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**REPORT No. 15**

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**NOMENCLATURE FOR AERONAUTICS**

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**By The NATIONAL ADVISORY COMMITTEE  
FOR AERONAUTICS**



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## NOMENCLATURE FOR AERONAUTICS.

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### INTRODUCTION.

For the information of those interested in aeronautics the following nomenclature has been prepared as a guide, with a view to eliminate the duplication of terms, the erroneous use of terms, and confusion of terms, and to define the principal terms which have come into use in the development of aeronautics. In the preparation of this nomenclature only those terms have been defined which are peculiar to this subject.

### AERONAUTICAL NOMENCLATURE.

**AEROFOIL:** A winglike structure, flat or curved, designed to obtain reaction upon its surfaces from the air through which it moves.

**AEROPLANE:** See Airplane.

**AILERON:** A movable auxiliary surface used to produce a rolling moment about the fore-and-aft axis.

**AIRCRAFT:** Any form of craft designed for the navigation of the air—airplanes, balloons, dirigibles, helicopters, kites, kite balloons, ornithopters, gliders, etc.

**AIRPLANE:** A form of aircraft heavier than air which has wing surfaces for support in the air, with stabilizing surfaces, rudders for steering, and power plant for propulsion through the air. This term is commonly used in a more restricted sense to refer to airplanes fitted with landing gear suited to operation from the land. If the landing gear is suited to operation from the water, the term "seaplane" is used. (See definition.)

*Pusher.*—A type of airplane with the propeller in the rear of the engine.

*Tractor.*—A type of airplane with the propeller in front of the engine.

**AIR-SPEED METER:** An instrument designed to measure the speed of an aircraft with reference to the air.

**ALTIMETER:** An aneroid mounted on an aircraft to indicate continuously its height above the surface of the earth.

**ANEMOMETER:** Any instrument for measuring the velocity of the wind.

**ANGLE:**

*Of attack or of incidence of an aerofoil.*—The acute angle between the direction of the relative wind and the chord of an aerofoil; i. e., the angle between the chord of an aerofoil and its motion relative to the air. (This definition may be extended to any body having an axis.)

*Critical.*—The angle of attack at which the lift-curve has its first maximum; sometimes referred to as the "burble point." (If the "lift curve" has more than one maximum, this refers to the first one.)

*Gliding.*—The angle the flight path makes with the horizontal when flying in still air under the influence of gravity alone, i. e., without power from the engine.

**APPENDIX:** The hose at the bottom of a balloon used for inflation. In the case of a spherical balloon it also serves for equalization of pressure.

**ASPECT RATIO:** The ratio of span to chord of an aerofoil.

**AVIATOR:** The operator or pilot of heavier-than-air-craft. This term is applied regardless of the sex of the operator.

**AXES OF AN AIRCRAFT:** Three fixed lines of reference; usually centroidal and mutually rectangular.

The principal longitudinal axis in the plane of symmetry, usually parallel to the axis of the propeller, is called the fore and aft axis (or longitudinal axis); the axis perpendicular to this in the plane of symmetry is called the vertical axis; and the third axis, perpendicular to the other two, is called the transverse axis (or lateral axis). In mathematical discussions the first of these axes, drawn from front to rear, is called the X axis; the second, drawn upward, the Z axis; and the third, forming a "left-handed" system, the Y axis.

**BALANCING FLAPS:** See Aileron.

**BALLONET:** A small balloon within the interior of a balloon or dirigible for the purpose of controlling the ascent or descent, and for maintaining pressure on the outer envelope so as to prevent deformation. The ballonet is kept inflated with air at the required pressure, under the control of a blower and valves.

**BALLOON:** A form of aircraft comprising a gas bag and a basket. The support in the air results from the buoyancy of the air displaced by the gas bag, the form of which is maintained by the pressure of a contained gas lighter than air.

*Barrage.*—A small spherical captive balloon, raised as a protection against attacks by airplanes.

*Captive.*—A balloon restrained from free flight by means of a cable attaching it to the earth.

*Kite.*—An elongated form of captive balloon, fitted with tail appendages to keep it headed into the wind, and deriving increased lift due to its axis being inclined to the wind.

*Pilot.*—A small spherical balloon sent up to show the direction of the wind.

*Sounding.*—A small spherical balloon sent aloft, without passengers, but with registering meteorological instruments.

**BALLOON BED:** A mooring place on the ground for a captive balloon.

**BALLOON CLOTH:** The cloth, usually cotton, of which balloon fabrics are made.

- BALLOON FABRIC:** The finished material, usually rubberized, of which balloon envelopes are made.
- BANK:** To incline an airplane laterally—i. e., to roll it about the fore and aft axis. Right bank is to incline the airplane with the right wing down. Also used as a noun to describe the position of an airplane when its lateral axis is inclined to the horizontal.
- BAROGRAPH:** An instrument used to record variations in barometric pressure. In aeronautics the charts on which the records are made indicate altitudes directly instead of barometric pressures.
- BASKET:** The car suspended beneath a balloon, for passengers, ballast, etc.
- BIPLANE:** A form of airplane in which the main supporting surface is divided into two parts, one above the other.
- BODY OF AN AIRPLANE:** The structure which contains the power plant, fuel, passengers, etc.
- BONNET:** The appliance, having the form of a parasol, which protects the valve of a spherical balloon against rain.
- BRIDLE:** The system of attachment of cable to a balloon, including lines to the suspension band.
- BURBLE POINT:** See Angle, critical.
- BULLSEYES:** Small rings of wood, metal, etc., forming part of balloon rigging, used for connection or adjustment of ropes.
- CABANE:** A pyramidal framework upon the wing of an airplane, to which stays, etc., are secured.
- CAMBER:** The convexity or rise of the curve of an aerofoil from its chord, usually expressed as the ratio of the maximum departure of the curve from the chord to the length of the chord. "Top camber" refers to the top surface of an aerofoil, and "bottom camber" to the bottom surface; "mean camber" is the mean of these two.
- CAPACITY:** See Load.  
The cubic contents of a balloon.
- CENTER:** *Of pressure of an aerofoil.*—The point in the plane of the chords of an aerofoil, prolonged if necessary, through which at any given attitude the line of action of the resultant air force passes. (This definition may be extended to any body.)
- CHORD:**  
*Of an aerofoil section.*—A right line tangent at the front and rear to the under curve of an aerofoil section.  
*Length.*—The length of the chord is the length of the projection of the aerofoil section on the chord.
- CLINOMETER:** See Inclinator.
- CONCENTRATION RING:** A hoop to which are attached the ropes suspending the basket.
- CONTROLS:** A general term applying to the means provided for operating the devices used to control speed, direction of flight, and attitude of an aircraft.
- CONTROL COLUMN:** The vertical lever by means of which certain of the principal controls are operated, usually those for pitching and rolling.
- CROW'S FOOT:** A system of diverging short ropes for distributing the pull of a single rope.

**DECALAGE:** The angle between the chords of the principal and the tail planes of a monoplane. The same term may be applied to the corresponding angle between the direction of the chord or chords of a biplane and the direction of a tail plane. (This angle is also sometimes known as the longitudinal V of the two planes.)

**DIHEDRAL IN AN AIRPLANE:** The angle included at the intersection of the imaginary surfaces containing the chords of the right and left wings (continued to the plane of symmetry if necessary). This angle is measured in a plane perpendicular to that intersection. The measure of the dihedral is taken as  $90^\circ$  minus one-half of this angle as defined.

The dihedral of the upper wing may and frequently does differ from that of the lower wing in a biplane.

**DIRIGIBLE:** A form of balloon, the outer envelope of which is of elongated form, provided with a propelling system, car, rudders, and stabilizing surfaces.

*Nonrigid.*—A dirigible whose form is maintained by the pressure of the contained gas assisted by the car-suspension system.

*Rigid.*—A dirigible whose form is maintained by a rigid structure contained within the envelope.

*Semirigid.*—A dirigible whose form is maintained by means of a rigid keel and by gas pressure.

**DIVING RUDDER:** See Elevator.

**DOPE:** A general term applied to the material used in treating the cloth surface of airplane members and balloons to increase strength, produce tautness, and act as a filler to maintain air-tightness; it usually has a cellulose base.

**DRAG:** The component parallel to the relative wind of the total force on an aircraft due to the air through which it moves.

That part of the drag due to the wings is called "wing resistance" (formerly called "drift"); that due to the rest of the airplane is called "parasite resistance" (formerly called "head resistance").

**DRIFT:** See Drag. Also used as synonymous with "leeway," *g. v.*

**DRIFT METER:** An instrument for the measurement of the angular deviation of an aircraft from a set course, due to cross winds.

**DRIP CLOTH:** A curtain around the equator of a balloon, which prevents rain from dripping into the basket.

**ELEVATOR:** A hinged surface for controlling the longitudinal attitude of an aircraft; *i. e.*, its rotation about the transverse axis.

**EMPANNAGE:** See Tail.

**ENTERING EDGE:** The foremost edge of an aerofoil or propeller blade.

**ENVELOPE:** The portion of the balloon or dirigible which contains the gas.

**EQUATOR:** The largest horizontal circle of a spherical balloon.

**FINS:** Small fixed aerofoils attached to different parts of aircraft, in order to promote stability; for example, tail fins, skid fins, etc. Fins are often adjustable. They may be either horizontal or vertical.

**FLIGHT PATH:** The path of the center of gravity of an aircraft with reference to the earth.

**FLOAT:** That portion of the landing gear of an aircraft which provides buoyancy when it is resting on the surface of the water.

**FUSELAGE:** See Body.

**GAP:** The shortest distance between the planes of the chords of the upper and lower wings of a biplane.

**GAS BAG:** See Envelope.

**GLIDE:** To fly without engine power.

**GLIDER:** A form of aircraft similar to an airplane, but without any power plant.

When utilized in variable winds it makes use of the soaring principles of flight and is sometimes called a soaring machine.

**GORE:** One of the segments of fabric composing the envelope.

**GROUND CLOTH:** Canvas placed on the ground to protect a balloon.

**GUIDE ROPE:** The long trailing rope attached to a spherical balloon or dirigible, to serve as a brake and as a variable ballast.

**GUY:** A rope, chain, wire, or rod attached to an object to guide or steady it, such as guys to wing, tail, or landing gear.

**HANGAR:** A shed for housing balloons or airplanes.

**HELICOPTER:** A form of aircraft whose support in the air is derived from the vertical thrust of propellers.

**HORN:** A short arm fastened to a movable part of an airplane, serving as a lever-arm, e. g., aileron-horn, rudder-horn, elevator-horn.

**INCLINOMETER:** An instrument for measuring the angle made by any axis of an aircraft with the horizontal, often called a clinometer.

**INSPECTION WINDOW:** A small transparent window in the envelope of a balloon or in the wing of an airplane to allow inspection of the interior.

**KITE:** A form of aircraft without other propelling means than the towline pull, whose support is derived from the force of the wind moving past its surface.

**LANDING GEAR:** The understructure of an aircraft designed to carry the load when resting on or running on the surface of the land or water.

**LEADING EDGE:** See Entering edge.

**LEEWAY:** The angular deviation from a set course over the earth, due to cross currents of wind, also called drift; hence, "drift meter."

**LIFT:** The component perpendicular to the relative wind, in a vertical plane, of the force on an aerofoil due to the air pressure caused by motion through the air.

**LIFT BRACING:** See Stay.

**LOAD:**

*Dead.*—The structure, power plant, and essential accessories of an aircraft.

*Full.*—The maximum weight which an aircraft can support in flight; the "gross weight."

*Useful.*—The excess of the full load over the dead weight of the aircraft itself, i. e., over the weight of its structure, power plant, and essential accessories. (These last must be specified.)

**LOADING:** See Wing, loading.

**LOBES:** Bags at the stern of an elongated balloon designed to give it directional stability.

**LONGERON:** See Longitudinal.

**LONGITUDINAL:** A fore-and-aft member of the framing of an airplane body, or of the floats, usually continuous across a number of points of support.

- MONOPLANE:** A form of airplane whose main supporting surface is a single wing, extending equally on each side of the body.
- MOORING BAND:** The band of tape over the top of a balloon to which are attached the mooring ropes.
- NACELLE:** See Body. Limited to pushers.
- NET:** A rigging made of ropes and twine on spherical balloons, which supports the entire load carried.
- ORNITHOPTER:** A form of aircraft deriving its support and propelling force from flapping wings.
- PANEL:** The unit piece of fabric of which the envelope is made.
- PARACHUTE:** An apparatus, made like an umbrella, used to retard the descent of a falling body.
- PATCH SYSTEM:** A system of construction in which patches (or adhesive flaps) are used in place of the suspension band.
- PERMEABILITY:** The measure of the loss of gas by diffusion through the intact balloon fabric.
- PITOT TUBE:** A tube with an end open square to the fluid stream, used as a detector of an impact pressure. It is usually associated with a coaxial tube surrounding it, having perforations normal to the axis for indicating static pressure; or there is such a tube placed near it and parallel to it, with a closed conical end and having perforations in its side. The velocity of the fluid can be determined from the difference between the impact pressure and the static pressure, as read by a suitable gauge. This instrument is often used to determine the velocity of an aircraft through the air.
- PONTOONS:** See Float.
- PUSHER:** See Airplane.
- PYLON:** A mast or pillar serving as a marker of a course.
- RACE OF A PROPELLER:** See Slip stream.
- RELATIVE WIND:** The motion of the air with reference to a moving body. Its direction and velocity, therefore, are found by adding two vectors, one being the velocity of the air with reference to the earth, the other being equal and opposite to the velocity of the body with reference to the earth.
- RIp CORD:** The rope running from the rip panel of a balloon to the basket, the pulling of which causes immediate deflation.
- RIp PANEL:** A strip in the upper part of a balloon which is torn off when immediate deflation is desired.
- RUDDER:** A hinged or pivoted surface, usually more or less flat or stream lined, used for the purpose of controlling the attitude of an aircraft about its "vertical" axis, i. e., for controlling its lateral movement.  
*Rudder bar.*—The foot bar by means of which the rudder is operated.
- SEAPLANE:** A particular form of airplane in which the landing gear is suited to operation from the water.
- SERPENT:** A short, heavy guide rope.
- SIDE SLIPPING:** Sliding downward and inward when making a turn; due to excessive banking. It is the opposite of skidding.
- SKIDDING:** Sliding sideways away from the center of the turn in flight. It is usually caused by insufficient banking in a turn, and is the opposite of side slipping.

- SKIDS:** Long wooden or metal runners designed to prevent nosing of a land machine when landing or to prevent dropping into holes or ditches in rough ground. Generally designed to function should the landing gear collapse or fail to act.
- SLIP STREAM OR PROPELLER RACE:** The stream of air driven aft by the propeller and with a velocity relative to the airplane greater than that of the surrounding body of still air.
- SOARING MACHINE:** See Glider.
- SPAN OR SPREAD:** The maximum distance laterally from tip to tip of an airplane wing, or the lateral dimension of an aerofoil.
- STABILITY:** A quality in virtue of which an airplane in flight tends to return to its previous attitude after a slight disturbance.
- Directional.*—Stability with reference to the vertical axis.
- Dynamical.*—The quality of an aircraft in flight which causes it to return to a condition of equilibrium after its attitude has been changed by meeting some disturbance, e. g., a gust. This return to equilibrium is due to two factors; first, the inherent righting moments of the structure; second, the damping of the oscillations by the tail, etc.
- Inherent.*—Stability of an aircraft due to the disposition and arrangement of its fixed parts—i. e., that property which causes it to return to its normal attitude of flight without the use of the controls.
- Lateral.*—Stability with reference to the longitudinal (or fore and aft) axis.
- Longitudinal.*—Stability with reference to the lateral axis.
- Statical.*—In wind tunnel experiments it is found that there is a definite angle of attack such that for a greater angle or a less one the righting moments are in such a sense as to tend to make the attitude return to this angle. This holds true for a certain range of angles on each side of this definite angle; and the machine is said to possess "statical stability" through this range.
- STABILIZER:** Any device designed to steady the motion of aircraft.
- STAGGER:** The amount of advance of the entering edge of the upper wing of a biplane over that of the lower, expressed as percentage of gap; it is considered positive when the upper surface is forward.
- STALLING:** A term describing the condition of an airplane which from any cause has lost the relative speed necessary for control.
- STATOSCOPE:** An instrument to detect the existence of a small rate of ascent or descent, principally used in ballooning.
- STAY:** A wire, rope, or the like used as a tie piece to hold parts together, or to contribute stiffness; for example, the stays of the wing and body trussing.
- STEP:** A break in the form of the bottom of a float.
- STREAM-LINE FLOW:** A term in hydromechanics to describe the condition of continuous flow of a fluid, as distinguished from eddying flow.
- STREAM-LINE SHAPE:** A shape intended to avoid eddying and to preserve stream-line flow.
- STRUT:** A compression member of a truss frame; for instance, the vertical members of the wing truss of a biplane.
- SUSPENSION BAND:** The band around a balloon to which are attached the basket and the main bridle suspensions.

- SUSPENSION BAR:** The bar used for the concentration of basket suspension ropes in captive balloons.
- SWEEP BACK:** The horizontal angle between the lateral axis of an airplane and the entering edge of the main planes.
- TAIL:** The rear portion of an aircraft, to which are usually attached rudders, elevators, stabilizers and fins.
- TAIL CUPS:** The steadying device attached at the rear of certain types of elongated captive balloons.
- THIMBLE:** An elongated metal eye spliced in the end of a rope or cable.
- TRACTOR:** See Airplane.
- TRAILING EDGE:** The rearmost edge of an aerofoil or propeller blade.
- TRIPLANE:** A form of airplane whose main supporting surface is divided into three parts, superimposed.
- TRUSS:** The framing by which the wing loads are transmitted to the body; comprises struts, stays, and spars.
- UNDERCARRIAGE:** See Landing gear.
- WARP:** To change the form of the wing by twisting it.
- WASH OUT:** A permanent warp of an aerofoil such that the angle of attack decreases toward the wing tips.
- WEIGHT:** Gross. See Load, full.
- WINGS:** The main supporting surfaces of an airplane.
- WING FLAP:** See Aileron.
- WING LOADING:** The weight carried per unit area of supporting surface.
- WING MAST:** The mast structure projecting above the wing, to which the top load wires are attached.
- WING RIB:** A fore and aft member of the wing structure used to support the covering and to give the wing section its form.
- WING SPAR OR WING BEAM:** A transverse member of the wing structure.
- YAW:** To swing off the course about the vertical axis.  
*Angle of.*—The temporary angular deviation of the fore and aft axis from the course.