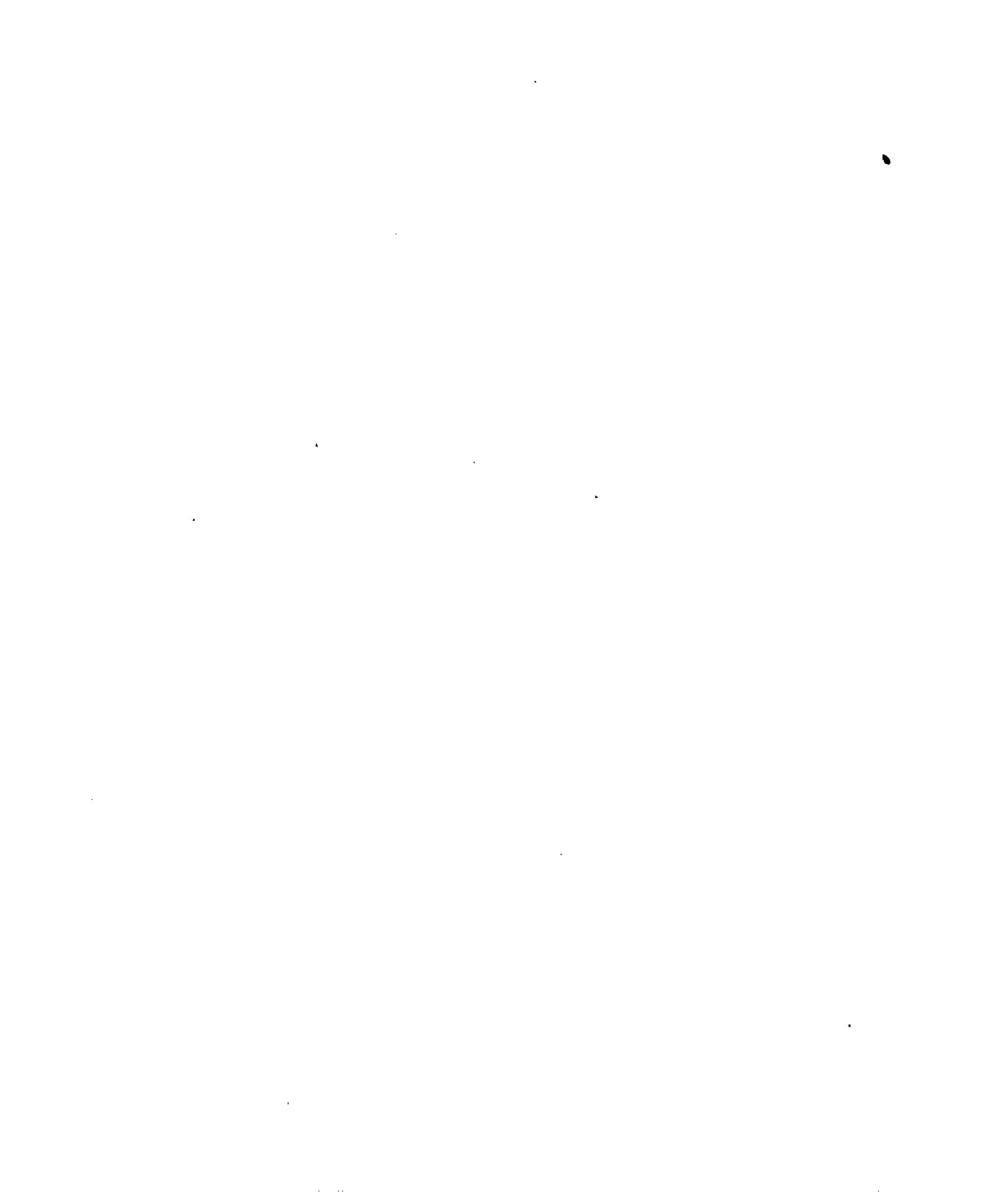

REPORT No. 9.

NOMENCLATURE FOR AERONAUTICS.

**By The NATIONAL ADVISORY COMMITTEE
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 eliminating the duplication of terms, the erroneous use of terms, and confusion of terms, and with a view to defining 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 new and peculiar to this subject.

AERONAUTICAL NOMENCLATURE.

AEROFOIL: A thin wing-like 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 for the control of rolling motion—i. e., rotation 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 sustentation, 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 or propellers in rear of the wings.

Tractor.—A type of airplane with the propeller or propellers in front of the wings.

AIR-SPEED METER: An instrument designed to measure the velocity of an aircraft with reference to the air through which it is moving.

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

ANEMOMETER: An instrument for measuring the velocity of the wind or air currents with reference to the earth or some fixed body.

ANGLE:

Of attack.—The angle between the direction of the relative wind and the chord of an aerofoil, or the fore and aft axis of a body.

Critical.—The angle of attack at which the lift is a maximum.

Gliding.—The angle the flight path makes with the horizontal when flying in still air under the influence of gravity alone.

ASPECT RATIO: The ratio of spread to chord of an aerofoil.

AVIATOR: The operator or pilot of heavier-than-air craft. This term may be applied equally, 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 athwartship axis (or transverse or lateral axis). In mathematical discussions the first of these axes is called the X axis, the second the Z axis, and the third the Y axis.

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 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 car, whose sustentation depends on the buoyancy of the contained gas, which is lighter than air.

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.

BANK: To incline an airplane laterally—i. e., to rotate it about the fore and aft axis. Right bank is to incline the airplane with the right wing down.

BANKING RUDDER: See Aileron.

BAROGRAPH: An instrument used to record variations in barometric pressure. In aeronautics the charts on which the records are made are prepared to indicate altitudes directly instead of barometric pressure.

BIPLANE: A form of airplane in which the main supporting surface is divided into two parts, one above the other.

BODY OF AN AIRPLANE: A structure, usually inclosed, which contains in a stream-line housing the power plant, fuel, passengers, etc.

CABRÉ: A flying attitude in which the angle of attacks is greater than normal; tail down; down by the stern—tail low.

CAMBER: The convexity or rise of a curve of an aerofoil from its Chord, usually expressed as the ratio of the maximum departure of the curve from the chord as a fraction thereof. "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:

Lifting.—The maximum flying load of an aircraft.

Carrying.—Excess of the lifting capacity over the dead load of an aircraft, which latter includes structure, power plant, and essential accessories.

CARRYING CAPACITY: See Capacity.

CENTER: The point in which a set of effects is assumed to be accumulated producing the same effect as if all were concentrated at this point.

Of buoyancy.—The center of gravity of the fluid displaced by the floating body.

Of pressure of an aerofoil.—The point on the chord of an element of an aerofoil, prolonged if necessary, through which at any instant the line of action of the resultant air force passes.

Of pressure of a body.—The point on the axis of a body, prolonged if necessary, through which at any instant the line of action of the resultant air force passes.

CHORD:

Of an aerofoil section.—A right line tangent to the under curve of the aerofoil section at the front and rear.

Length.—The length of the chord is the length of the aerofoil section projected on the chord, extended if necessary.

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.

CRITICAL ANGLE: See Angle, Critical.

DÉCALAGE: An increase in the angular setting of the chord of an upper wing of a biplane with reference to the chord of the lower wing.

DEVELOPED AREA OF A PROPELLER: A layout of the area of a propeller blade designed to represent the total area of the driving face, in which the elements of area are developed as if unfolded onto the plane of the drawing (necessarily an approximation on definite assumptions, as no true development of the helix can be made).

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 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 its attachment to an exterior girder construction containing the car.

DISK AREA OF A PROPELLER: The total area of the disk swept by the propeller tips.

DIVING RUDDER: See elevator.

- DOPE:** A general term applied to the material used in treating the cloth surface of air-plane members to increase strength, produce tautness, and act as a filler to maintain air-tightness; usually of the cellulose type.
- DRAG:** The total resistance to motion through the air of an air craft—i. e., the sum of the drift and head resistance.
- DRIFT:** The component of the resultant wind pressure on an aerofoil or wing surface parallel to the air stream attacking the surface.
- ELEVATOR:** A hinged surface for controlling the longitudinal attitude of an air craft—i. e., its rotation about the athwartship axis.
- ENGINE, RIGHT OR LEFT HAND:** The distinction between a right-hand and a left-hand engine depends on the rotation of the output shaft, whether this shaft rotates in the same direction as the crank or not. A right-hand engine is one in which, when viewed from the output shaft, looking toward the output end, the shaft is seen to rotate clockwise.
- ENTERING EDGE:** The foremost part of an aerofoil.
- FINS:** Small planes on air craft to promote stability; for example, vertical tail fins, horizontal tail fins, skid fins, etc.
- FLIGHT PATH:** The path of the center of gravity of an air craft with reference to the air.
- FLOAT:** That portion of the landing gear of an air craft which provides buoyancy when it is resting on the surface of the water.
- FUSELAGE:** See body.
- GAP:** The distance between the projections on the vertical axis of the entering edges of an upper and lower wing of a biplane.
- GLIDE:** To fly without power.
- GLIDER:** A form of air craft 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.
- GLIDING ANGLE:** See Angle, Gliding.
- 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.
- HEAD RESISTANCE:** The total resistance to motion through the air of all parts of an air craft not a part of the main lifting surface. Sometimes termed "parasite resistance."
- HELICOPTER:** A form of air craft whose support in the air is derived from the vertical thrust of large propellers.
- INCLINOMETER:** An instrument for measuring the angle made by any axis of an aircraft with the horizontal.
- KEEL PLANE AREA:** The total effective area of an aircraft which acts to prevent skidding or side slipping.
- 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.
- KITE BALLOON:** See Balloon, kite.
- LANDING GEAR:** The under structure of an aircraft designed to carry the load when resting on, or running on, the surface of the land or water.
- LATERAL STABILITY:** See Stability, lateral.
- LEADING EDGE:** See Entering edge.

- LEEWAY:** The angular deviation from a course over the earth, due to cross currents of wind.
- LIFT:** The component of the force due to the air pressure of an aerofoil, resolved perpendicular to the flight path in a vertical plane.
- LIFT BRACING:** See Stay.
- LIFTING CAPACITY:** See Capacity, lifting.
- LOAD, FULL:** See Capacity, lifting.
Reserve (or useful).—See Capacity, carrying.
- LOADING:** See Wing loading.
- 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.
- LONGITUDINAL STABILITY:** See Stability.
- METACENTER:** The point of intersection of a vertical line through the center of gravity of the fluid displaced by a floating body when it is tipped through a small angle from its position of equilibrium and the inclined line which was vertical through the center of gravity of the body when in equilibrium. There is, in general, a different metacenter for each type of displacement of the floating body.
- MONOPLANE:** A form of airplane whose main supporting surface is disposed as a single wing on each side of the body.
- MOTOR:** See Engine.
- NACELLE:** See Body.
- NATURAL STABILITY:** See Stability.
- NOSE DIVE:** A dangerously steep descent, head-on.
- ORNITHOPTER:** A form of aircraft deriving its support and propelling force from flapping wings.
- PILOT TUBE:** A tube with an end open square to the fluid stream, used as a detector of an impact pressure. More usually associated with a concentric tube surrounding it, having perforations normal to the axis for indicating static pressure. The velocity of the fluid can be determined from the difference between the impact pressure and the static pressure. This instrument is often used to determine the velocity of an aircraft through the air.
- PROPELLER:**
Developed area of.—See Developed area of a propeller.
Disk area of.—See Disk area of a propeller.
Right-hand.—One in which the helix is right handed.
- PUSHER:** See Airplane.
- PYLON:** A marker of a course.
- RACE OF A PROPELLER:** The air stream delivered by the propeller.
- RIB:** See Wing.
- RIGHT (OR LEFT) HAND:**
Engine.—See Engine.
Propeller.—See Propeller, right-hand.
- RIGID DIRIGIBLE:** See Dirigible, rigid.
- 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 when in motion.
- SEAPLANE:** A particular form of airplane in which the landing gear is suited to operation from the water.

- SIDE SLIPPING:** Sliding toward the center of a turn. It is due to excessive amount of bank for the turn being made, and is the opposite of skidding.
- SKIDDING:** Sliding sideways in flight away from the center of the turn. 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 wheels collapse or fail to act.
- SLIP:** This term applies to propeller action and is the difference between the actual velocity of advance of an aircraft and the speed calculated from the known pitch of the propeller and its number of revolutions.
- SOARING MACHINE:** See Glider.
- SPREAD:** The maximum distance laterally from tip to tip of an airplane wing.
- STABILITY:** The quality of an aircraft in flight which causes it to return to a condition of equilibrium when meeting a disturbance. (This is sometimes called "Dynamical stability.")
- Directional.*—Stability with reference to the vertical axis.
- Inherent.*—Stability of an aircraft due to the disposition and arrangement of its fixed parts.
- Lateral.*—Stability with reference to the longitudinal (or fore and aft) axis.
- Longitudinal.*—Stability with reference to the lateral (or athwartship) axis.
- STABILIZER:** See Fins.
- Mechanical.*—Any automatic device designed to secure stability in flight.
- STAGGER:** The amount of advance of the entering edge of the upper wing of a biplane over that of the lower; 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 steerage-way and 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 where discontinuity takes place.
- STREAM-LINE SHAPE:** A shape intended to avoid eddying or discontinuity and to preserve stream-line flow, thus keeping resistance to progress at a minimum.
- STRUT:** A compression member of a truss frame; for instance, the vertical members of the wing truss of a biplane.
- SWEEP BACK:** The horizontal angle between the lateral (athwartship) 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, and fins.

TAIL FINS: The vertical and horizontal surfaces attached to the tail, used for stabilizing.

THRUST DEDUCTION: Due to the influence of the propellers, there is a reduction of pressure under the stern of the vessel which appreciably reduces the total propulsive effect of the propeller. This reduction is termed "Thrust deduction."

TRACTOR: See Airplane.

TRAILING EDGE: The rearmost portion of an aerofoil.

TRIPLANE: A form of airplane whose main supporting surfaces are divided into three parts, superposed.

TRUSS: The framing by which the wing loads are transmitted to the body; comprises struts, stays, and spars.

VELOMETER: See Air-speed meter and anemometer.

VOL-PIQUÉ: See Nose dive.

VOL-PLANE: See Glide.

WAKE GAIN: Due to the influence of skin friction, eddying, etc., a vessel in moving forward produces a certain forward movement of the fluid surrounding it. The effect of this is to reduce the effective resistance of the hull, and this effect, due to the forward movement of the wake, is termed the "wake gain."

In addition to this effect the forward movement of this body of fluid reduces the actual advance of the propeller through the surrounding medium, thereby reducing the propeller horsepower.

WARP: To change the form of the wing by twisting it, usually by changing the inclination of the rear spar relative to the front spar.

WINGS: The main supporting surfaces of an airplane.

WING LOADING: The weight carried per unit area of supporting surface.

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: An athwartship member of the wing structure resisting tension and compression.

YAW: To swing off the course about the vertical axis, owing to gusts or lack of directional stability.

Angle of.—The temporary angular deviation of the fore and aft axis from the course.