition in the rocket, especially one set perpendicular to the rocket's long **axis**, designed to not allow gases to pass.

Bungee - Round, woven elastic material, often used as **shock cord** in high power rockets.

Burn - The chemical reaction that occurs within a rocket motor producing a high velocity gas.

Burn Time - The time that it takes for a motor to fully expend its fuel.

Burnout - The point at which propellant is exhausted in a motor.

Burnout Velocity - The velocity achieved by the model at **burnout**.

Burn Rate - The rate at which a substance is consumed by burning, such as propellant or a fuse.

Butt Joint - A joint made by gluing an edge to a surface, such as a **fin** to a **body tube**.

CA - Cyano Acrylate: a thin, very strong adhesive also known as Super Glue.

Cabosil - A super fine silica. Unlike **microballoons**, which are tiny glass spheres, Cabosil is "cut" glass fibers and very light. Used as a **filler** in **epoxy** fin fillets to reduce weight, and control sagging and dripping in thin epoxies.

Caliber - Ratio of a rocket's diameter to its length. Example; if a rocket is 1" in diameter, then each 1" increment of distance along its length is a one-caliber measurement. See **One-Caliber Stability**.

Camber - The increase in curvature of an **airfoil** along its **chord**.

Cambered Airfoil - An **airfoil** (wing) on which only the top surface is tapered, the bottom surface remaining flat.

Camouflage - A paint scheme used to conceal an object in its background.

Canard - A **fin** or **wing** located at the middle or front of a rocket. Canard fins are often used on guided missiles since they make the missile less stable and easier to steer. Because canard fins move the center of pressure forward and tend to destabilize model or high power rockets, they are only used for style or to be true to a scale representation.

Canopy - The fabric of the top of a parachute.

Canted Nozzle - A nozzle positioned so that its line of thrust is not parallel to the direction of flight. See **Vectored Thrust**.

Cantilever Beam - a projecting member, fixed at one end rigidly and free at the other. Wings and fins are both cantilever beams.

CAR - Canadian Association of Rocketry: The organization governing model and high power rocketry in Canada.

Case, Casing - The outside framework of a rocket **motor**.

Case Rupture - The splitting of the motor due to excessive pressure in the combustion chamber.

Cast Propellant - A solid propellant formed by the pouring of a soft propellant into a mold to solidify into a hard grain. See **Grain**.

CATO - Catastrophic Take Off (or Catastrophe At Take Off) A violent failure of the rocket motor casing, closures, or nozzle. This usually occurs at take off, and often results in the destruction of the airframe. The exact meaning of CATO is in dispute.

Center of Gravity - The point at which a rocket balances when completely prepped for flight.

Center of Pressure - The point at which the aerodynamic lift on a rocket is centered.

Centering Ring - A ring of paper, cardboard, plywood, or other material which connects the motor tube to the **airframe**, ensuring that the motor remains parallel to the rocket's main **axis**. A motor tube requires at least two centering rings. More powerful motors sometimes require more.

CG - See **Center of Gravity**.

CHAD - Slang term meaning Cheap and Dirty. Most common usage is CHAD-staging, in which a **booster** motor is attached to the rear of a rocket motor in a single-stage

rocket. Since the booster returns to Earth without a recovery device, this practice is a violation of **NAR** safety rules.

Chord - The short dimension (front-to-rear) of a glider's wing. See **Span**.

Chuff - Slang for a condition in which a motor fails to produce maximum thrust. The rocket's speed and **altitude** suffer as a result. In a serious case, the rocket does not achieve adequate air speed and crashes.

Chuffing - Intermittent burning of a rocket motor, accompanied by the sound of a steam engine starting.

Class B Motors – Rocket motors containing more than 62.5 grams of propellant or motors that impart more than 120 **newton-seconds** of **thrust**.

Class C Motors – Rocket motors contain less than 62.5 grams of propellant or impart 120 **newton-seconds** of **thrust** or less.

Clean - A rocket design that is streamlined and free of projections.

Clip Whip - Short extensions at the end of a launch system with **microclips**.

Closed Breech - Piston launcher where the piston is mounted on the launcher, the motor is mounted in the model and the piston movement is upwards with the model.

Closure - The front and rear sections of a reusable motor assembly, which connect to the motor **casing** by threads, snap rings, or other method.

CLSO – Canadian Launch Safety Office, a division of Transport Canada that governs safety and issues all launch waivers for rocketry in Canada, ranging from approval of the Canadian Model Rocket Safety Code to permitting satellite launches at the Spaceport, Fort Churchill, Manitoba

Clustering - A boost technique which uses 2 or more motors side by side in the same rocket.

Coasting Phase- That part of the rocket's flight between **burnout** and the **airstart** of the next stage or between burnout and activation of the recovery system.

Coefficient of Drag (Cd) - The aerodynamic drag of a rocket as a function of its speed and cross-section. An indication of a rocket's aerodynamic efficiency.

Cold Power - A type of rocket motor powered by CFC refrigerant under pressure. All support for this line was discontinued in the mid-seventies because of concern over the effect of CFC's on stratospheric ozone.

Combustion Chamber - The part of the motor where the actual combustion occurs. Composite fuels require a set pressure in the combustion chamber to continue burning at the proper rate. Failure to maintain the pressure results in **chuffing**.

Competition Model - Model whose design is optimized expressly for a particular competitive event.

Component - A manufactured part required to assemble a model, such as fins.

Composite - A solid rocket motor type which uses two or more substances for combustion, neither component being **black powder**. A typical composite motor in hobby rocketry uses rubber as a fuel and **ammonium perchlorate** as an **oxidizer**.

Composite (material) - Two or more separate and distinct materials, the combination of which produces a new material with more desirable properties such as increased strength, lower density or better workability.

Compound Dihedral Angle - A “bent wing”, in which a glider’s wing describes two straight planes at different vertical angles, with the tip pitched at a steeper angle than the root. See **Dihedral**.

Concentric - Having a common center.

Cone - See **Nose Cone**.

Cone Stability - The inherent stability of conic shapes to fly without fins provided the CG is ahead of the CG.

Conic - Of or pertaining to a **cone**.

Coning - An unstable flight condition in which a rocket’s spin causes the rear portion of the rocket to describe a circle. Coning greatly increases aerodynamic drag and reduces peak **altitude**.

Configuration - The arrangement of **fins**, **wings** and other parts of a rocket or aircraft.

Contact Cement - An adhesive that is applied to both parts to be joined and allowed to set up. They are bonded on contact, usually permanently.

Continuity - The condition of a continuous circuit in a launch system once safety has been closed. A continuous electrical circuit will allow electricity to flow, so in the context of a launch controller “Continuity” means the igniter circuit is correctly connected and the rocket motor is ready to be ignited.

Control Surfaces - Surfaces such as flaps and elevons used to control the **attitude** of a rocket or glider aerodynamically.

Core - The hole or slot in the **grain** of propellant in a motor. Alteration of the core's shape determines the thrust characteristics of the motor.

Core Ejection - Ejection of a central pod holding the **motor** from the rear of the model.

Core Sample - What happens when an airframe devoid of nosecone punches into the ground without benefit of recovery system. Named for the tubular sample of sod and dirt stuffed into the body tube on impact. Also known as "drilling for oil." See **Lawn Dart**.

Countdown - The process, usually marked in seconds counting down to zero, of the final preparation and launch of a rocket.

Coupler - A section of tube used to connect 2 sections of larger body tubing.

Covering - Material covering the framework of a structure.

CP - See **Center of Pressure**.

CPR - Close Proximity Recovery: an electronically-controlled system that permits high-altitude rockets to have most of their descent controlled with a drogue. The main parachute deploys at lower altitude.

CPSC – Consumer Product Safety Commission. Rules restrict use of **HPR** motors (H and up) to adults 18 years of age and up.

Craze, Cracking - Cracking of paint or fogging of acrylic resin due to incompatibility of paint, primer, adhesive, and/or material.

Cross Section - The area exposed if a part is cut through.

Cyanoacrylate - Adhesive developed through the space program. Adhesive hardens very quickly and forms a high strength bond without the mixing of components. Also known as Superglue, Crazyglue, and **CA**.

Dart - An unpowered vehicle, with the same aerodynamic characteristics as a rocket. A dart is one method of propelling a payload package to a maximum **altitude**. The dart rides on top of a large **booster**, possessing a higher **coefficient of drag**. During powered flight the dart acquires all the momentum of the entire vehicle. As the booster begins to slow during the **coasting phase**, its greater drag causes it to fall away from the dart which continues to ascend to a higher altitude.

Davis Douche - Variant of the **flash pan**, where wicks are inserted into each motor and the wick ends are put into the pan of BP. **See Flashpan, with Caution.**

Death Dive - See **Power Prang**

Decalage - The difference, in degrees, between the angles of attack of the wings and stabilizer of an aircraft. This difference builds in some inherent stability, allowing the aircraft to recover from dives and stalls.

Deceleration - A reduction of velocity.

Deflection - Bending or displacement from the neutral position due to loading from some outside force.

Deflector - See **blast deflector**.

Delay - an electronic, mechanical, or pyrotechnic device that permits the rocket's unpowered ascent between motor burnout and the deployment of the recovery device. Typically, the delay is a **pyrotechnic grain** which separates the propellant from the deployment charge and which burns at a known rate. The delay grain begins to burn either at the same time the propellant grain is ignited (**composite** motors), or at the end of propellant ignition (black powder motors). When the delay grain burns through, it ignites the **deployment charge**.

Also, the period of time between propellant **burnout** and recovery system **deployment**.

DeltaV - Change in velocity

Delta Wing - Wing **planform** in the shape of a large triangle, used for **supersonic** flight conditions.

Density - Ratio amount of a substance in a set volume.

Deployment - The condition of releasing, or deploying, a parachute or other recovery device.

Deployment Bag - A bag constructed of some fireproof material such as Nomex, in which a rocket's parachute is packed. The bag serves to protect the parachute from hot deployment charge gasses, and assists in the orderly deployment of the parachute to prevent shroud tangling.

Deployment Charge - The **pyrotechnic** charge which pressurizes the part of the rocket containing the recovery system, deploying the recovery device.

Dethermalizer - A device designed to ruin the aerodynamic properties of a aircraft, enabling it to safely escape a thermal and return to the ground.

Dhanook - To be tricked due to suffering a bad case of launch happiness.

Diamond Airfoil - An airfoil on which the leading and trailing edges are tapered symmetrically to a point. This airfoil is used on missiles designed for supersonic flight. Sometimes called a **Nike airfoil**, since the classic example is the Nike family of missiles.

Dihedral Angle - The angle at which a glider's wing tips tilt upward from the horizontal plane, to impart **roll** and **yaw** control.

Directional Stability - The ability of an aircraft to return to its original flight direction after being forced off course.

Direct Staging - Air start of a **sustainer** motor caused by the burning propellant of the booster motor.

Display Launcher - A launcher that is not functional and is used to show off a model.

Dive - Motion of an aircraft in a head down or nose down attitude.

Dope - A liquid lacquer based paint used to seal the grain of wood.

Doppler Effect - Change in sound frequency caused by the source's rapid movement towards or away from the observer.

Dorcasitis - An uncontrollable competitor's disease, the symptoms of which are to impulsively make last minute changes intended to improve a tested competition model's performance, only to have the modification backfire or cause a disqualification.

Douche Plate - Metal centering plate on the bottom of a cluster motor model to prevent damage caused by the BP flare-up using a **flashpan** or **Davis Douche**.

Downdraft - The movement of a column of cooler air downwards, opposite to a thermal.

DQ - Slang for disqualification

Drag Coefficient - See **Coefficient of Drag**.

Drag Race - An event, usually informal, in which multiple rockets are launched simultaneously.

Drag Recovery - Recovery method using the shape of the model to slow the model down enough for safe recovery.

Drilling For Oil - See **Core Sample**.

Drogue Parachute - Small, heavily reinforced **parachute** designed to slow the craft so safe release of the larger main chutes are possible.

DSE - Detectable Seismic Event; see **Death Dive**.

DOT - Department of Transportation: A federal agency responsible for laws concerning the roads, especially the interstate highway system. Transportation of motors and propellants is often regulated by DOT regulations.

Dual Recovery - See **Two-Stage Recovery**.

Dullcote[®] - A spray coating from Testor's Corp. that protects the finish of a model while removing the sheen of the finish.

Egg Lifter - A rocket designed to carry one or more eggs as **payload**. Used in competition in which the object is to boost the egg to the maximum possible **altitude** and recover it without breaking.

Ejection Baffle - A physical or mechanical barrier ahead of a motor mount designed to absorb the heat and hot particles of the ejection charge while allowing the gas to pressurize the airframe.

Ejection Charge - A small charge of **pyrotechnic** matter, usually **BP**, triggered either by the **delay** train, **timer** or an **altimeter**, used to deploy the recovery device.

Electric Match - A brand of igniter (see **igniter**).

Elevation - An angle on a vertical plane. See **Azimuth**.

Elevator - A moveable surface on the horizontal stabilizer of an aircraft. The surface is responsible for pitch control.

Elliptical Dihedral - A curved **wing**, in which the tip of a glider's wing curves up at a higher angle than the rest of the wing. The angle is the form of an arc rather than a sharp turn. See **Dihedral**.

Engine - A device that uses energy to produce mechanical motion. In rocketry, the term is often used interchangeably with Motor, though Motor is the more accurate term. See **Motor**.

Epoxy - A two-part adhesive used extensively in applications requiring high strength.

Chemically, a compound in which an oxygen atom is joined to two carbon atoms in a chain to form a bridge. Specifically, a resin containing epoxy groups, that polymerizes spontaneously when mixed with a phenol (see phenolic), forming a strong, hard, resistant adhesive.

Epoxy is probably the most commonly used adhesive in high power rocket construction. It comes in several formulations, mostly having to do with the time it takes to cure. Epoxy's only disadvantages as a rocketry adhesive are its relatively high weight and its low (approx. 200° F.) melting point.

Erosion, nozzle - The wearing or burning away of the throat of the motor nozzle caused by the hot gases ejecting from the motor. Also called **Ablation**.

Exhaust Clearance - On some models, the amount of offset required to prevent damage to parts below the motor nozzle from the motor exhaust.

Exhaust Velocity - The speed of the gases ejected from the motor nozzle. Exhaust velocity is an important consideration in motor design because, according to Newton's third law of Motion, the thrust of the motor is at least partially dependent on the velocity of the motor's exhaust.

Explosives Act - Canadian law defining and governing the use of all explosive substances outside the Canadian Armed Forces.

FAA – Federal Aviation Administration. This is the organization that governs airspace in the U.S. HPR hobbyists must obtain a **waiver** from the FAA for permission to fly large or high (2000+') altitude rockets. Equivalent to Transport Canada and the Air Ministry in the United Kingdom.

FAR101 - FAA regulations regarding airspace use for hobby rocketry.

Fairing - Rigid or semi-rigid coating used to streamline the **airflow** around a rocket component sticking out in the airflow.

Featherweight Recovery - A recovery method used by very light model rockets. Typically, the rocket ejects its motor and then floats to the earth like a feather, its extremely low weight never allowing it to become aerodynamically stable.

Fiberglass[®] - A man-made material consisting of glass fibers spun and woven into a mat-like cloth adhered to a rocket with epoxy resins. It is used to add strength to high power rockets, so that they can withstand higher-powered motors than they otherwise could. Although fiberglass is a commonly used word, it is actually a trade mark of Owen-Corning Inc.

Filler - A substance applied to a surface to fill gouges in the surface or help shape the surface.

Fillet - A smooth line of adhesive which is built up at the root of a fin to strengthen the joint formed by the fin and the body tube.

Fin - A surface at the rear of a rocket that serves to stabilize it in flight. Fins are usually planar surfaces placed at right angles to the body tube.

Fin Canister - A section of tubing with fins mounted on it, intended to slide over the airframe. Also called a fin can.

Finishing - The art of giving a model a smooth, streamlined outside surface.

Firewall - A bulkhead designed to prevent fire from passing that point.

Flame Bucket - An opening at the base of a launch pad to allow the exhaust to vent. One side is angled to form a blast deflector.

Flap - a movable control surface on an aircraft or rocket that deflects air. Ailerons, elevators and rudders are all flaps. Flaps are also used as airbrakes.

Flashbulb - A magnesium-filled glass bulb, once commonly used in photography. In rocketry, flashbulbs are used to ignite **thermalite** fuses or BP charges for second stage ignition or recovery device deployment. They have the advantage of requiring very low electrical impulses to activate them. However, this attribute also makes them susceptible to accidental activation by static electricity.

Flashpan - A type of ignition sometimes used for BP **clusters**. The rocket is placed in a pan covered with a thin layer of black powder. When the rocket is to be launched, the powder is ignited with an electrical **igniter**. The resulting flash sends burning particles into the motor nozzles and fires all the motors in the cluster simultaneously.

CAUTION: This technique presents dangers when used with black powder, and must NEVER be used with composite motors which ignite from the front.

Flat Spin - A spin around the short **axis** of a rocket while the craft is descending in a horizontal **attitude**.

Flex Wing - A wing that employs a thin flexible for the main lifting surface stretched over a semi-rigid frame.

Flight Line - The area at a launch site where rockets are prepared by participants. The forward-most area where spectators are permitted.

Flight Path - The line connecting successive positions of an aircraft while in flight, relative to the ground.

Flight Profile - A graphic representation of a aircraft's flight as seen from the side, showing its position and altitude.

Flightworthy - An aircraft or rocket, having undergone inspection and possibly testing, that has been determined to be ready and sound to fly.

Flutter - An oscillation of regular period but irregular amplitude caused by a momentary disturbance but maintained by the characteristics of the fluttering component.

Flying Wing - An aircraft, whose wing is designed and balanced for stable flight, that does not rely on stabilizers or canards to maintain the flight stability.

Foam Core - A built up wing using shaped Styrofoam rather than the classic sticks and ribs, then covered with a thin cover of wood such as balsa.

Form Drag - Drag resulting from the shape of an object, causing turbulence of the airflow. An example is a square wing edge versus a rounded streamlined edge.

Freefall - The fall of an object without guidance or retardation other than through drag.

Free Flight - Unconstrained and unassisted flight of a rocket, relying on the rocket's inherent stability.

Friction - The resistance an object encounters while moving across the surface of another object.

Friction Fit - The joining of two objects, relying not on adhesive but on the tight fit caused by one object being inserted into another, such as the nose cone inserted into a body tube.

Frontal Area - the surface area of a rocket which faces directly into the airflow.

Fuselage - The structure or airframe that houses payload, crew or passengers. Although not inaccurate, this term is used more commonly with regard to airplanes than to rockets.

G10 - A grade of fiberglass commonly used for fins on high power rockets. G10 designates a laminate made of fiberglass cloth laid in epoxy resin.

G-Switch - A mechanical device which detects the presence of acceleration through the movement of a weighted electrical contact. G-switches are normally used in combination with other electronic devices such as **timers**. For example, an electronic

timer can be programmed to count down a certain number of seconds after the G-switch closes an electrical circuit, at the end of which time the timer closes a second circuit which activates a **deployment charge** or **sustainer** motor igniter.

Gantry - A crane and scaffolding arrangement, mounted on rails, used to service a full-sized rocket while on the launch pad.

Glide - The controlled descent of an air vehicle using control surfaces, not rockets to maintain control. The descent is a result of gravity and lifting forces generated by the shape of the air vehicle.

Glide path - The descent of a gliding air vehicle as viewed from the side.

Glide Ratio - The ratio between distance traveled horizontally and the amount of vertical drop.

Gliding Booster - A **booster** stage whose fins are placed **asymmetrically** and is balanced to achieve a glide after ejecting from the rocket.

GLOW - Gross Lift Off Weight - The mass of a rocket completely prepped for flight.

Gore - The rounded triangular section of fabric between two longitudinal seams or shrouds in a parachute canopy.

GOX - Gaseous Oxygen

Grain - In rocketry, any pellet or cast section of propellant or other combustible material. The black powder propellant packed and shaped into a single-use model rocket motor is referred to generically as a grain.

Also, the direction of the fibers in a piece of wood, such as balsa. See **Wood Grain**.

GSE - Ground Support Equipment

Gusset - A roughly triangular shaped piece of material added to reinforce a joint, often in a corner.

Gyroscope - A well balanced flywheel, rotating at high speed and generating a high moment of rotation. Gyroscopes work to maintain their original orientation, and so are used to provide **stability** to rockets.

Hand-Launch-Glider - A small robust glider designed to be launched by hand.

Hatch - A door in the side of a spacecraft or aircraft.

HD - Helicopter Duration; a competitive event in **NAR**-sanctioned launches, using rockets with **helicopter recovery**.

Heads-up - An alert called by the Launch Control Officer if one of three conditions prevail:

- A model using an advanced technique such as a cluster is about to be launched.
- An untried rocket design is about to launch and the results are uncertain.
- A recovery system has failed, and it is possible that the rocket will crash in an area containing people.

Headwind - Wind blowing generally into the front of an aircraft, thereby slowing its ground speed.

Helicopter Recovery - A method of model rocket recovery in which long **blades** are deployed at **apogee** so that the rocket descends gently through auto-rotation.

Hershey Bar Wing - A rectangular wing, with no taper on either the leading or trailing edge.

HLG - See **Hand-Launch-Glider**.

HPR - High Power Rocketry. High power rockets are defined as having: a single motor with more than 160 Newton-seconds total impulse or an installed impulse of 320 Newton-seconds and no more than 40,960 **Newton-seconds**, and an average thrust in excess of 80 **Newtons**. (H through N range)

Hybrid - A type of reusable rocket motor in which the fuel and **oxidizer** are kept separate and in different material states (such as a compressed liquid and a solid) until combustion occurs. A typical hybrid motor currently uses hydrogen peroxide gas as an oxidizer, and cardboard or plastic as fuel.

Hypergolic - An arrangement of liquid fuel and oxidizer which ignites spontaneously when combined.

Hypersonic - Term used to describe a vehicle exceeding Mach 5.

IAR - Independent Association of Rocketry.

Igniter - A length of high-resistance wire, sometimes coated with a flammable material, which is placed in contact with the motor propellant prior to the rocket's launch. When an electrical current is passed through the igniter by the launch controller, the wire's high resistance causes it to become very hot and ignite the surrounding propellant.

Igniter Plug - Plug of paper or plastic forced into the motor nozzle after insertion of the igniter, designed to keep the igniter pressed against the propellant.

Impulse - Thrust force multiplied by time. The units of measurement are usually Newtons and Seconds.

Inclinometer - A device for determining a rocket's **apogee** without the use of electronics. A distance is measured off from the launch pad prior to launch. At the time of launch, an observer stands at the measured point and keeps the inclinometer aimed at the rocket. The inclinometer mechanically records the angle at which it is held. Since two angles and the distance between the rocket's point of origin and the inclinometer are known (assuming that the rocket is launched vertically), a triangle can be graphed which will indicate the apogee attained by the rocket. See **Theodolite**.

Indian Fire Brigade - derisive term for stomping out grass that has caught fire.

Indirect Staging - **Air start** of the motor on a **sustainer** stage by some means other than using the forward-shot bit of propellant from the **booster** motor.

Induced Drag - Drag resulting from lift generated by the foils and lifting body of a aircraft or rocket.

Interstage - A section of a rocket in between two stages, such as the interstage spacing ring between the first and second stage of the Saturn V.

I_{sp} - Symbol for **Specific Impulse**

J-Foil - A self-inflating parachute airfoil developed by Domini C. Jalbert. It is very maneuverable and is the current standard airfoil in skydiving parachutes.

Javelin In - See **Lawn Dart**.

Jet Deflector - See **Blast Deflector**.

JIC - Just In Case: Any precaution taken to avoid trouble, such as sanding residue off igniter clips.

Jig - A tool that uses dowel, blocks of wood, clamps and/or forms to allow precise shaping and/or construction of hard to assemble parts, or mass production of commonly used parts such as centering rings.

Kaplow Clip - A popular type of motor **retainer** designed by Bob Kaplow.

Kevlar® - A synthetic fiber, originally woven into mats for use in bullet-resistant body armor. Kevlar is highly resistant to tearing or burning. Kevlar thread is used in some model rockets as a shock cord. In model rockets, this provides the advantage of allowing the cord to be anchored to the motor mount rather than to the open end of the

airframe. This design is less susceptible to **zippering** and burning. Larger-diameter Kevlar cord is increasingly being used as shock cords on high-power rockets for the same reason, and because Kevlar is stronger than **bungee** or elastic straps.

Kevlar is also woven into sheaths or bags, and used to protect elastic shock cords and parachutes in larger rockets. See **Deployment Bag**.

Kicker - A liquid, usually of the Freon family, used to accelerate the set time of **cyanoacrylate** adhesive.

Kitbash - The practice of modifying a rocket kit to achieve some result other than that intended by the manufacturer.

Krushnic Effect - The effect caused when rocket motor exhaust is confined in an open tube, such as a booster stage airframe. The exhaust gas over-expands and loses its velocity, reducing the motor thrust. Also called over-expansion. Usually occurs when a booster motor separates but the booster stage does not.

L1, L2, L3 - Levels one through three: reference to the three levels of high power rocketry certification.

Laminar Flow - A smooth flow of air, noted for lack of turbulence. In current theory, it is modeled as consisting of layers of air having similar speed and density.

Laminated Wood - Wood made from multiple layers, commercially made plywood being the most common example.

Land Shark - The condition in which a rocket, for whatever reason, fails to attain air flight and slides along the ground under power.

Launch Controller - An electrical device used to activate the motor igniter, which in turn ignites the motor. The launch controller should always incorporate a lock-out device such as a key, to prevent accidentally activating the igniter before the rocket is ready to be launched.

Launch Happy - Euphoria from being overly addicted to burnt fuel fumes on a particular day. Symptoms include repeatedly launching a model on increasingly more powerful motors until there are no motors left or the rocket shreds.

Launch Lug - Usually, a tube attached to the side of the rocket to accommodate a launch rod, to stabilize the rocket while building up air speed.

Launch Pad - An assembly containing the launch rod or tower and blast deflector if any, which permits the rocket to remain steady until launched.

Launch Rail - A stiff rail, often with a cross section in the shape of a square letter C or I. Lugs on the rocket ride on the rail. Using a rail rather than a rod provides the advantage that a rail can be made much stiffer than a rod, providing better wind resistance and preventing vibration-induced whipping of the launch rod.

Launch Rod - A stiff rod, whose diameter can be from 1/8" to 1" depending on the size and weight of the rocket, along which a rocket flies for the first few feet of its travel. The launch rod stabilizes the rocket's flight while it builds up air speed.

Launch Tower - A launch pad containing any sort of stabilizing device other than a launch rod. In model rocketry, a tower commonly consists of 3 or 4 smooth rods which support the rocket on all sides, eliminating the need for a launch lug.

Lawn Dart - Similar to a Core Sample but requires the nosecone to remain in place prior to impact. Named after a lawn game of the sixties in which large darts were thrown into the air to land inside rings placed on the ground about 25' apart (as in horse shoes).

LBP - Live Biological Payload. Transport of any vertebrate animal is currently in violation of all rocketry safety codes.

LCO - Launch Control Officer. Person in charge of controlling the range and launching rockets.

LDRS - Large and Dangerous Rocket Ships: the name of the annual **TRA** launch.

Leading Edge - The front edge of a wing or fin.

LEUP – BATF Low Explosive User Permit for rocket motors with greater than 62.5 grams of propellant, as well as other substances deemed by the government to be low explosives such as **Thermalite**.

Liftoff Mass - See **GLOW**.

Lite-ply - A model builders plywood, noted for its low density.

Low Power – Typically rockets flying on motors in the A to D range.

LOX - Liquid Oxygen

Lucerne Soft Landing - A condition - experienced only on ground surfaces of cracked playa clay - in which a rocket which has landed remains in a semi-upright position with one **fin** stuck in a crack in the ground.

Mach Number - An expression of velocity calculated by dividing the actual velocity by the speed of sound.

Magazine - An ATF-approved storage device for large rocket motors and other low-explosive devices.

Mass Ratio - Final mass (after propellant burn) divided by initial mass.

Max Q - The point during the powered flight phase of a rocket's ascent at which acceleration stresses on the airframe are the greatest. This is the point at which a **shred** is most likely to occur.

Maximum Thrust - The peak **thrust** a motor generates.

Mean Chord - A wing's root **chord** plus its tip chord, divided by two.

Mercury Switch - An electrical switching device consisting of an oval glass bulb which contains two electrical contacts (penetrating the bulb, and at one end of the oval) and a drop of mercury.

In hobby rocketry, mercury switches are used to detect the absence of acceleration in a moving rocket. When the rocket launches, acceleration forces hold the mercury drop at the bottom of the bulb, away from the electrical contacts. When the rocket's acceleration ceases, the mercury - which is a heavy metal and stores considerable momentum - moves forward in the bulb, bridges the gap between the contacts, and closes the electrical circuit.

The electrical circuits controlled by mercury switches are most commonly used to activate recovery system **deployment charges** or **sustainer motor igniters**.

Micro Bubbles - Tiny glass globules which are sometimes added to epoxy adhesive in applications like fin **fillets**, to reduce weight.

Microclips - Small, toothless electrical clips commonly used to connect the launch system to the igniter on model rockets.

Mid-body Ejection - The practice of placing a rocket's separation point midway up the body tube, helping to prevent tube **zippering**.

Mid Power - Typically rockets flying on motors in the E to G range.

Minimum Diameter - a model whose diameter is just large enough to accommodate its motor.

Model Rocket - An aircraft that ascends into the air using some form of reaction motor, without the use of aerodynamic lifting surfaces. Model rockets have the following

characteristics: Gross launch weight, including the motor(s), does not exceed 1500 grams. Motor power does not exceed 160 newton seconds of impulse and/or contain more than 62.5 grams of propellant each, and no more than 125 grams of propellant in multiple motor configurations. All components of model rockets must be of wood, paper, rubber, breakable plastic or similar material and without substantial metal content.

Modroc - Slang for **Model Rocket**.

Module - A combination of parts or components arranged and mounted or packaged as a single unit. The parts work together to perform a specific function or functions.

Monokote - Model aviation covering consisting of colored heat shrinkable vinyl, applied with a tacking iron. Often used as trim tape.

Motor - A device that imparts motion through reaction.

Motor Clip - See **Motor Hook**.

Motor Code - The accepted method of expressing the characteristics of a particular motor.

Motor power ranges (total impulse) are expressed with letters A through N. Each letter expresses a power range twice as powerful as the preceding range. The power ranges are as follows:

MOTOR CLASS	MINIMUM NEWTONS	MAXIMUM NEWTONS
¼ A	0.0	0.625
½ A	0.626	1.25
A	1.26	2.5
B	2.51	5
C	5.01	10
D	10.01	20
E	20.01	40
F	40.01	80
G	80.01	160
H	160.01	320
I	320.01	640
J	640.01	1280
K	1280.01	2560
L	2560.01	5120
M	5120.01	10,240
N	10,240.01	20,480

The motor code is expressed as a letter followed by a series of numbers. For example, C6-3, in which C is the power range (5.01-10 Newtons), 6 is the average thrust in Newtons, and 3 is the delay time in seconds(counting from propellant burn-out).

Motor Diameter - The diameter of a hobby rocketry motor casing. Most commercially-manufactured motors are made in standard sizes. Motor diameters are most commonly expressed in millimeters. The most commonly seen motor diameters are 10.5mm, 13mm, 18mm, 24mm, 29mm, 38mm, 54mm, 75mm, and 98mm.

Motor Hook - A device for retaining the motor on a model rocket.

Murphy's Law - The guiding principle of Rocketry preparation: "If anything can go wrong, it will."

Music Wire - A high grade, stiff wire made to low tolerances that comes in a wide variety of diameters. Commonly used to make springs, it is also known as piano wire. Most often used in model rocketry as launch rods.

NAR – National Association of Rocketry

NARAM - National Association of Rocketry Annual Meet: The annual week-long launch hosted by the NAR.

NARCON - The annual NAR convention.

Neutral Stability - The condition in which a rocket's CP and CG are at the same spot. Dynamically, this creates a situation in which a rocket may fly steadily in dead air but can't recover if the **angle of attack** is greater than zero.

Newton - The amount of force required to accelerate one kg, one meter per second per second. 4.45 newtons equals one pound of force.

Newton-Second - The typical unit of measurement for rocket thrust. One newton-second is one newton of thrust maintained for one second.

NFPA - National Fire Protection Association - Private corporation for setting safety standards.

NFPA 1122 - Standards code for U.S. Model Rocketry.

NFPA 1127 - Standards code for U.S. High Power Rocketry.

Nichrome - Refers to the metal content (nickel/chromium) of the **igniter** wire most commonly used in model rockets. Nickel/chromium is chosen as a material because it

has high resistance and high strength. When exposed to an electrical current, it will glow yellow-hot before burning through.

Nike Airfoil - See **Diamond Airfoil**.

Nitrous Oxide - (N₂O)Gaseous oxidizer used in current hybrid rocket motors

Nomex[®] - A lightweight, fire-resistant Nylon fiber, originally woven into fireproof garments for fire fighters, race car drivers and astronauts. Also commonly used in aircraft upholstery. In hobby rocketry, Nomex is used as sheaths and bags to protect elastic shock cords and parachutes. See **Deployment Bag**.

Nose Blow Recovery - Recovery method for light models by simply ejecting the nose cone and having it come down attached on the **shock cord**.

Nose Cone - The pointed object at the front of a rocket. Cones are not always strictly cone-shaped. They are sometimes rounded but are most commonly ogive (a pointed arch). Nose cones are an important consideration in rocket design, since they provide two ways to move the center of gravity forward if needed; by using a longer cone, or by adding weight to the cone.

Nose Heavy - The condition in which a glider is trimmed into a dive or a rocket has excessive mass in the nose.

Nose Weight - A weight, often of lead, epoxy or modeling clay, which is added to the nose of a rocket to move its center of gravity forward and improve the rocket's stability.

NSL - National Sport Launch: an annual three-day launch hosted by the **NAR**.

Oddroc - Slang term for a strange-looking rocket. Oddrocs are often made in the shape of other, non-rocketry-related items.

Ogive - In rocketry, the shape of a common type of nose or tail **cone**. If the sides of the cone are curved rather than straight, the geometric shape of the cone is actually an ogive rather than a cone.

One-Caliber Stability - A widely-accepted rule of thumb for rocket stability: The center of gravity should be approximately one body width (one "caliber") ahead of the center of pressure.

OOP - Out Of Production. This is a reference to a rocket that was once but is no longer produced by a commercial manufacturer. Reproduction of plans, parts lists, and scaling information for once-popular out-of-production model rockets has become an Internet cottage industry.

Open Breech - A piston launcher in which the motor travels up the piston tube and engages the motor mount. See **Piston Launcher**.

Optimum Weight - The mass required to lift a rocket to the highest possible altitude on a given motor.

Orange Book – BATF explosives rule book.

Oscillation, Parachute - The swinging from side to side of a payload under a parachute.

Outboard - Direction parallel to the lateral **axis** of the rocket and perpendicular to the centerline.

Over-Expansion - See **Krushnic Effect**.

Oxidizer - A substance which provides oxygen to a combustion process, aiding in the speed and efficiency of combustion. The addition of an oxidizer to the chemical process of combustion can cause a fuel that would barely burn under normal atmospheric conditions to burn so enthusiastically that it can be used as a rocket propellant.

Pad Manager - Person responsible for assigning pads and controlling the launch pad area. Helps rocket flyers set up pads and rockets for flight.

Parachute - A piece of plastic, cloth, nylon, or other material, shaped something like an umbrella when deployed, which slows the descent of a rocket.

Paraglider - A flexible, kite-like glider deployed like a parachute and designed to be a recovery device.

Parallel Staging - A practice similar to **clustering**, in which two or more “stages” mounted parallel to the main motor ignite simultaneously. The “stages” usually contain shorter-burning, higher-thrust motors than the main **airframe** (or **sustainer**), and drop off when their motors burn out.

Parasheet - A flat piece of plastic or other material, formed into a circle or polygon, which is used as a **parachute**. This is the most common type of parachute used with model rockets.

Parasite - Usually, a glider which is boosted into flight by being attached to the airframe of a model rocket which is modified to accept it.

Pay Forward - A Harry Stine expression. To pay back the mentors of our youth, not by tangible means to the mentors, but by acting as mentor to the next generation.

Payload - A package or thing placed in a rocket, which normally does not contribute directly to the success of the flight. For example, an altimeter used to record a rocket's maximum altitude is an example of a payload.

Payload Section - A portion of rocket airframe set aside for payloads. Also called payload bay.

PD - Parachute Duration; a popular competitive event in **NAR**-sanctioned launches.

Permeability -The measure of diffusion or "leakage" of gas through a fabric. The permeability determines the rate of descent.

Phenolic - Literally, anything containing phenol, which is a petroleum distillate having many industrial applications.

Phenolic resin, with which phenolic airframes are impregnated, is made by mixing phenol with an aldehyde such as formaldehyde, and is used for forming all sorts of molded and cast items.

Phenolic airframes are made by impregnating paper with phenolic resin, then tightly winding it into a tube and allowing the resin to cure. The word phenolic is often used to describe any body tube which contains phenolic resin.

Piano Wire - See **Music Wire**.

Pilot Chute - A small parachute attached to the apex of a large main parachute, and so oriented that it emerges from the airframe first. Air drag from the inflating pilot chute assists the main chute to exit the airframe, pulling it out apex-first so that it is less likely to tangle.

Pink Book - The common name for the **NAR** Contest Rules Manual.

Pinwheel - A condition in which a rocket spins on its horizontal axis. Usually caused by a split in a motor casing. This condition is highly dangerous, as the rocket's trajectory is completely unpredictable.

Piston Ejection - Ejection of the recovery device through the use of a solid sliding bulkhead inside the airframe. The use of a piston eliminates the need for **wadding**.

Piston Launcher - A type of launcher used with small competition model rockets. At the moment of motor ignition, a piston assists the motor in launching the rocket.

Pitch - A back-and-forth motion of the nose of a rocket in flight, on the **axis** determined as "up-and-down". See **Yaw**.

Planer - A tool to shave thin slices of material in order to shape or smooth the material.

Planform - The geometric shape of a wing or fin.

PMC - See **Plastic Model Conversion**.

Plastic Model Cement - A mixture of solvent and styrene plastic used to adhere plastic to plastic or plastic to paper.

Plastic Model Conversion - A refitting of a static plastic model kit to allow it to fly as a model rocket.

Plugged Motor - A motor made with a solid bulkhead in the front end, blocking any passage of ejection gases into the airframe.

Polyhedral - A wing broken up into multiple panels, angled in relation to each other.

Pop-Lug - A launch lug affixed the model in such a way that it comes off the model as it clears the launch rod or rail.

Pop 'n Go Ignition: A technique whereby a powdered chemical accelerant is poured over an igniter placed in the nozzle to insure ignition. Typical accelerants include Black Powder, Photographer's Flash Powder etc. So called because of the distinctive "pop" that occurs when the mixture is ignited. Can be dangerous if too much powder is used since this can potentially damage the nozzle and thereby cause a catastrophic motor failure (**CATO**).

Pop Pod - The motor mount on a conventional boost glider. When the motor deployment charge fires, the pop pod separates from the glider, deploys a streamer and returns to earth, leaving the glider free to glide.

Power Prang - (See **Prang**) Slang term for a condition in which an unstable rocket reverses course and moves toward the ground while still under power. Also called a Death Dive.

Prang - Slang for any condition in which a rocket contacts the ground without benefit of recovery system. The origin of the term is in dispute. Stine claims (Handbook of Model Rocketry, 6th ed., p. 196) that it is a British term, originally used in the aircraft industry to describe deformation of an airframe by ground impact. May refer to the sound made when a wing strikes the ground.

Prefect - The head of a **TRA** Prefecture, or the designated person, to maintain a line or communications with, or to see compliance to, the TRA.

Prefecture - A club or group affiliated with the **TRA**.

Pressure Relief Hole - A hole in the airframe of an **HPR** model to relieve the difference in pressure between the inside of the model and the atmosphere, so as not to prematurely eject the nose section.

Primer - A special mix of paint, applied directly as a first coat, that is formulated to have excellent adhesion and a uniform colour over various materials such as body filler.

Propellant Mass Fraction - The propellant mass divided by initial mass.

Propulsive Chaff - (Brit.) The remains of a shredded rocket while still airborne.

PRS - Pacific Rocket Society - An amateur rocketry organization.

Pseudo Scale - A model designed and decorated to appear to be a scale model.

Pyrotechnic - Of or pertaining to fire or explosion. The term is most commonly used with reference to fireworks.

Rangehead - The part of a launch site where the pads are located.

Rear Ejection - The ejection of recovery device through the rear of a model.

Red Baron - The condition in which a **boost glider's** motor pod and recovery system gets tangled with the glider portion, causing the glider to spiral down as if it had been "shot down".

Reefed Parachute - A **parachute** whose shroud lines are restricted to prevent full opening of the canopy.

Reynolds Number - A nondimensional co-efficient that measures the compression of air due to scaling. This allows scale models to be tested in wind tunnels.

Relayer - A **launch controller** that controls electrical current to the **igniter** through an electrical relay. This arrangement allows the power source to be placed close to the **rangehead**, reducing the voltage drop through long wires.

Retainer - A device for keeping the rocket **motor** from being ejected by the force of the **deployment charge**.

RG - See **Rocket Glider**.

Rigid Wing - A glider with **wings** using rigid airfoils rather than a parafoil or flexible wing.

RMS - Reusable Motor System. A solid rocket motor which can be re-fueled and reused.

Rocket Glider - A type of **boost glider** that has the characteristics of a model rocket when ascending, then changes its configuration to have the characteristics of a glider when descending. All parts remain with the model other than the spent fuel.

Rogallo Wing - A flexible delta wing platform developed by Francis Rogallo that is popular for kites, hang-glidiers and ultralights.

Roll - Rotational motion of a rocket through the long (flight) **axis**.

Root Chord - The chord at the root of a wing or fin. See **Chord**.

Root Edge - The edge of a fin or wing that is glued to the airframe.

Rotor - A multi-bladed propeller used to produce lift or control the orientation of an aircraft.

Rotor Blades - Wing-like extensions, rotating around a central hub of a helicopter or **autogyro**.

Rotor Disc -The disc of space formed by the rotation of rotor blades.

Rotor Hub - The central attachment point for the blades of a rotor. The attachment usually determines the pitch angle of the blades. The hub can be of 2 types: fixed or rotating.

RRS - Reaction Research Society - The oldest continuously-running amateur rocketry group in the United States.

RSO - Range Safety Officer. Person(s) responsible for field safety. Determines suitability of rockets to fly at a particular site. Inspects rockets prior to flight.

RTF - Ready to Fly. A rocket which is sold pre-built, as opposed to a kit.

SC - See **Shock Cord**.

Scale - The practice of building model rockets which are replicas of existing rockets or other aircraft, which models are constructed to a size that is a particular percentage of the original aircraft's size. Scale models are often built for competition, and their level of detail can be very exact.

Scissors Wing - A variable geometry wing **planform** used on **rocket gliders**, where the wing unit rotates and aligns with the fuselage when not in glide mode.

Scott Towel Special - A cheap rocket costing less than \$1, made of a tube taken from paper towels, toilet paper or gift wrap, a hand rolled paper nose cone, and card fins or tube fins or other recycled material. The use of balsa for fins or any other conventional model parts immediately disqualifies the model as a Scott Towel Special.

Screamer - A really, obnoxiously loud **beeper**.

Screw Eye - A headless screw on which the shaft is extended and formed into a circular eye.

Scrub - to cancel a launch attempt due to problems, technical or otherwise.

SD - Streamer Duration; a common competitive event in **NAR**-sanctioned launches.

Sealer - Paint-like substance to cover wood parts. Sealer seals the wood grain, preventing any penetration of moisture, allowing a smoother finish, and the use of less paint.

Sears-Haack - A series of nose cones designed and used for maximum aerodynamic efficiency on very high-speed rockets. The most commonly encountered cone in this series is a **Von Karmon** cone.

Servo - A small mechanical device, which upon receiving a signal from a radio or timer will perform an action such as the movement of a pushrod.

Shock Cord - A length of elastic or bungee which provides shock absorption for the rocket components at the point of flight where the deployment charge fires and the parachute opens.

Shock Cord Mount - The attachment point for a shock cord.

Shoulder - A slight sharp indentation at the base of a nose cone or top or base of a transition, allowing the part to be slid into a tube while allowing alignment of the rocket sections to be maintained.

Shred - The condition in which a rocket's airframe fails during launch. This is caused when the force applied by a rocket motor exceeds the tensile strength of the rocket airframe. The effect of a shred is similar to an explosion.

Shroud, Parachute - Lines or strings which pull down on the edges of a parachute. The shrouds come together at their bottom ends to provide a point of attachment between the parachute and the rocket.

Shroud, Transition - A piece of material, often card stock, used to smoothly allow the airframe to go from one diameter to another.

Single-Stage Recovery - A process by which a rocket is recovered by means of a single parachute, streamer, or group of parachutes which deploy at one time. See **Two-Stage Recovery**.

Sink Rate - The rate of vertical drop during the recovery phase of a flight, in feet or metres per second. Sink rate used to specify parachute or streamer size for a rocket.

Skin - The thin outside surface of a hollow part or object.

Skywriting - Slang term for the smoke trail left by an unstable rocket which does not fly straight.

Snap Swivel - A small device, originally developed to connect fishing lures to leaders., which is attached to a model rocket's parachute shrouds. This permits the parachute to be easily removed and replaced on the rocket, and permits the parachute to rotate in relation to its connection point, which reduces shroud tangling.

Snuffer Tube - A small metal tube used to extinguish a wick such as in a **dethermalizer**.

Sonic Barrier - The zone of high air density caused by the compression wave of an object traveling near the speed of sound.

Sonic Boom - Loud report caused by the passing of the compression front generated by an object as it exceeds the speed of sound.

Sonic Speed -The speed of sound at the current conditions of air density. humidity and temperature.

Spack - (Brit.) Slang for the sound of a model rocket hitting the ground from high altitude.

Span - The long (side-to-side) dimension of a wing. See **Chord**.

Spar - A long, thin, structural member of a airframe.

Also, SPAR - Special Projects And Research, formerly a department of Bombardier/De Haviland Canada, now the maker of satellites and robotic arms for use in space.

Specific Impulse (I_{sp}) - The total impulse of a motor divided by unit weight of propellant.

Speed Of Balsa - That speed at which a rocket's balsa fins shred. The speed varies with thickness of balsa, thrust gradient, type of glue used and mostly quality of building technique.

Spill Hole - A hole in the center of the canopy of a hemispherical parachute, designed to reduce payload oscillations caused by the canopy spilling air unevenly from its edges.

Spinerons - Tabs attached to fins and set at an angle, intended to spin the rocket in order to stabilize it.

Spin Stabilization - The use of spin along the long axis of a rocket to stabilize the flight, thus making the rocket act as a gyroscope.

Sport Model - A model rocket designed and built with no specific purpose in mind other than to fly it.

Spot Landing - A competition event in which the goal is to land the model closest to a predetermined spot on the launch field.

Sport Rocketry - Rocketry activities pursued as a pastime, diversion, or personal enjoyment. Term is often used as a contrast to "competition rocketry."

Squib - A small charge of black powder or other propellant, contained in a hollow tube and set off with an electrical igniter. The term is usually used in connection with an electronically-actuated deployment charge for a rocket's recovery system.

SSTO - Single Stage To Orbit

Stab - Stabilizer: Usually refers to the fin-like structures at the rear of a conventional boost glider.

Stability - The tendency of a rocket to move in a straight line in the direction it is pointed at launch.

A hobby rocket employs "passive" stability, in that it depends on its inherent stability (the relationship of its centers of pressure and gravity) and the counterbalancing pressure of the **airflow** on its **fins** to keep it moving in the correct **attitude**. Missiles and spacecraft usually employ "active" stability schemes, in which attitude jets or movable vanes help correct the rocket's course in flight.

Stability involves a rocket's ability to continue to fly straight when the **angle of attack** is greater than zero. A stable rocket continues to fly in its intended direction, even if moderate wind or other influences try to change its course.

A poorly-designed rocket can be either unstable, marginally stable or excessively stable. An unstable rocket (whose center of gravity is behind its center of pressure) will

fly erratically when launched. A marginally stable rocket (whose center of gravity is less than one diameter ahead of its center of pressure) might be able to maintain a straight flight attitude if there is no side wind (angle of attack is zero.) However, if outside forces such as wind intervene (angle of attack greater than zero), the rocket can be thrown off its flight path and behave in an erratic manner. An excessively stable rocket (whose center of gravity is much more than one diameter ahead of its center of pressure) will tend to turn toward those outside forces rather than remain on the intended line of flight. See **Weathercocking**.

Stall - The angle of maximum lift for an airfoil. Stalls are dangerous because lift dramatically decreases (often to near zero) at any angle past the stall point

Static Balance - A state in which a model's center of gravity can be demonstrated to be in a proper relationship to the center of pressure by actually balancing the model on a narrow surface.

Static Firing - The firing of a motor, mounted in such a way that the motor can not move. Used usually with instrumentation, to permit performance measurement.

Stine's Law - The guiding principle of Rocketry construction and flight: "If at first you don't succeed, try following instructions."

Streamer - A device for slowing the descent of a rocket, sometimes used in place of a **parachute** in smaller rockets. The streamer consists of one or more long, narrow lengths of plastic, fabric or paper which are connected to the rocket in the same fashion as a parachute, and which deploy and flutter to slow and stabilize the falling rocket. Since streamers do not slow the descent as much as a parachute, they are normally only used on relatively small or very robustly-built model rockets. However, they are useful in windy conditions since they will not allow the descent to drift as much as a parachute will.

String Test - See **Swing Test**.

Strip - A condition in which a rocket's fins, or a glider's wings, are pulled off the airframe by excess thrust.

Striptease - The "act" of having wings or fins stripped off an airframe.

Also, a pop-pod glider that separates from the booster pod prematurely.

Stuffer Tube - A small-diameter tube - commonly an extension of the motor tube - which is used in large-diameter rocket airframes to duct deployment charge gases to the recovery system storage area. This reduces the internal area which must be pressurized by the deployment charge.

Styrofoam - A very light material made of expanded polystyrene plastic. Though Styrofoam has little structural strength, is easily shaped into shapes, such as large nose cones and glider wings, that can be skin-reinforced by fiberglassing or lamination of thin wood veneers.

SU - Single Use; a disposable motor which cannot be re-used.

Subsonic - A speed less than Mach 1.

Superroc - Usually, a lengthened version of an existing model rocket design, used in altitude and duration competition. Scoring is based on altitude multiplied by airframe length. Super-Roc has different length limits for different motor classes. For example; A has a range of 75 to 150 cm, C has a range of 125-250cm. The rockets can be longer but the excess length is not counted into the length factor. In the altitude category the rocket may be recovered in more than one section.

Supersonic - A speed greater than Mach 1 and less than Mach 5.

Sustainer - In a multi-stage rocket, the last or top stage. In a parallel staged rocket, the longest-burning motor.

Sweepback - The amount of angle that the leading edge of a wing has been shifted back from a line perpendicular to the airframe of a model.

Swing Test - A stability test in which a string is attached to a model rocket at the center of gravity and then swung around the head. If the model is stable, it will head nose into the direction of travel. This test has a large margin of error, thus producing models often overly stable. It can not be used for large rockets, unless King Kong consents to twirl the string. Sometimes called a **string test**.

Symmetrical Airfoil - An airfoil (wing) in which both the top and bottom surfaces are tapered.

Tail Boom - The spar extending past the wings of an aircraft to which the tail or stabilizer surfaces are attached. It is usually cut down to a minimum diameter as required for strength.

Tail Drag - See **Base Drag**.

Tail Heavy - General description of a model that will require nose weight to achieve the desired CP/CG relationship for stable flight.

Taper - A uniform decrease in diameter in a cylindrical or near cylindrical part.

Telemetry - The transmission of data to a remote receiver, usually through the use of radio frequency broadcast.

Template - The outline of a part, made of a tough material used as a stencil to produce multiple parts of that size and shape.

Terminal Velocity - The highest allowed velocity for a shape or design, any further attempt to accelerate the object will result in drag forces completely eliminating the acceleration.

Theodolite - A device for determining altitude by measuring both elevation and azimuth angles. More accurate than a simple inclinometer, which measures only the elevation angle.

Thermalite - A low-explosive device in the shape of narrow string, similar to detonation cord. Thermalite is often used to enhance the efficiency of igniters in large-diameter composite motors, and is sometimes used for **airstarting** motors. The possession and use of Thermalite now requires a **LEUP** to be issued from the **BATF**.

Throat - The narrowest cross-section of a rocket motor's nozzle.

Thrust - The propulsive force developed by a rocket **motor** during the rocket's powered ascent.

The force produced by a rocket motor is described by Newton's second law of motion "Force equals mass times acceleration" and by Newton's third law of motion "for every acting force, there is an equal reacting force in the opposite direction." The amount of forward thrust generated by a motor is defined by the second law ($F=MA$), the third law merely says that it must move. In obedience to the second law, the two variables which must be known in predicting a motor's thrust is the mass of exhaust gas expelled at any given moment, and the exhaust's velocity.

Thrust Decay - The gradual loss of **thrust** at the end of a motor's **burn**.

Timer - An electronic device which is used to control events during a rocket's flight, such as **sustainer** motor ignition or recovery system **deployment**. A timer is normally combined with another device such as an **accelerometer** or **G-switch**, which provides a start signal for the timer.

Tip Chord - The chord at the tip of a wing or fin. See **Chord**.

Tip-Off - An alteration of a rocket's flight direction caused by interaction of the launcher, rocket, and wind direction as the rocket leaves the launcher.

T-Max - The time interval between ignition and maximum **thrust**.

Total Impulse - The total **thrust** produced by a rocket motor across its full burn time. Usually expressed in **Newton-seconds**.

TRA - Tripoli Rocketry Association

Trailing Edge - The rear edge of a wing or fin.

Transition - See **Adapter**.

Transonic - The condition of crossing the sonic barrier. This is the period of maximum aerodynamic stress in a supersonic flight.

Trimming - The act of adjusting surfaces on an aircraft through warping or shifting trim tab angles to achieve stable controllable flight.

TSTO - Two Stage To Orbit

TTMM - To The Motor Mount: An extension of **TTW** fin mounting, in which the fin tab which has passed through the airframe wall contacts the motor mount tube and is bonded there with epoxy.

TTW - Through The Wall; a technique for increasing the strength of a fin-to-airframe mounting joint. The airframe is slotted at the point where the fin is to be mounted. The fin is extended or tabbed so that it can pass through the body tube instead of bonding to its surface. Commonly the root of the fin bonds to the surface of the motor tube, then fillets are built up where the fin passes through the airframe.

Tumble Recovery - A recovery method where a very light model rocket ejects its motor and shifts its **CG** behind the **CP**, thus preventing stable flight and causing the model to tumble end over end.

Tunnel - Slang for wind tunnel.

Also, a long hollow conduit on the side of a rocket used to protect wiring traveling from the top to the bottom of the rocket.

Turbulator - A device used on rockets with conical cross-sections, such as **egg lofters**, to prevent the extra drag which occurs when the **laminar airflow** separates from the airframe. This is done by causing the airflow to become turbulent at the point where it would normally separate from the airframe.

Two-Stage Recovery - A process by which a rocket is recovered by means of a **streamer** or **drogue parachute** which opens at **apogee**, followed by a main parachute which opens at lower **altitude**. See **Single-Stage Recovery**.

Ultrascale - The practice of building very large **HPR** versions of smaller model rockets, several times the size of the original.

Umbilical Mast - A mast extending beside a rocket while sitting on its launcher, designed to support wiring or hoses to the rocket. It is often designed to pull the wiring or hose out of the way once the model's motors ignite.

Unsymmetrical Thrust - A condition in which the **thrust** of a motor or motor **cluster** is not parallel to the **axis** of the rocket. This is most often caused by the failure of part of a cluster of motors to ignite or a protuberance extending into the exhaust stream of a single motor.

Upscale - The practice of building large **HPR** versions of smaller model rockets.

Vacu-form - A method of making lightweight plastic components like **nose cones** by using heated plastic, a mold, and a vacuum pump that is attached to the mold.

Vectored Thrust - A condition in which a rocket motor's **thrust** is not parallel to the motor's **axis**. This is achieved by canting the motor's exhaust nozzle, and is often done to reduce the unsymmetrical thrust that results from outboard motors failing to ignite on clustered-motor rockets.

Von Karmon - A nose cone shape. Von Karmon is a special case of the **Sears-Haack** series of nose cone shapes, used on very high-speed rockets. It is the most efficient volume per unit nose drag.

Wadding - A non-flammable filler material placed in a model rocket airframe before the parachute is inserted, and serving two purposes:

- To act as a piston for deployment charge gases
- To protect the parachute and other deployment system components from burning.

Waiver - A permission granted by the **FAA** to launch large rockets into airspace that it controls, for specific altitudes (usually 5000 or 10,000 feet) and for a specific period of time.

Warp - A twist, usually undesired, in a normally flat object such as a fin

Weathercocking - The tendency of a rocket to fly into a breeze, altering the flight path from vertical.

Wedging - A method of securing fins by forcing the fin root in between tubes in a motor cluster.

Wind Tunnel - A specially designed pipe in which moving air can be channeled in a controlled way, producing an air stream of laminar flow and constant velocity, thus allowing testing of a design under constant conditions.

Wing - In British usage, a rocket's fins. Also, the lifting surfaces of a glider.

Wing Loading - A method for measuring appropriate wing size, calculated by dividing the wing area in inches squared by the mass of the aircraft.

Winglets - Small fin or wing-like extensions attached to the ends of the wings of an aircraft.

Wood Grain - The predominant direction of the fibers in a piece of wood. important to note as the strength of the material is perpendicular to the fiber direction.

Yaw - A back-and-forth motion of the nose of a rocket in flight, on the **axis** determined as "left-and-right". See **Pitch**.

Zipper/Zippering - A condition in which a slot is cut in an **airframe** by a **shock cord**. This condition is caused by early or late recovery system **deployment**, in which the recovery system deploys while the airframe is moving at a high rate of speed.