



AEROSPACE INFORMATION REPORT

AIR1489™**REV. C**

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Superseding AIR1489B

(R) Aerospace Landing Gear Systems Terminology

RATIONALE

AIR1489C has been reaffirmed to comply with the SAE Five-Year Review policy.

1. SCOPE

This report has been compiled by the Landing Gear Systems Terminology Panel of SAE Committee A-5 (Aerospace Landing Gear Systems). It represents an effort to gather together those terms commonly used within the discipline. Some terms are of course common to other disciplines as well. Others, however, are unique in form and/or meaning to the landing gear discipline. The need has been noted to set these terms down and provide a standard definition in order that communication within the discipline may be conducted with a common understanding. Full use has been made of available published information, and a list of references is provided. See also References (a) to (e).

Terms listed are usually applicable to a general functional area of landing gear disciplines. These general functional areas include; landing impact, directional ground control, velocity control (acceleration, retardation, and arrestment), structural support, ground flotation, and ground maintenance. In the listing of terms and definitions, each term is followed by a code in parenthesis which indicates which basic functional area or major component to which the term is most applicable.

Codes indicating basic functional area or major component are as follows:

a. Landing Gear Systems

1. Landing Gear (General) (L/G)
2. Tire (Tire)
3. Wheel (Whl)
4. Brake (Brk)
5. Nose Wheel Steering (NWS)
6. Shock Absorber (S/A)
7. Brake Control (B/C)

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b. Related Systems

1. Air Vehicle/Aircraft (A/V)
2. Arresting Gear (A/G)
3. Operating Base & Equipment (Base)
4. Catapult (Cat)

ABORT (A/V) - (1) To cut short or break off an action, operation, or procedure with an aircraft, space vehicle or the like, especially because of equipment failure, as to abort a takeoff, abort a mission, or abort a launch. (2) An aircraft, space vehicle, or the like that aborts. (3) An act or instance of aborting. (4) During catapulting, the act of suspending a launch and removing the airplane from the catapult. See also **BALANCED FIELD LENGTH** and **CRITICAL FIELD LENGTH**.

ACCELERATE - STOP DISTANCE (Base, A/V) - A measure of the field length requirement for aircraft operation. The accelerate-stop distance is the sum of (1) the distance required to accelerate the aircraft from a standing start to the critical engine failure speed and (2) assuming the critical engine to fail at this speed, the distance required to bring the aircraft to a full stop.

ACCELERATION (Whl, Brk, B/C, etc.) - (1) The rate of change of velocity with respect to time (as in speed or direction). (2) The act or process of accelerating, or the state of being accelerated. Negative acceleration is called deceleration.

ACCUMULATOR (L/G, A/G, Brk, B/C, etc.) - A device or apparatus that accumulates or stores up, as: a contrivance in a hydraulic system that stores fluid under pressure. An accumulator can store air for emergency gear blowdown or shock strut hiking (energy). Also an electric storage battery (British).

ACN/PCN (L/G, Base) - The Aircraft Classification Number/Pavement Classification Number system was developed to provide a single means for reporting the aircraft weight bearing capacities of airfield pavements for use in controlling pavement over load.

ACTUATING SYSTEM (A/V, etc.) - A system (mechanical, fluid, electrical, or otherwise) that supplies and transmits energy for the operation of other mechanisms or systems.

ACTUATOR (L/G, A/G, Brk, etc.) - A device that transmits energy and supplies force for the operation of other mechanisms or systems. It may utilize hydraulic, electrical, gaseous, or other sources of energy.

ACTUATOR-LOCKING (L/G, etc.) - An actuator with integral provisions for locking the output rod or shaft in a given position or positions.

ADAPTIVE CONTROL SYSTEM (B/C, L/G, SA) - Also active control. A control system which continuously monitors the dynamic response of the controlled system and automatically adjusts critical system parameters to satisfy the preassigned response criteria, thus producing the same response over a wide range of environmental conditions.

AERODYNAMIC COEFFICIENT (A/V) - Any nondimensional coefficient relating to aerodynamic forces or moments, such as a coefficient of drag, a coefficient of lift, etc.

AERODYNAMIC FORCE (A/V, etc.) - The force exerted due to the relative motion between a gaseous fluid and a body completely immersed in it.

AIRFIELD, EXPEDITIONARY, (Base) - The Expeditionary Airfield (EAF) is an on-shore, aviation weapons support system which permits deployment of land based aircraft within effective range of ground forces. Although an EAF can be as basic as a grass landing zone (LZ) to support helicopter operations, the installation of one or more EAF subsystems adds versatility and/or durability to the site selected for aircraft operations. See also SATS.

AIRFIELD, FORWARD-AREA (Base) - Airfields that must support the operation of liaison, observation, and light transport type aircraft, including heavy cargo helicopters, for a period ranging from a few days to three weeks. Airfields of this class will be constructed by engineer combat and airborne battalions, and usually will be located in the Division area of a combat zone. The strength characteristics of the forward-area airfield will normally govern the landing gear flotation design for any fixed-wing aircraft or heavy cargo helicopter with a mission requirement to operate in a near-front-line unit (for example, the retail delivery mission in an Air Line of Communications). The controlling forward area airfield is characterized as a field having a 4-CBR subgrade with no structural surfacing. It should be noted that an aircraft having sufficient flotation to operate on a 4-CBR subgrade for the number of design operations will have the capability of operating a lesser number of times on subgrade strengths substantially below 4 CBR. (TO - Theater of Operations)

AIRFIELD, HEAVY-LOAD (Base) - An airfield that must support heavy bomber type aircraft. The load-carrying capacity of pavements for this type of airfield is equivalent to a main gear load of 265 000 lb on a four-wheel, dual-twin configuration having tire contact areas of 267 in² for each wheel, twin spacing of 37 in center-to-center (c-c), and inside wheels of twins spaced 62 in c-c. (ZI - Zone of the Interior)

AIRFIELD, LIGHT-LOAD (Base) - An airfield that must support fighter and medium cargo type aircraft. The load-carrying capacity of pavements for this type of airfield is equivalent to a main gear load of 25 000 lb on a single wheel having a tire contact area of 100 in².

AIRFIELD, MEDIUM-LOAD (Base) - An airfield that must support heavy cargo, tanker, and medium bomber type aircraft. The load-carrying capacity of pavements for this type of airfield is equivalent to a main gear load of 100 000 lb on a two-wheel, twin configuration having tire contact areas of 267 in² for each wheel and wheel spacing of 37 in c-c.

AIRFIELD, REAR-AREA (Base) - Airfields that normally must support the operation of heavy cargo aircraft, medium cargo aircraft, and fighter-bomber aircraft for a period of four to six months. Airfields of this class will be constructed, rehabilitated, extended, and maintained by engineer construction battalions and will usually be located in the Zone of Communications or in the Army rear area. The strength characteristics of the rear-area airfield will normally govern the landing gear flotation design for heavy cargo and fighter-bomber aircraft. The controlling rear-area airfield is characterized as a field having the equivalent of a T11 landing mat surface lying directly on a 4-CBR subgrade.

AIRFIELD, SUPPORT-AREA (Base) - Airfields that normally must support the operation of medium cargo aircraft (and conceivably certain fighter-bomber aircraft designed for close tactical support) for a period of two weeks to one month. Airfields of this class may be constructed by several types of engineer units including engineer construction battalions, engineer combat battalions, and engineer airborne battalions and light equipment companies, and will usually be located in the Corps forward or Division rear area. The strength characteristics of the support-area airfield will normally govern the landing gear flotation design for medium cargo aircraft with such typical missions as the bulk delivery of supplies to Corps and Division forces in an intra-theater Air Line of Communications. The controlling support area airfield is characterized as a field having the equivalent of an M8 landing mat surface lying directly on a 4-CBR subgrade.

AIRFIELD, THEATER OF OPERATIONS (Base) - Theater-of-Operations airfields (more specifically TO airfield types) are limited-life facilities which represent the maximum construction capability of engineer troop units in the field, considering time limitations imposed by the tactical situation and available construction equipment and surfacing materials. The TO airfield classes are defined as rear-area, support-area, and forward-area airfields, and light VTOL landing areas.

AIRFIELD, ZONE OF INTERIOR (Base) - Zone-of-Interior airfields are permanent facilities constructed in accordance with the criteria given in Air Force Manual 88-6. Pavements may be either rigid (concrete); flexible (bituminous), or a combination thereof. The ZI airfield classes, as defined for Air Force construction, not only represent a range of flotation capabilities but also directly represent the designs on which most existing military airfields are based. Thus, the relations presented have a direct application to existing airfields in addition to providing a basis for comparison of proposed new aircraft landing gear designs with those of existing aircraft. The ZI airfield classes are defined as heavy-load, medium-load, or light-load airfields.

ALIGHTING GEAR (L/G) - A general term which includes all equipment or components concerned with alighting on or landing on water, land, shipboard or elsewhere, i.e., wheels, shock struts, floats, skis, etc. See also **LANDING GEAR**.

ALIGNING TORQUE (Tires) or Self-Aligning Torque - The footprint torque which in a rolling tire resists rolling in a curvilinear path, i.e., tends to align the roll into a straight path.

ANGULAR VELOCITY (Whl, etc.) - The change of angle per unit time; specifically the change in angle of the radius vector per unit time.

AQUAPLANE (Tire, A/V) - See **HYDROPLANE**.

ANGLE OF CORD (Tires) - The angle at which the cords in adjacent layers of fabric are set in the body or carcass of a tire relative to the centerline of the tread.

ANTISKID CONTROL (B/C, A/V) - A group of interconnected components which interact to reduce excessive brake pressure (hydraulic brake system) or clamping force (electrical brake system) and thus prevent inadvertent or excessive tire skidding thereby contributing to shorter aircraft stopping distances. See also **SKID CONTROL SYSTEM**.

AREA, LIGHT VTOL LANDING (Theater of Operations) (Base) - This is a special category landing area which will normally require no construction effort other than the clearing of vegetation. It will be characterized as an area having a non-surfaced, 1-1/2 CBR subgrade and will permit one to three operations of aircraft, such as personnel transport helicopters, on ground which, while having the minimum strength required for operation of most common military types of wheeled ground vehicles, can support these vehicles without significant danger of immobilization. It should be noted that the type of aircraft using this landing area will be capable of repeated operation from areas having greater than 1-1/2 CBR strength.

ARMING (B/C) - Provision of pre-setting a skid control function such as touchdown protection by some specific operating sequence of the aircraft (i.e., gear retraction/extension, squat switch activation, etc.). Term may also be applied to systems other than skid control.

ARRESTING CABLE (Base) - A wire rope which is stretched across a deck or runway, and which is engaged by the aircraft arresting hook to decelerate the aircraft. Also called cross deck pendant. See also **ARRESTING GEAR**.

ARRESTING GEAR (Shipboard and Field) (Base, A/G) - Any gear or apparatus designed to arrest something in its motion either all or part of such gear being external to the object being arrested. Specifically, any such apparatus used (i.e., in carrier landings) to arrest airplanes in the landing roll. "Arresting gear in its commonest form comprises a wire rope (arresting wire, arresting cable, cross deck pendant), or the like, stretched across the deck or runway in the path of the airplane and which engages the airplane arresting hook; and energy absorbing devices (arresting engine). In lieu of the wire rope/arresting hook system, a webbing assembly is sometimes used to engage the airframe and/or the landing gear, usually in emergency circumstances." See **BARRIER**, **BARRICADE**. Also see Reference (f).

ARRESTING HOOK (A/G) - The hook assembly, usually mounted on the aircraft for the purpose of engaging arresting gear mounted on the deck or runway for deceleration (arrestment) of the aircraft. The hook assembly consists of the shank (usually a V, Y or single "stinger" arrangement) and a hook point, usually detachable. The arresting hook installation in the airplane usually consists of the hook assembly, the holddown damper (dashpot, snubber), the holddown accumulator and pressure gauge(s), the extend/retract actuator (sometimes combined with the dashpot), the centering spring or similar device, the uplatch mechanism, the cockpit controls, and any related linkages, mechanisms, and fairings. See **TAIL HOOK**. Also see References (g) and (i).

ARRESTING WIRE (Base, A/G) - See **ARRESTING CABLE**.

ARTICULATED (L/G) - On a landing gear, an arrangement where the gear is hinged to permit folding as desired for retraction or operation, i.e., articulated axle. See Figure 1.

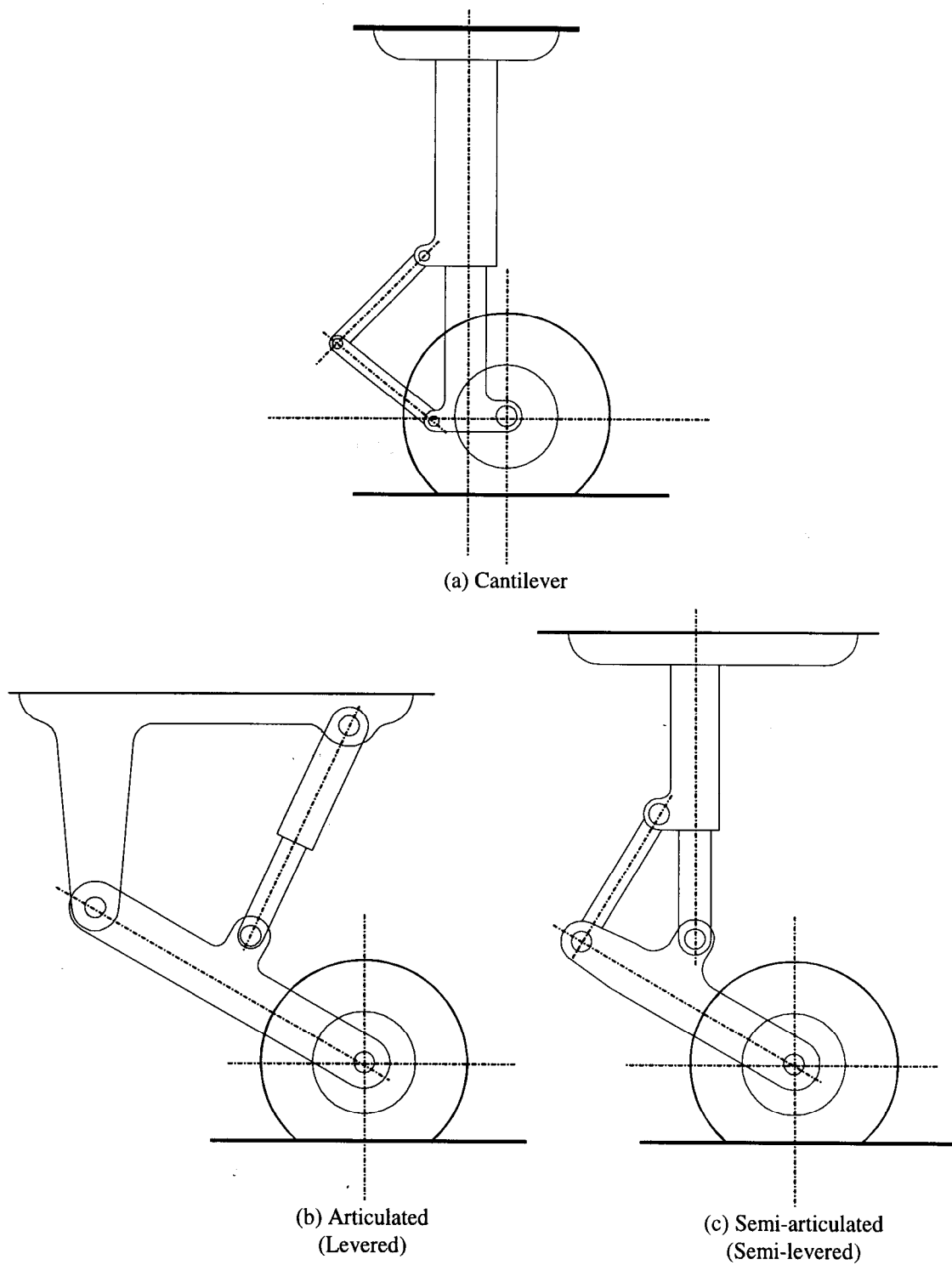


FIGURE 1 - LANDING GEAR ARRANGEMENT SCHEMATICS

ASPECT RATIO (Tires) - Ratio of tire section height to section width. General category: Low aspect ratio equal to or less than 0.77.

ASSEMBLY LOAD (L/G) - The total load imposed upon one gear assembly, i.e., one main gear assembly. Also called post load or ground load.

ATO (ABORTED TAKEOFF) (A/V) - See ABORT and REJECTED TAKEOFF.

ATO (Assisted Takeoff) (A/V) - A procedure in which an assist is utilized for takeoff operation such as rocket assist (RATO) or jet assist (JATO). A catapult (shipboard and shorebased) is a launching device which can be reused repeatedly and rapidly to provide takeoff assistance.

AXLE (L/G) - A supporting shaft upon which a wheel turns or which provides support for a rotating member.

AXLE BASE (L/G) - The dimension between axle centerlines on a multiple axle landing gear.

AXLE BEAM (L/G) - The structural member which connects and supports axles on a multiple axle gear arrangement. Also called bogie beam or truck beam.

AXLE SLEEVE (L/G) - A tubular sleeve which fits over the axle and supports the wheel bearings. Function includes (a) protection of the axle from galling or damage from bearing races, and (b) permitting wheel tire assembly buildup and torque adjustment in the shop and therefore protecting against sand, dust, and foreign object damage during installation on the aircraft. Also called false axle and bearing can.

BACKLASH (L/G, etc.) - In an aircraft control system, a looseness or free play in the linkage between crew station controls (input) and the device being controlled (output). In a landing gear system, similarly, any looseness, free play or slop in the system, i.e., nose wheel steering backlash/free play.

BACK PRESSURE (A/V, Brk, etc.) - Pressure exerted backward; in a field of fluid flow, a pressure exerted contrary to the pressure producing the main flow, i.e., brake back pressure. Net operating pressure is equivalent to gross system pressure less back pressure and other mechanical losses. Also refers to residual system pressure which the brake return mechanism must overcome or react against when a brake off command is executed.

BACKUP (L/G, etc.) - An item or system kept available to replace a primary item or system and to perform the same function of the primary item or system in the event that the primary equipment fails, i.e., a backup gear extension system.

BALANCED FIELD LENGTH (Base) - Any airfield where the actual field length is equal to the critical field length is designated a Balanced Field Length. See CRITICAL FIELD LENGTH.

BARRIER, MID-FIELD (Base) - A type of arresting gear located at the mid-point of the runway to decelerate and stop an aircraft. May be utilized as the aircraft lands in either direction on the runway.

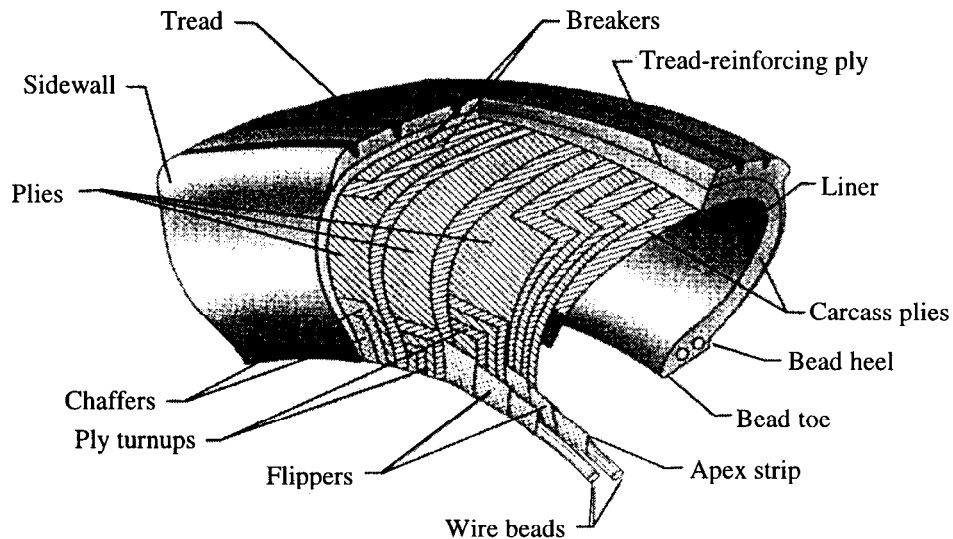
BARRIER, OVERRUN (Base, A/G) - A type of arresting gear located near the end of a runway to decelerate and stop an aircraft in case of brake system or other failure. Generally an overrun area is provided off the end of the runway for runout.

BARRIER, POP-UP (Base, A/G) - A type of arresting gear designed such that for normal operations, the aircraft rolls over the barrier. As an emergency requires and a command signal is given, the barrier pops up into a position for engagement prior to the aircraft pass.

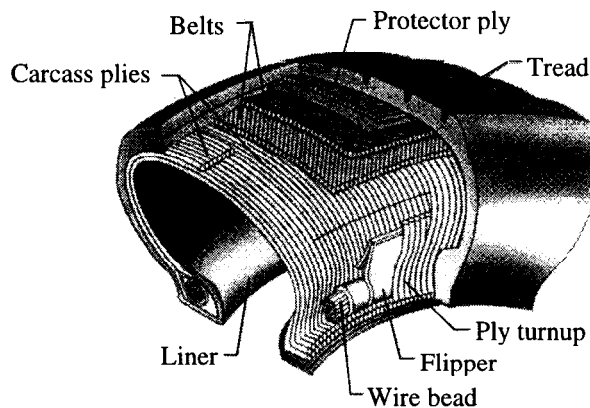
BARRICADE (Base, A/G) - Similar to barrier; for deceleration and recovery of an airplane with a known landing emergency. Generally a strap or webbing arrangement connected to an energy absorbing system. Whereas a barrier often is designed to engage an airplane landing gear, a barricade primarily is designed to engage the wings and other airframe structure, but may also engage the landing gear.

BEACHING GEAR (A/V, Base) - Any wheeled device attached to a seaplane or flying boat to permit moving it onto the beach or shore and to move the aircraft about ashore. May be removed during normal operations and attached for beaching operations.

BEAD (Tire) - Layers of wire, usually steel, imbedded in rubber and wrapped with fabric. They give a base around which the plies are anchored and provide a firm fit on the wheel. To provide increased stiffness in this area, "flippers" are then sometimes wrapped around the enclosed beads. Beads restrict air pressure expansion of the tire and jumping off the bead seat of the wheel. This term may also be properly applied to the entire zone of the tire in contact with the wheel rim. See Figure 2.



(a) Bias-ply tire



(b) Radial-belted tire

FIGURE 2 - AIRCRAFT TIRE CONSTRUCTION

BEAD BUNDLE (Tire) - The bead wires wrapped together to form the tire bead.

BEAD HEEL (Tire) - The outer bead edge which fits against the wheel flange.

BEAD TOE (Tire) - The inner bead edge closest to the tire centerline.

BEAD WIRE (Tire) - The steel wire from which the tire beads are wound.

BEARING CAN (Whl) - See AXLE SLEEVE.

BIAS-PLY (Tire) - Pneumatic tire in which the ply cords are laid at alternate angles substantially less than 90 degrees relative to the centerline of the tread. See Figure 2.

BLOW DOWN (L/G) - An emergency extension of the landing gear using an air charge in the event of hydraulic failure when the gear does not have free fall capability through the air stream.

BOGIE (L/G) - A low, strongly built cart. In landing gear usage, two or more wheels or sets of wheels on axles connected by means of an axle beam (or bogie beam) pivoted at the lower end of a shock strut assembly or structure to permit pitching motion as it rides over the runway or other supporting surface.

BOGIE BEAM (L/G) - See AXLE BEAM.

BOGIE GEAR (L/G) - A type of landing gear configuration utilizing a shock strut or structural support assembly and at the lower end, a pivoted bogie assembly.

BOLTER (A/V) - An attempted arrested landing wherein (1) the arresting hook fails to engage the arresting wire due to hook skip, (2) the aircraft touches down beyond the wire area, (3) the arresting hook fails to retain the wire, or (4) the arresting hook or wire fails after engagement. The aircraft then becomes airborne and resumes normal flight.

BOUNCE, AIRCRAFT (L/G, B/C) - A vertical motion of the entire aircraft during the landing transient before full and stable weight on wheels is achieved. See REBOUND.

BRACE (L/G) - See DRAG BRACE, JURY BRACE, SIDE BRACE, etc.

BRAKE, ANNULAR PISTON (Brk) - A type of brake using an annular or ring shaped piston/cylinder arrangement and powered by hydraulic or air pressure to apply force for squeezing a set of alternate rotating/stationary discs together to produce torque and a decelerating force.

BRAKE BACK PLATE (Brk) - The structural end plate on a multiple disc brake opposite the actuators. Its purpose is to restrain the discs and resist the force exerted by the actuators.

BRAKE BY WIRE (A/V, B/C) - A braking system in which hydraulic brakes or electromechanical brakes are applied via electrical signals rather than a mechanical connection.

BRAKE CARRIER (Brk) - See BRAKE HOUSING.

BRAKE CHATTER (Brk) - A self-induced brake vibration of less than 100 cps, excited by the friction characteristics of the rubbing surfaces. This vibration is characterized as a torsional oscillation of the wheel and/or brake rotors against the elasticity of the tire and is sometimes referred to as wheel chatter.

BRAKE CONTROL SYSTEM (A/V, Brk, B/C) - The total system for control of a brake or brakes. May be a mechanical system, hydraulic system, electrical/electronic system, etc., but generally includes a combination of types i.e., mechanical pilot input to brake pedals, mechanically or hydraulically actuated hydraulic system to the brakes, electrically actuated hydraulic system to the brakes, or electrically actuated brakes all controlled by an electronic/mechanical controller.

BRAKE CURRENT (Brk) – Brake current is the electrical current drawn by an electrically actuated brake assembly.

BRAKE DESIGN LANDING LOAD (Brk) – The brake design landing load is the average of the 100 peak clamping loads generated in the electrically actuated brake assembly during the design landing stop test as determined by test or analysis of test results.

BRAKE DISC (Brk) - A single disc of a brake. May be a rotating disc (rotor) in a single or multiple disc brake or stationary disc (stator) in a multiple disc brake. Functions in a heat absorbing capacity and to produce a frictional retarding force. May be a solid disc or an assembly of segments.

BRAKE, DISC (Brk) - A type of brake utilizing one or more rotating discs with a clamping force applied to produce a frictional retarding force.

BRAKE DISPLACEMENT (Brk) - The volumetric displacement required in a brake actuation system to actuate from full off to full on.

BRAKE DRAG (Brk) - Any residual resistance to motion produced by a brake assembly when in the full off condition.

BRAKE DRAG FORCE (Brk) - Any resistance to motion produced by a brake assembly. May apply to an on or off condition but generally considered as the decelerating force produced by the brake when powered to on condition.

BRAKE DRUM (Brk) - Cylindrical, rotating part fastened to the wheel. Acts as a friction surface, a heat sink, and to transmit torque.

BRAKE, DRUM (Brk) - A type of brake utilizing a brake drum and brake shoe or expander tube arrangement.

BRAKE ENERGY (KINETIC ENERGY) (Brk) - The portion of the energy due to the motion of the vehicle mass and the residual engine thrust which must be converted by the brake assembly to some other form of energy and either dissipated or absorbed.

BRAKE, EXPANDER TUBE (Brk) - A drum type brake using a rubber-like tube to expand and press the brake lining segments against the friction surface of the drum.

BRAKE HORSEPOWER (Brk) - The horsepower (time rate of doing work) delivered by the brake.

BRAKE HOUSING (Brk) - The brake part which contains hydraulic or pneumatic fluid passages and the actuating pistons and cylinders. For an electric brake, it would house the actuating motors, gear assemblies, and pistons. Also called brake carrier, power plate, actuator housing.

BRAKE LINING (Brk) - Individual blocks of wearable material, discs that have wearable material integrally bonded to them, or discs in which the wearable material is an integral part of the disc structure.

BRAKE LINKAGE (A/V, Brk) - Links or levers, or structural members used to connect an axle mounted, free rotating brake assembly to the fixed structure of the gear. Also a linkage system for the purpose of actuating a brake assembly.

BRAKE LOAD (Brk) – Brake load is the clamping load the brake (typically an electric brake) is designed to generate.

BRAKE MASTER CYLINDER (A/V, Brk) - In a fluid operated brake system, the cylinder assembly which receives an input command force and in turn transmits a fluid (hydraulic/pneumatic) force to one or more actuating cylinders, usually located at or on the individual brake assemblies.

BRAKE PRESSURE METERING VALVE (A/V, Brk) - A fluid metering valve in the brake control system that distributes the proper fluid pressure and flow in proportion to the mechanical and/or electrical inputs from the brake pedals to the brake.

BRAKE, MULTIPLE DISC (Brk) - A brake assembly utilizing many alternate rotating and stationary discs (rotors and stators).

BRAKE, MULTIPLE PISTON (Brk) - A brake configuration utilizing two or more actuating cylinders and pistons, interconnected and circumferentially spaced around the brake housing.

BRAKE OVERHEAT INDICATOR (A/V, Brk) - A device or system for the purpose of detecting and indicating to the pilot that an overheat condition exists in the brakes, i.e., caution and/or warning.

BRAKE OFF POSITION (Brk) – Brake Off Position (BOP) is a retracted EMA position that permits free rotation of the wheel and brake assembly after a brake application and release cycle. See EMA

BRAKE PRESSURE PLATE (Brk) - A stationary disc with a prescribed cross-section used to distribute the applied piston actuating loads or forces to the brake discs. Also called primary disc, retractor plate.

BRAKE RATED WEAR LIMIT (Brk) - BRWL is the brake maximum wear limit used in the Accelerate-Stop Test and the Most Severe Landing Stop Test for electrically actuated brakes.

BRAKE ROD (Brk) - That part of the brake linkage connecting the brake housing to the inner cylinder or gear part to take out the torque.

BRAKE ROTOR (Brk) - Rotating disc. A part normally keyed to the wheel and rotating with it relative to the fixed axle.

BRAKE SHOE (Brk) - A structural part of the brake assembly which is actuated by the system force input and which presses the brake lining against the rotating brake drum.

BRAKE, SINGLE DISC (Brk) - A brake configuration utilizing a single rotating disc.

BRAKE STATOR (Brk) - Stationary disc. A part normally keyed to a stationary part of the brake assembly.

BRAKE, SPOT TYPE (Brk) - A brake configuration utilizing a single cylinder and piston arrangement with a “spot” type lining to rub against the rotating disc.

BRAKE SQUEAL (Brk) - A self-induced brake vibration mode with a frequency greater than 100 cps. This vibration mode is characterized by torsional oscillation of the non-rotating parts of the brake assembly against the elastic restraint of the torque takeout or brake rod linkage.

BRAKE SYSTEM CURRENT (Brk, B/C) – Brake system current is the electrical current available to the EMA by the brake control system. See EMA, Brake Current.

BRAKE SYSTEM POWER (Brk, B/C, A/V) – Brake system power is the electrical power that is available to the brake assembly by the brake control system. See EMA, EMA Brake Power.

BRAKE SYSTEM VOLTAGE (Brk, B/C) – Brake system voltage is the electrical voltage that is available to be delivered to the brake assembly from the aircraft brake control system. See EMA, EMA brake Voltage.

BRAKE TORQUE (Brk) - The torque developed by the friction elements of the brake assembly. This torque is transmitted through the wheel and tire where it is reacted by a drag force at the tire/runway interface. Other resultant forces are reacted by the aircraft structure. See also BRAKE TORQUE COMPENSATING LINKAGE.

BRAKE TORQUE COMPENSATING LINKAGE (Brk) - A mechanical linkage for the purpose of transmitting brake torque reaction loads to the fixed structure of a landing gear, especially in a bogie type landing gear configuration where brake drag loads reacted at the tire/runway interface would cause excessive pitching of the bogie assembly if uncompensated with the linkage to fixed gear structure. The linkage system may also contain hydromechanical and/or automatic electronic control elements. Also called Brake Torque Reaction Linkage.

BRAKE TORQUE TUBE (Brk) - A tubular shaped part of the brake assembly which fits around the axle and to which the stators (stationary discs) are keyed. The torque tube transmits the stator torque to the brake housing and/or other fixed brake structure, and to the axle, compensating linkage, or gear structure.

BRAKE WHIRL (Brk) - Rotating bending motion of the brake and axle, associated with angular misalignment between stators and rotors and with circumferentially non-uniform contact pressure distribution.

BRAKED ROLL (A/V) - The portion of an aircraft landing roll during which the brakes are applied for deceleration of the vehicle.

BRAKING, ANTISKID (A/V, B/C, Brk) - The process of braking an aircraft and utilizing an antiskid system as an integral part of the brake control system.

BRAKING, AUTOMATIC (A/V, Brk) - Control of aircraft braking with an automatic system and the pilot out of the control loop. An input of the desired rate of deceleration is made prior to landing. The system generally includes an antiskid system and manual selection of a deceleration rate. Eliminates pilot technique during the braked roll.

BRIDLE, CATAPULT (Base, Cat) - A wire rope or synthetic fiber assembly designed to connect an aircraft to a catapult for the purpose of accelerating the aircraft for takeoff. The bridle connects to two catapult hooks on the aircraft and passes around the catapult shuttle spreader. The bridle falls off the aircraft (sheds) as it overtakes the shuttle and is generally restrained by a bridle arrestor system on the deck. Now obsolete in the U.S. Navy due to conversion to nose gear launch system, but may be still in use in some foreign navies. See also PENDANT, CATAPULT.

BUFFER, CATAPULT (Base, Cat) - In nose gear catapulting, a device or system for decelerating the aircraft to zero velocity at hookup condition by the engagement of the holdback bar with the slider of the catapult deck hardware.

BUNGEE (L/G) - A spring, elastic cord, or other tension (or compression) device used in a system to balance an opposing force or in a landing gear system to assist in retracting or extending the gear or to absorb shock, etc., i.e., downlock bungee, uplock bungee, overcenter bungee, etc. Also known as shock cord.

BURST PRESSURE (Tire, Whl, Brk, etc.) - The pressure required to rupture or burst. Generally a design includes allowance for maximum expected pressure in service multiplied by a reasonable safety factor.

CBR (CALIFORNIA BEARING RATIO) (Base) - A measure of the bearing capacity of soil. The CBR of a soil is expressed in terms of a percentage of the bearing capacity of a standard crushed limestone surface (100).

CALIPER, BRAKE (Brk) - A "C" shaped structural part of a brake assembly which fits around the edge and adjacent to both sides of the rotating disc. The caliper contains an actuator(s) to provide a force against the rotating disc to produce the decelerating force.

CAMBER (Whl, Tire) - The angle which the plane of a wheel or tire makes with a plane normal to the ground. Usually considered positive when the angle vector moves up and outboard relative to the centerline of the vehicle.

CANTILEVER LANDING GEAR (L/G) - Landing gear arrangement in which the axle is attached to the lower piston, and the piston slides inside the outer cylinder. A torque arm scissors linkage restricts the travel of the piston in rotation relative to the outer cylinder and limits the piston telescoping travel. See Figure 1.

CARCASS (Tire) - The structural body of a tire. Generally would include all tire components except the tread.

CASING (Tire) - Structural part of a tire. See also CARCASS.

CASTER (Whl, Tire) - To swivel about an eccentric vertical axis. Also the dimension which defines this characteristic, i.e., distance from the point where the swivel axis intersects the ground and the centroid of the tire contact area. Generally considered positive when the tire centroid point falls aft of the swivel axis intersect point. Also called castor. See also TRAIL.

CASTERING GEAR (L/G) - A gear configuration which has a designed-in capability to caster such as a nose gear or tail gear. See also **CROSS WIND GEAR**.

CATAPULT (Base, Cat) - A device or machine used to accelerate an airplane to takeoff speed. The capability for rapid and repeated re-use distinguishes it from rocket or JATO assisted takeoff devices. Also, a device (usually explosive) for ejecting a person from an aircraft. Also, a device used to eject crash locator radios from an aircraft.

CATAPULT BRIDLE (Base, Cat) - See **BRIDLE**.

CATAPULT HOOK (A/V) - A hook or hooks built into an aircraft for the purpose of engaging the pendent or bridle used to connect the aircraft to the catapult shuttle spreader. Now obsolete in the U.S. Navy due to conversion to the nose gear launch system, but may be still in use in some foreign navies.

CATAPULT SHUTTLE (Base, Cat) - The deck-mounted or field-mounted arrangement or device for the purpose of towing the aircraft for catapulting. Usually includes an inverted hook (spreader) for engagement with the catapult launching bridle, pendant, or launch bar.

CENTRIFUGAL FORCE (Whl, Tire, etc.) - The apparent force in a rotating system, deflecting masses radially outward from the axis of rotation, with magnitude per unit mass $\omega^2 R$ where ω is the angular speed of rotation, and R is the radius of curvature of the path. This magnitude may also be written V^2/R in terms of the linear speed V . This force (per unit mass) is equal and opposite to the centripetal acceleration.

CENTRIFUGAL GROWTH (Tire) - The growth in diameter of a rotating tire due to centrifugal force.

CHAFER STRIP (Tire) - The strips of rubber coated fabric which reinforce the bead area and protect the carcass plies against wheel chafing and against damage when mounting or demounting the tire.

CHUTE, DECELERATION (A/V) - See **CHUTE, DRAG**.

CHUTE, DRAG (A/V) - A parachute attached to an aircraft and deployed usually after touchdown for the purpose of decelerating the aircraft by means of aerodynamic drag.

CHUTE, DROGUE (A/V) - A parachute deployed for the purpose of providing the necessary force for extracting and deploying a main drag chute or chutes.

CHUTE, PILOT (A/V) - A parachute deployed to initiate a sequence of events in a drag chute system; i.e., the pilot chute is mechanically (or otherwise) ejected into the airstream. The pilot chute provides enough drag to pull the drogue chute which in turn provides adequate power to extract and deploy the main chute(s).

CLEARANCE, BRAKE RUNNING (Brk) - The clearance provided in a brake assembly in the "full off" condition between the actuators and the pressure plate or between the pressure plate and adjacent rotor, i.e., the actuator travel required from "full off" to initial application of force to the friction surfaces.

CLEARANCE, LATERAL (Whl, Tire, etc.) - The clearance provided at the side of a wheel or tire to insure against interference during rotation and/or variations in a predetermined location, i.e., deflections, lateral runout, looseness in the system, etc.

CLEARANCE, RADIAL (Tire, Whl, etc.) - The clearance provided radially to insure against interference during rotation and/or variations in a predetermined location. Tire radial clearance should include allowances for new tire growth due to pressure, service relaxation, and centrifugal growth.

CLOSED LOOP SYSTEM (B/C, etc.) - A system in which the output is used to control the input. See feedback control loop.

COD (CARRIER ONBOARD DELIVERY) (Base) - Operation involving aircraft delivery of personnel or material on board an aircraft carrier.

COEFFICIENT OF FRICTION (Tire, etc.) - A number indicating the amount of some change under certain specified conditions, often expressed as a ratio. Specifically, coefficient of friction is the ratio of the available tangential force at a common boundary of two bodies (i.e., tire and runway) in contact that can resist the motion or tendency to motion of one relative to the other to the normal force acting on the two bodies at that boundary. (Commonly denoted by μ or μ .)

COEFFICIENT OF FRICTION, EFFECTIVE (Tire, etc.) - The net effective value for coefficient of friction within a specified operating range (i.e., of velocity, temperature, etc.).

COEFFICIENT, SIDE FRICTION (Tire) - Coefficient of friction in a lateral direction for a tire. (May be affected by tread pattern.)

COEFFICIENT OF FRICTION, MAXIMUM INSTANTANEOUS (Tire) - A peak value for coefficient of friction which usually can not be sustained over a period of time.

COMMAND (B/C, etc.) - A signal or input whereby functions are performed as the result of a transmitted signal.

COMMAND CONTROL (B/C, etc.) - A system whereby functions are performed as a result of a transmitted signal

COMPENSATOR (L/G, Brk, etc.) - A device which compensates, makes up for, or offsets. For example a hydraulic pressure compensator (nose wheel steering system, etc.) which would maintain a positive pressure on the unit in case of loss of system pressure. Device may also be of mechanical or electrical design.

CONTACT AREA (Tire) - The area of a loaded tire which is actually in contact with the supporting surface. Generally elliptical in shape.

CORD BODY (Tire) - The main body of the tire which includes layer(s) of cord fabric (plies).

CORD FABRIC (Tire) - The fabric from which the plies, breakers, and chafer strips are made. May be rayon, nylon, fiberglass, etc.

CORNERING FORCE (Tire) - Lateral force of a tire perpendicular to the direction of motion at a given yaw angle.

CORNERING POWER (Tire) - The initial slope of the curve of cornering force versus yaw angle.

COROTATING (Whl) - See WHEELS, COROTATING.

COULOMB DAMPING (L/G, etc.) - The dissipation of energy that occurs when a particle in a vibrating system is resisted by a force whose magnitude is a constant independent of displacement and velocity, and whose direction is opposite to the direction of the velocity of the particle. Also called dry friction damping.

COUPLED (Brk, Whl) - A vibration term referring to the vibration frequency, damping, and mode shape of a component when affected by other components in the system. See also WHEELS.

COUPLING (B/C, Whl, etc.) - (1) A device or contrivance for joining adjacent ends or parts of anything. (2) A device permitting transfer of energy from one electrical circuit to another, or from one mechanical device to another.

COVERAGE (Base) - The number of passes of loaded tires of an aircraft in adjacent tire paths sufficient to just cover a given width of pavement one time. Determining factors are: width of traffic lane, number of wheels, width of tire contact area, and the traffic distribution. Also called Load Repetition Factor.

CRITICAL DAMPING (L/G, etc.) - The minimum damping that will allow a displaced system to return to its initial position without oscillation.

CRITICAL ENGINE FAILURE SPEED (A/V) - A minimum speed at which it is considered safe to attempt to complete the takeoff with one engine inoperative.

CRITICAL FIELD LENGTH (Base) - Critical Field Length is the length of field (runway) required to accelerate an aircraft to the critical engine failure speed, experience failure of the critical engine, and either (1) continue takeoff and have just enough runway left to execute a safe takeoff, or (2) elect to reject the takeoff and be able to stop the aircraft exactly at the end of the runway.

CRITICAL SPEED (Whl, Tire, etc.) - A speed of a rotating system that corresponds to a resonance frequency of the system.

CROSS WIND GEAR (L/G) - A landing gear configuration which permits alignment of the wheels to compensate for crab angle of the aircraft (due to crosswinds) at touchdown and for rollout. A fixed angle may be set in to the gear or freedom to caster and align with the direction of aircraft travel may be utilized.

CURED ANGLE (Tire) - The angle at which the cords are set in the tire after cure. In practice it may be measured from centerline of axle or from the plane of symmetry.

CURED END COUNT (Tire) - Cords per inch in the tire ply fabric after cure.

CYCLE, GEAR EXTENSION (L/G) - In a retractable landing gear system, the transition cycle from the up and locked (stowed) position to the down and locked (extended) position.

CYCLE, GEAR RETRACTION (L/G) - In a retractable landing gear system, the transition cycle from the gear down and locked (extended) position to the up and locked (stowed) position.

CYLINDER, LANDING GEAR (L/G) - A tubular structural member which houses the piston, orifice, oil, gas, and other elements of an air-oil shock absorber or the mechanical elements of a mechanical system. Carries lugs and/or provisions for various attachments on the exterior.

DAMP (L/G, etc.) - To suppress oscillations or disturbances.

DAMPER (L/G, etc.) - A device or system for the purpose of suppressing oscillations or disturbances. May be hydraulic or mechanical. Also British term for shock absorber.

DAMPER, DRAG (L/G) - A damper for the purpose of retarding drag forces. Sometimes built into a landing gear drag strut.

DAMPER, HOP (L/G) - A damper designed into a landing gear system for the purpose of suppressing pitching oscillations of the bogie assembly in a bogie type gear.

DAMPER, SHIMMY (L/G) - A damper designed into a landing gear system for the purpose of suppressing shimmy or oscillation of the wheel system. Especially on gear configuration with castering provisions such as nose or tail wheel.

DAMPING BEHAVIOR (Tire) - The characteristic of a tire which tends to damp out periodically applied forces.

DAMPING, FRICTION (L/G) - See COULOMB DAMPING.

DAMPING, HYDRAULIC (L/G) - A damping system in which a hydraulic fluid is utilized. External applied forces cause the oil to be moved through an orifice or restriction. Resisting force is proportional to the square of the velocity.

DAMPING RATIO - The ratio of actual damping to critical damping. It may be expressed as the ratio of output under static conditions to twice the output at the lowest frequency where a 90 degree phase shift is observed.

DAMPING, STRUCTURAL (A/V, L/G, etc.) - Damping due to internal friction within the material itself. It is independent of frequency and proportional to the maximum stress of the vibration cycle. Also called solid damping.

DAMPING, VISCOUS (L/G, etc.) - Damping encountered by bodies moving at moderate speed through a fluid. The resisting force is proportional to the velocity.

DASHPOT (L/G, S/A) - A type of shock absorber which utilizes resistance of oil being forced through an orifice or restriction to oppose an impact load. Differs from an air-oil shock absorber in that no air charge system is utilized.

DEAD BAND (NWS, etc.) - Free motion at the wheel(s) under control (output) over which the controlling system (input) has no authority. See also Backlash. May also apply to other mechanical systems. May also be defined as movement of the input control which produces no response in the output.

DEAD LENGTH, ACTUATOR (L/G, etc.) - Nominal length between attach points of an actuator when in the fully retracted condition less the available stroke.

DECELERATION (Whl, etc.) - The act or process of moving, or of causing to move, with decreasing velocity. Negative acceleration.

DECK RUN, CATAPULT (Cat, Base) - The distance from the end of the catapult power stroke to the beginning of the round down.

DEFLECTION (Tire) - The radial compression or displacement of a tire under load. This may be expressed by a finite value as the ratio (percentage) of the actual deflection measurement to the total available deflection (undeflected outside diameter less the wheel rim flange diameter) divided by two.

DETECTOR (B/C, etc.) - Sensor, also an instrument employing a sensor to detect the presence of something in the surrounding environment i.e., wheel speed sensor, proximity sensor, etc.

DIFFERENTIATOR (B/C, etc.) - In computer operations, a device whose output is proportional to the derivative of an input signal. In electronics, a transducer whose output wave form is the time derivative of its input waveform.

DIRECTIONAL STABILITY (A/V, Tire, etc.) - The properties of an aircraft, rocket, tire, etc. enabling it to restore itself from a yawing or side swiping condition. Also called weathercock stability.

DISPLAY (L/G, B/C, etc.) - The cockpit or crew station presentation of information regarding condition of a component or system such as landing gear position (up and locked, down and locked, in transit), brake overheat warning, etc.

DOCKING (A/V, etc.) - The act of coupling two or more orbiting objects. The operation of mechanically connecting together, or in some manner bringing together orbital payloads.

DOLLY, CATAPULT (Base, Cat) - A low, mobile platform that rolls on casters. A wheeled apparatus used to support an aircraft for lunching from a catapult. A low wheeled platform used to support the nose wheel of an airplane for lunching from a SATS catapult, and to which the aircraft is connected for lunching. The airplane lifts off from the dolly at the end of the power stroke, and the dolly remains on the ground and is braked to a halt.

DOOR, WHEEL FAIRING (A/V) - A door in the Landing Gear installation for the purpose of fairing the wheel well to the contours of the aircraft after the wheels are retracted inside the vehicle.

DOOR, STRUT FAIRING (A/V) - A door in the landing gear installation for the purpose of fairing the gear strut well to the contours of the aircraft after the strut is retracted into the aircraft.

DOWNLOCK (L/G) - The downlock is a mechanism or device for locking the landing gear in the down or extended position preparatory to landing. It locks the structure in the proper position for taking loads imposed by ground operations. A downlock pin may be used to prevent inadvertent gear retraction while on the ground. Some types used are: (a) "on center" or "over center" side or drag brace held in position hydraulically and/or mechanically. (b) Secondary "Jury brace" held on or past center hydraulically and/or mechanically. (c) Lock pin engagement. (d) Hook and roller engagement (generally used for uplock), etc.

DRAG BRACE (L/G) - A structural brace of a landing gear system whose primary function is to react drag loads imposed on the system. This member may be a folding member and often serves a secondary function of locking the gear system in the extended and/or retracted position.

DRAG BRAKE (A/V) - A device for the purpose of providing a retarding force upon a body in motion through a fluid, parallel to the direction of motion of the body. See also **GROUND SPOILERS**, **SPEED BRAKE**.

DRAG CHUTE (A/V) - Any of various types of parachutes attached to high performance aircraft that can be deployed, usually during landings, to decrease speed and also, under certain flight conditions, to control and stabilize the aircraft.

DRAG EFFICIENCY, ANTISKID or BRAKING (B/C) - The measure of efficiency of a brake control system expressed as a ratio (percentage) of the actual drag performance produced over a given period of time (or distance) relative to the maximum (100%) drag performance obtainable for the given set of conditions (i.e., coefficient tire to runway, wet, dry, temp., etc.).

DRAG STAY (L/G) - See **DRAG BRACE**.

DRIVE COUPLING (B/C) - See **COUPLING**.

DROP TEST (L/G, A/V) - A type of test to determine the dynamic capabilities of a landing gear shock absorber system to accept the loads and kinetic energies specified and imposed upon it. The shock absorber system may be mounted in a test rig and dropped at specified loads and velocities, or a complete aircraft may be free dropped. The test is for the purpose of verifying the energy absorption capability and for optimization of the energy control system (hydraulic, pneumatic, mech., etc.).

DUTY CYCLE (L/G, Tire, Brk, Whl) - One complete taxi-take-off and landing-taxi cycle.

DYNAMIC LOAD (L/G, Tire, etc.) - A load imposed by dynamic action, as distinguished from a static load. Specifically, with respect to aircraft, rockets, or spacecraft, a load due to an acceleration, as imposed by gusts, maneuvering, landing, firing rockets, braking, catapulting, etc.

DYNAMIC STABILITY (A/V) - The characteristics of a body, such as an aircraft, that causes it, when disturbed from an original state of steady flight or motion, to damp the oscillations set up by restoring moments and gradually return to its original state, specifically, the aerodynamic characteristics.

DYNAMIC TORQUE (Brk) - The torque which a brake will produce for deceleration dynamically as opposed to static torque. Dynamic torque is affected by velocity, temperature, lining coefficient, and other factors.

DYNAMOMETER, ROADWHEEL (Brk) - A device for measuring (testing) forces and power or capability of brakes. Generally the system includes a large rotating steel wheel (mass) which is brought up to speed by external power and represents an inertia equivalent to which the brake is to be tested. The test brake/wheel/tire assembly is loaded against the dynamometer wheel and the power of the brake is utilized to stop the rotating mass.

DYNAMOMETER, SHAFT (Brk) - A device for measuring (testing) forces and power or capability of brakes. No tire; torque and inertia only.

DYNAMOMETER, TIRE TEST (Tire) - See also **Dynamometer, Brake Test**. A device for measuring (testing) capabilities of tires. Differs from a **Brake Test Dynamometer** in that an **Inertia Equivalent** is generally not required. The dynamometer wheel is powered to rotate and the tire is loaded radially against it. Tire test parameters of interest are usually load, speed, time, and distance.

EFFICIENCY, RETRACTION (L/G) - A measure of efficiency for retraction of a landing gear system represented by a ratio (percentage) i.e., area under the load/stroke curve for the actuator compared to the maximum attainable load/stroke curve area for the actuator.

EFFICIENCY, SHOCK ABSORBER (L/G, S/A) - A measure of efficiency for a shock absorber represented by a ratio (percentage) i.e., area under the load stroke curve for the shock absorber compared to a theoretical straight line (horizontal) load/stroke curve representing maximum attainable output.

ELECTRO-MECHANICAL ACTUATOR (Brk, L/G) - In the context of the brake assembly, the electro-mechanical actuator (EMA) is the brake subassembly, typically comprised of but not limited to, the ball screw or roller screw, electric motor, and gear train that converts electrical power to brake clamping force. Some landing gear assemblies may also use EMAs for landing gear actuation or other motion control.

ELECTRO-MECHANICAL ACTUATOR BRAKE POWER (Brk) – EMA brake power is the electrical power supplied to the brake (typically only the EMAs on the brake).

ELECTRO-MECHANICAL ACTUATOR BRAKE VOLTAGE (Brk) – EMA brake voltage is the electrical voltage applied to the brake assembly to generate clamping loads.

ELECTRO-MECHANICAL ACTUATOR CONTROLLER (EMAC) – The electro-mechanical actuator controller (EMAC) is the electronic subassembly of the electric brake control system that determines and applies the electrical power to the electro-mechanical actuator to generate clamping loads.

ENERGY, BRAKE (A/V, Brk) - The portion of total energy of an aircraft which in deceleration process goes to the brake. Other portions go to aerodynamic drag, rolling resistance, etc.

ENERGY, DRAG CHUTE (A/V) - The portion of total energy of an aircraft which in the deceleration process goes into the drag chute in the form of aerodynamic drag.

ENERGY LOSSES (Tire) - Tire loss of energy due to rolling resistance of the tire which includes consideration of forces required to compress the tire as it rolls, as well as the work required to flex the tire carcass.

ENERGY, SHOCK ABSORBER (A/V, S/A) - The portion of the total aircraft energy which in the landing process goes into the shock absorber(s). Generally, it is the part due to the vertical sink speed of the vehicle at touchdown although some of this energy is damped out in the aircraft structure, and tires.

ENERGY, TIRE (A/V, Tire) - The portion of the total aircraft energy which in the landing process goes into the tires. The tires also absorb energy during the braking process.

EQUIVALENT SINGLE WHEEL LOAD (A/V, Base) - A theoretical calculated load which, if applied to a single tire, with a contact area equal to that of one tire of the assembly, would produce the same effect on the airfield as does a multiple wheel assembly.

EQUIVALENT STATIC WHEEL LOAD (Tire, Whl) - A static wheel or tire load rating based on a dynamic load reduced by a specified factor. May be higher than the actual required static load rating for a specific application, in which case the tire/wheel static rating is dictated by this consideration rather than the actual static rating requirement.

EXPANDABLE TIRE (Tire) - A tire which in the free, uninflated state assumes a shape which is smaller in diameter and cross section than when in the inflated state. For the purpose of conserving stowage volume in the aircraft. Requires deflation after takeoff and prior to retraction, and reinflation after gear extension and prior to landing.

EXTENDED POSITION (L/G, S/A) - The configuration of a retractable landing gear when it is down and locked and ready for landing and supporting the aircraft. Also used in describing the state of a shock absorber when it is in the unloaded or uncompressed position.

FAIL SAFE (L/G, B/C, NWS., etc.) - A design or systems used to minimize risk in case of a malfunction. For example, a steering control system designed to fail in a free caster mode rather than a wheel hard over condition.

FALSE AXLE (L/G) - See AXLE SLEEVE.

FEEDBACK - (1) The return of a portion of the output of a device to the input; positive feedback adds to the input, negative feedback subtracts from the input. (2) Information, as to progress, results, etc., returned to an originating source.