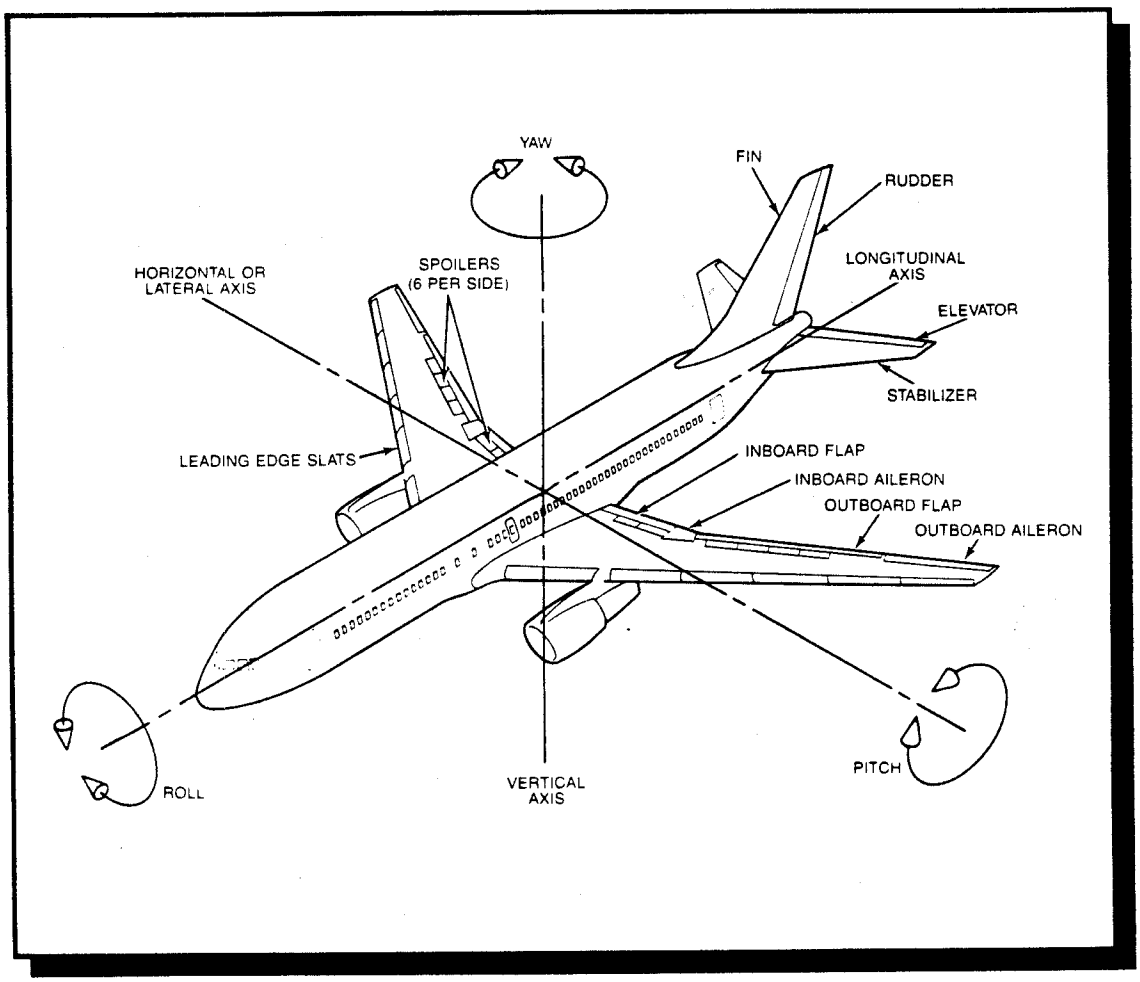
Acc. 4546
July 1988

AIRCRAFT INDUSTRY TERMINOLOGY



Boeing Commercial Airplanes
Employee Training and Development

DRAWING TERMINOLOGY

Many people believe it is necessary to be a drafts person to thoroughly understand a blueprint. If this were true, it would be impossible to read a blueprint unless all the steps executed by the drafts person were understood. It is obvious that one can read a book without being an author. Similarly, it is possible to read a blueprint without being a drafts person. However, since the language of lines that makes up a blueprint is not as well known as the printed word, certain drafting principles must be learned before one can become a good blueprint reader. These principles are few in number and are not difficult to learn. A thorough knowledge of them will solve most blueprint reading problems.

Some words and phrases convey different meanings when applied to blueprint reading than when used in everyday conversation. It is essential that you know the meaning of such words and phrases if you are to receive full benefit from this course. Study the following explanations and make certain you understand them before attempting to study further in the text. It is not necessary to memorize these definitions word for word, but it is essential that you understand them.

POINT

A point is a place—not a tangible object. A point has position without size. A dot is sometimes used to represent a point, but a dot, no matter how small, has length, width, and thickness. A point is theoretical and has position only.

POINT

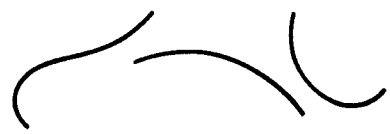
LINE

A line is an extended point; it has only one dimension—length. While it is impossible to draw a line without showing at least the thickness of the pencil lead, only length is important; width and thickness are considered nonexistent. Thus, if a point is extended from one position to another, as from A to B in the example, line AB is described.

LINE

A "straight line" is a line that does not change its direction. Line AB is a straight line.

A "curved line" is a line that changes its direction at every point. A "broken line" is a line that changes its direction at only certain points.



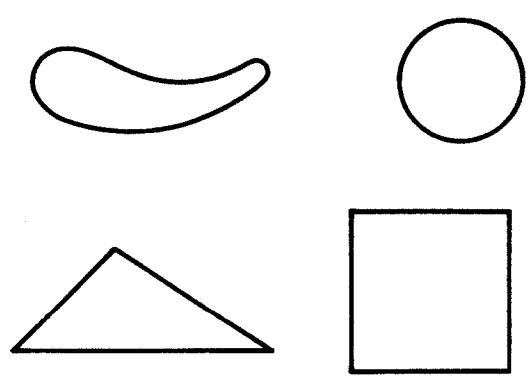
CURVED LINES

BROKEN LINES

The word "line" is generally understood to mean a straight line unless otherwise noted.

SURFACE

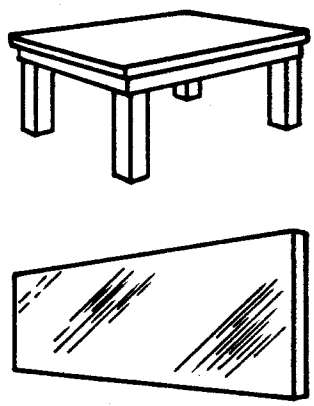
When three or more points are connected by lines to enclose an area, the enclosed area is a surface. A surface has only two dimensions—length and height (or width). Like a line, a surface is considered to have no thickness.



SURFACES

PLANE

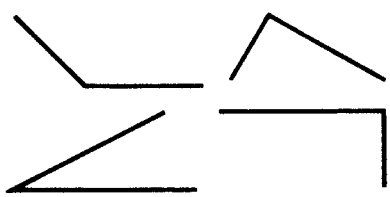
A surface that is perfectly flat with no depressions or elevations is called a plane surface. If a straightedge is laid on a plane surface in any direction, every point of the straightedge will touch the surface. Table tops and window panes are examples of plane surfaces.



PLANE SURFACES

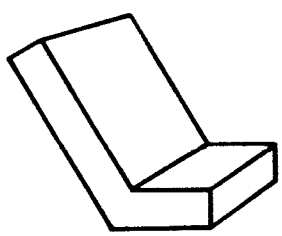
ANGLE

An angle is the opening between two straight lines that meet at a point. The two straight lines are the "sides" of the angle, and the point where they meet is the "vertex" of the angle.



ANGLES

An angle is also formed by the intersection of two surfaces or planes.

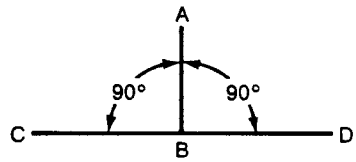


ANGLE

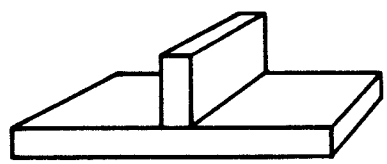
Since the distance between the sides of an angle will vary at every point along the sides, it is not possible to measure the size of an angle by "inch" measurement. Instead, the distance between the sides is measured by "degrees" as explained on a subsequent page of this manual.

PERPENDICULAR

If a straight line, as AB, meets another straight line, as CD, so that the two angles formed (CBA and ABD) are equal, the lines are said to be perpendicular to one another.



Also, when two planes meet so that equal angles are formed, the planes are said to be perpendicular to one another.

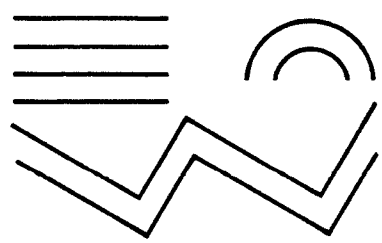


RIGHT ANGLES

The angles formed by lines or planes that are perpendicular to one another are called right angles. Angles CBA and ABD are right angles.

PARALLEL

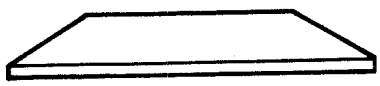
Parallel lines are lines that run in the same direction and maintain a constant distance between them throughout their length. Parallel lines will never meet or get farther apart no matter how far they are extended.



PARALLEL LINES

HORIZONTAL

Horizontal planes and lines are those that lie "straight across" in front of the observer. Both ends of a horizontal line or plane are at equal heights. The top of a level table is a horizontal plane. When viewed from one edge, the top surface of the table would appear as a horizontal line.

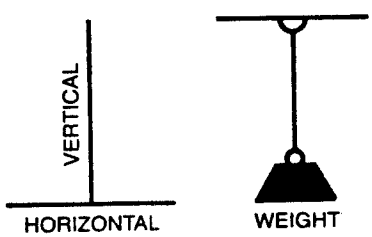


HORIZONTAL PLANE

HORIZONTAL LINE

VERTICAL

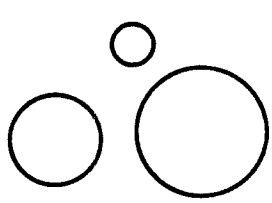
A vertical line is a line that is perpendicular to a horizontal line. One end of a vertical line is directly above and in line with the other end. A vertical line does not need to be accompanied by a horizontal line. If a weight is suspended motionless on a string, the string will describe a vertical line.



VERTICAL LINES

CIRCLE

A circle is a plane figure bounded by a curved line every point of which is equally distant from a point within called the center.



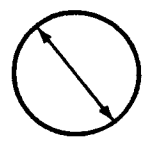
CIRCLES

CIRCUMFERENCE

The circumference of a circle is the line that bounds the circle. Therefore the circumference is the distance around the circle.

DIAMETER

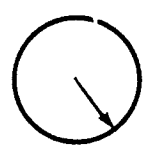
The diameter of a circle is a straight line that passes through the center and is terminated at both ends by the circumference. The diameter is the distance across the circle; this distance being measured through the center.



DIAMETER

RADIUS

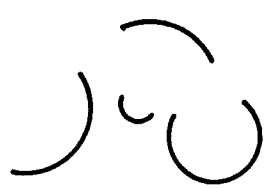
The radius of a circle is any straight line drawn from the center to the circumference. The radius is one-half the distance across the circle, or one-half the diameter.



RADIUS

ARC

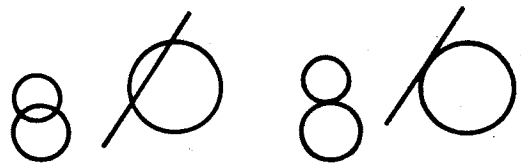
An arc is any portion of the circumference of a circle.



ARCS

TANGENT

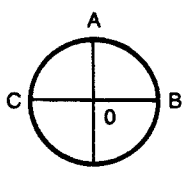
A tangent to a circle is a line, straight or curved, that touches the circumference at only one point and is perpendicular to the radius at that point.



LINES NOT TANGENT TANGENT LINES

DEGREES

For angular measurement purposes every angle is considered to be a portion of a circle, the vertex of the angle being the center of the circle. The circumference of the circle is divided into 360 equal parts, called degrees. (A small circle (°) when placed next to a number, denotes degrees, thus (90°).) Thus, the number of degrees that are contained between the sides of the angle describes the size of the angle.

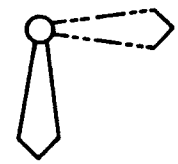
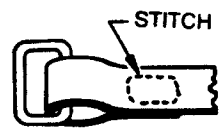
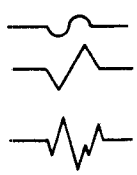
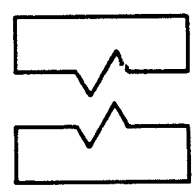
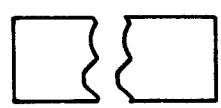
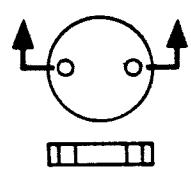


If a circle contains two diameters, each perpendicular to the other, four right angles are formed. It is apparent that each of the angles contains one-fourth of the 360 degrees. Therefore, a right angle, as AOB, is a 90-degree angle. Also, a straight line, as COB, is actually a 180-degree angle.

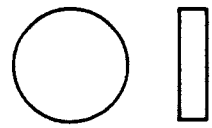
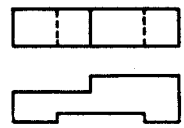
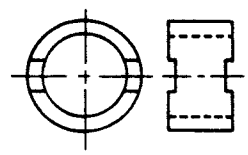
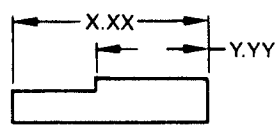
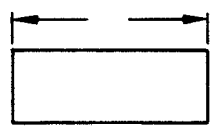
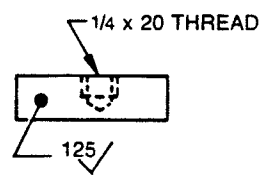
MINUTES AND SECONDS

When measurements smaller than one degree are required, minutes and seconds are used. (A minute (′) is one-sixtieth of a degree (i.e., 90°6′). A second (″ is one-sixtieth of a minute (i.e., 90°6′18″).)

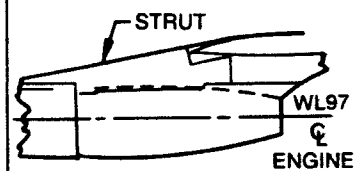
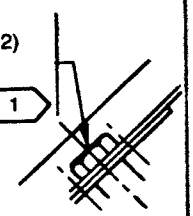
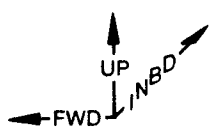
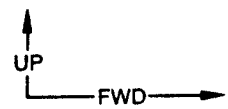
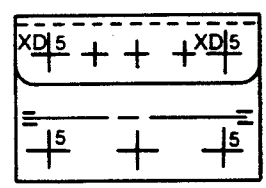
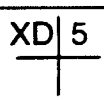
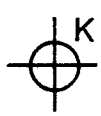
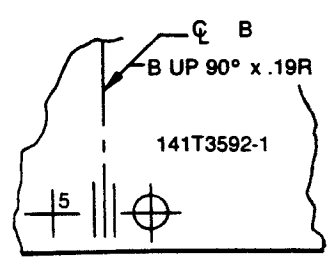
LINE STANDARDS AND SYMBOLS

LINE STANDARDS			
NAME	CONVENTION	DESCRIPTION AND APPLICATION	EXAMPLE
PHANTOM LINE		Medium series of one long dash and two short dashes evenly spaced ending with long dash Used to indicate alternate position of parts, repeated detail, or to show reference parts. Also used to show adjacent parts and variable contour of lines in motion.	
STITCH LINE		Medium line of short dashes evenly spaced and labeled Used to indicate stitching or sewing.	
BREAK (LONG)		Thin solid ruled lines with freehand zig-zags Used only if breaks are fairly long. Used to reduce size of drawing required to delineate object and reduce detail.	
BREAK (SHORT)		Thick solid freehand lines Used to indicate a short break. Used generally if break is fairly short. Shows that a drawing may be shortened for clarity.	
CUTTING OR VIEWING PLANE OR VIEW INDICATOR LINE		Thick solid lines with arrowhead Heavy broken lines 0.38 to 2.00 in long depending on the size of the drawing. Used to indicate direction in which section or plane is viewed or taken. Shows sectional cuts or auxiliary views.	

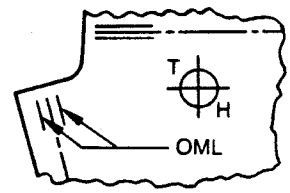
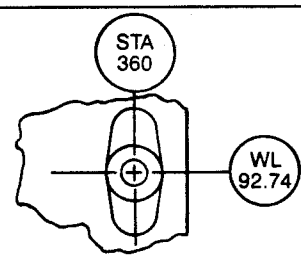
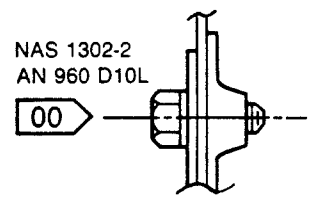
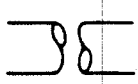
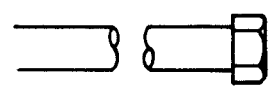
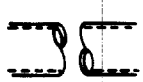
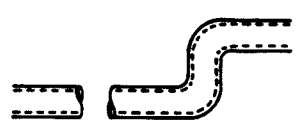
LINE STANDARDS AND SYMBOLS

LINE STANDARDS			
NAME	CONVENTION	DESCRIPTION AND APPLICATION	EXAMPLE
VISIBLE LINES OR OUTLINE		Heavy unbroken lines Used to indicate visible edges of an object. Sometimes called object lines.	
HIDDEN LINES OR INVISIBLE LINES		Medium lines with short evenly spaced dashes Used to indicate concealed edges. The dashes may vary depending on the size of the drawing.	
CENTERLINES		Thin lines made up of long and short dashes alternately spaced and consistent in length Used to indicate symmetry about an axis and location of centers. Used to indicate travel of a center in motion.	
DIMENSION LINES		Thin lines terminated with arrow heads at each end Used to indicate distance measured. Numerals may appear in the center of the line or at one end.	
EXTENSION LINES		Thin unbroken lines Used to indicate extent of dimensions.	
LEADER		Thin line terminated with arrowhead or dot at one end Used to indicate a part, dimension, or other reference.	

LINE STANDARDS AND SYMBOLS

SYMBOLS			
NAME	CONVENTION	DESCRIPTION AND APPLICATION	EXAMPLE
CENTERLINE	℄	Designates the center plane of an object when used in conjunction with a centerline.	
FLAG INDICATOR		Numbers, letters, or symbols are drawn inside the flag to indicate cross reference. Note: Letters or symbols are only for special applications.	NAG 1304-ISD NAG 43DD4-19(2) AN 960 D416 AN 310-4 MS 24665-153 1  GENERAL NOTES 1 INSTALL COTTER PIN PER BAC 5018
DIRECTIONAL INDICATOR		Shows the relationship of a view to airplane coordinates and the perspective of an object.	VIEW A-A 
FASTENER LOCATION		Number in the fastener hole location symbol designates the fastener diameter in 32nd of an inch.	
5/32-DIA FASTENER LOCATION			
RIVET CALLOUT			
"K" OR COORDINATING HOLE		These holes are production facilities used to coordinate tools (jigs, etc.) to install parts, assemblies, or installations.	

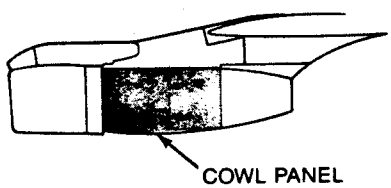
LINE STANDARDS AND SYMBOLS

SYMBOLS			
NAME	CONVENTION	DESCRIPTION AND APPLICATION	EXAMPLE
TOOLING HOLES		Holes used in the fabrication of parts. They hold parts in place during manufacturing operations.	
STATION INDICATOR		Used to designate stations (STA), waterlines (WL), buttock lines (BL).	
LIMITED RELEASE INDICATOR		Limited, see assembly breakdown list for release.	
BREAK METAL ROD		Used to show an imaginary break in a a solid round.	
BREAK METAL TUBE		Used to show an imaginary break in a hollow round.	

GLOSSARY OF AIRCRAFT TERMS

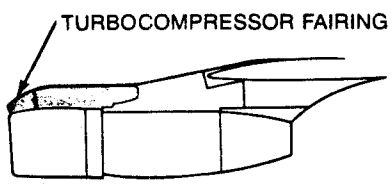
GLOSSARY OF JET ENGINE TERMS

COWL PANEL. The hinged and removable sides of the pod or nacelle that covers an engine.

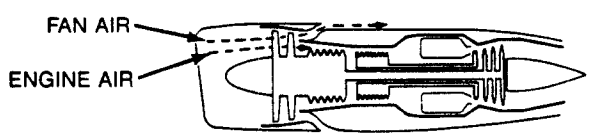


COWLING. A removable covering placed around all or part of an engine.

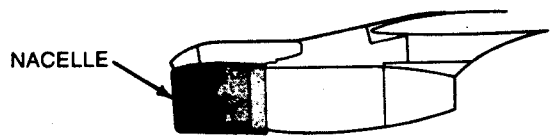
FAIRING. An auxiliary structural member that streamlines and reduces the drag of a part to which it is fitted. It is shaped to provide a smooth flow of air.



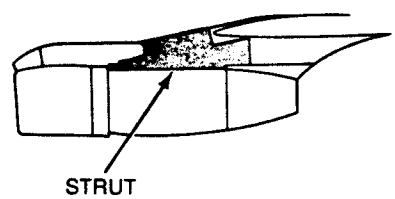
FAN ENGINE. A turbojet engine with a set of compressor blades that operate outside of the basic engine case and move air around the outside of the engine.



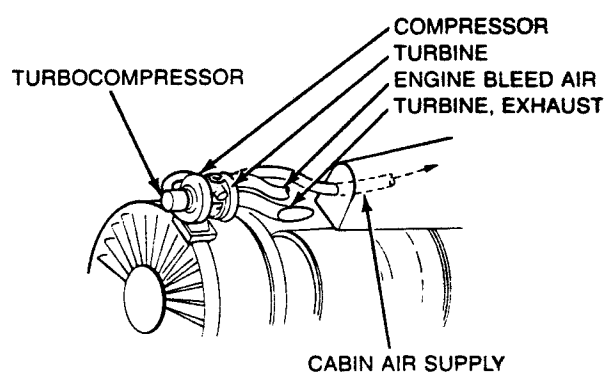
NACELLE. A streamlined enclosure that covers the engine. Sometimes called a pod.



STRUT. A structural member that braces or resists compression or tension loads in the direction of its length. On Boeing airplanes, the pylons that support the engines are called struts.

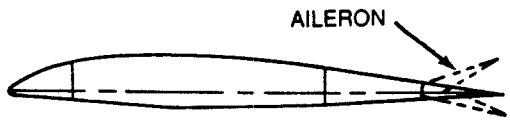


TURBOCOMPRESSOR. A small centrifugal compressor mounted on the upper side of some jet engines. It is driven by air bled from the jet engine and supplies air pressure for the passenger cabin and the pneumatic starting system.



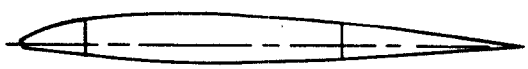
GLOSSARY OF TERMS

AILERON. Hinged sections of the trailing edge of the left and right wings that operate together to provide lateral control. When one aileron is raised, the opposite is lowered, producing rolling movements around the longitudinal axis of the aircraft.

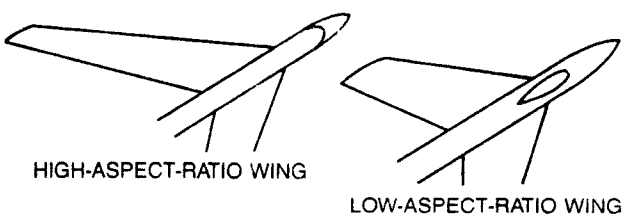


AIR BRAKE. A device to increase the air resistance of an airplane, thus slowing its speed (see SPOILER).

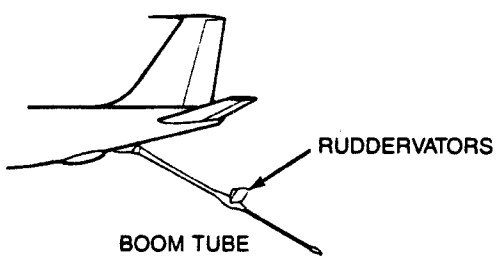
AIRFOIL. A surface, such as an airplane wing, aileron, or rudder, designed to obtain a reaction from the air through which it moves.



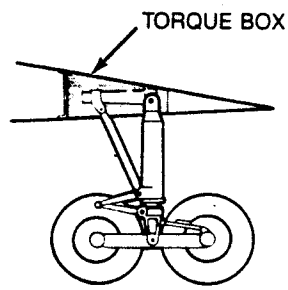
ASPECT RATIO. The relation of wingspan to wing chord, ascertained by dividing span dimension by chord dimension.



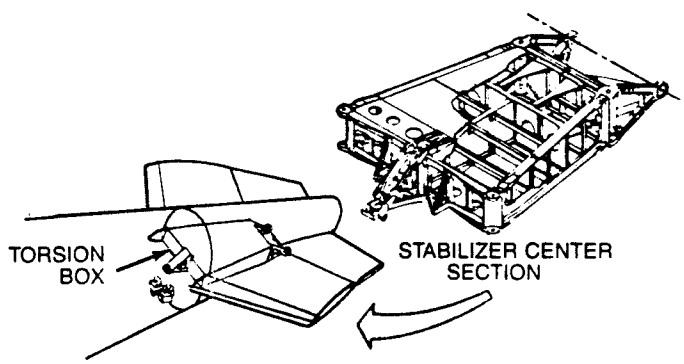
BOOM (flying boom). The extendable refueling tube designed and developed at Boeing for the KC-97 and KC-135 tanker planes. Boom position is controlled by aerodynamic control surfaces, arranged in a V-configuration, called ruddervators.



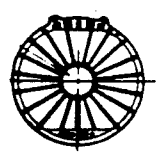
BOX, TORQUE (landing gear). A tapered box-like structure attached to the aft side of the rear spar to support the landing gear on the KC-135 and 707-series aircraft.



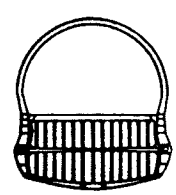
BOX, TORSION (stabilizer). The hinged center section of a horizontal stabilizer that can be raised and lowered to change the angle of incidence of the horizontal tail (flying tail).



BULKHEAD. A heavy structural member in the fuselage to contain pressures or fluids or to disperse concentrated loads. A heavy circumferential frame that may or may not be entirely closed by a web.

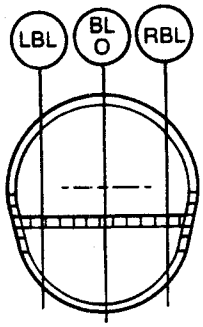


EMPENNAGE PRESSURE BULKHEAD REAR VIEW

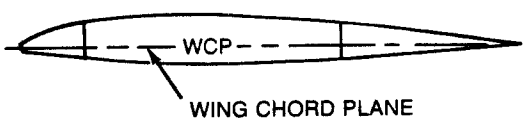


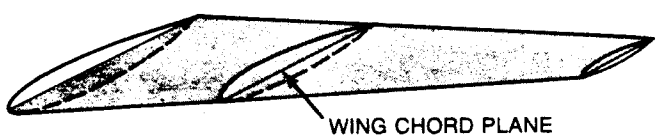
WHEELWELL PRESSURE BULKHEAD REAR VIEW

BUTTOCK LINE. A vertical reference line or plane parallel to the centerline of the airplane used to locate points or planes to the left or right of the airplane centerline.

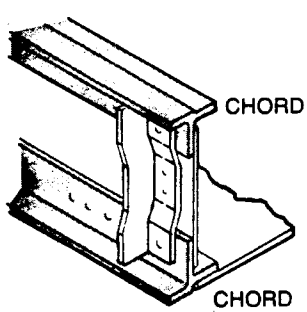


CHORD PLANE, WING. The plane that defines the planform of the wing and around which the airfoil is figured. The wing chord plane scribes a line from the extreme point of the leading edge to the extreme point of the trailing edge, thus giving a datum line to measure incidence and dihedral.

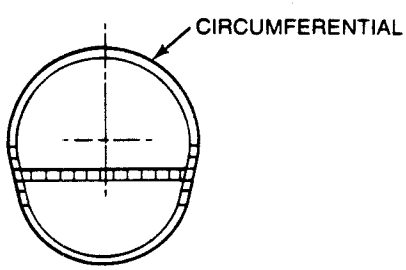




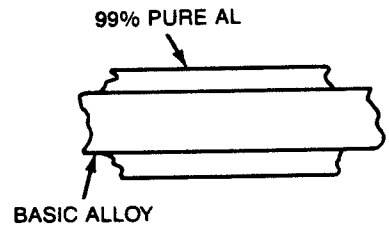
CHORD (structural). Sometimes called a cap. A strong member that forms the edges of beam structures or heavy frames.



CIRCUMFERENTIAL. A frame that is shaped to the fuselage.



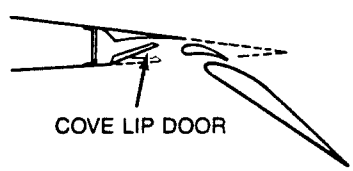
CLAD. A 99% pure aluminum layer, molecular-bonded to the basic alloy by rolling while heated.



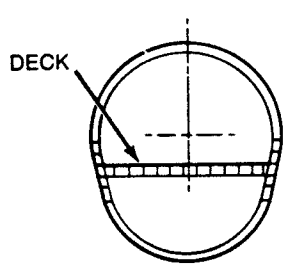
CLIP. Sometimes called bracket. Usually a small angle used to attach lightweight parts such as wiring clamps.

COMPOSITE MATERIAL. Composites are considered combinations of material differing in composition or form. The constituents retain their identities in the composite; that is, they do not dissolve or otherwise merge completely into each other although they act together. Normally, the components can be identified physically.

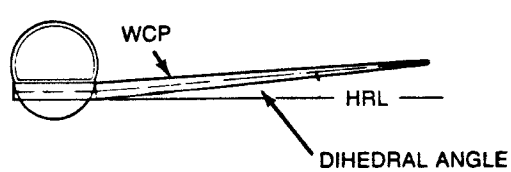
COVE LIP DOOR. A movable door on the under surface of the wing, hinged at the rear spar, that lifts upward when the flaps are lowered. These doors allow high-pressure air to flow through the main flap slots. Used on KC-135, 707, and 720 airplanes.



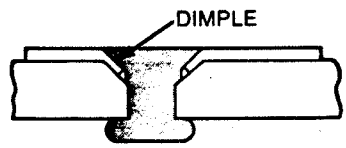
DECK. The horizontal floor in the control cabin or passenger cabin. The horizontal structure to support fuselage tanks in the B-52 (fuel deck).



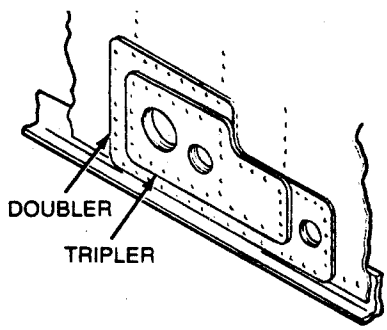
DIHEDRAL. The angle the wing chord plane makes with a horizontal reference plane.



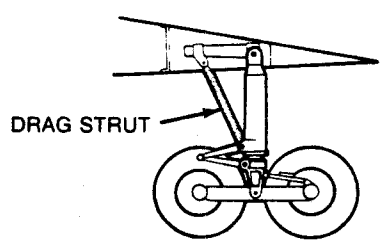
DIMPLE. A depression of the area around the edges of a hole in thin sheet to provide for a countersunk rivet.



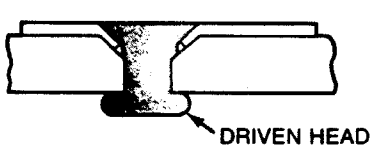
DOUBLER. A second sheet or plate installed next to the web or skin in a small area subject to high local loads to provide a double thickness of material. A tripler is a third sheet to provide three layers of material.



DRAG STRUT. A diagonal brace attached to the forward end of the landing gear trunnion and the lower end of the oleo strut. Absorbs drag loads during ground maneuvers and braking.

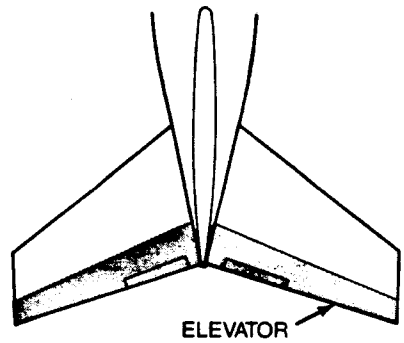


DRIVEN HEAD. The upset portion of a rivet shank that has been hammered flat by the bucking bar during installation.



DUTCH ROLL. A phenomenon peculiar to sweptwing aircraft. A continuous combination of yaw and roll.

ELEVATOR. The hinged section of the horizontal stabilizer used to control pitch.



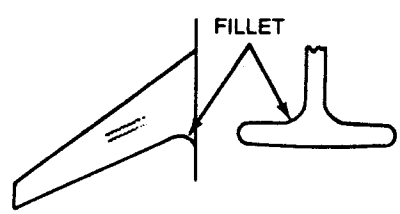
EMPENNAGE. The aft portion of an aircraft, usually consisting of a group of stabilizing planes or fins, to which control surfaces such as elevators and rudders are attached.

EXTRUSION. A part formed by squeezing the material through a die that has a hole cut to the desired cross-sectional shape of the part.

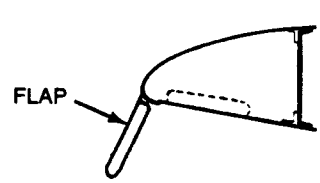
FAIRING. An auxiliary structural member shaped to provide a smooth flow of air and reduce drag.

FAYING SURFACE. A surface that fits, joins, or unites closely with an adjacent surface overlapping it.

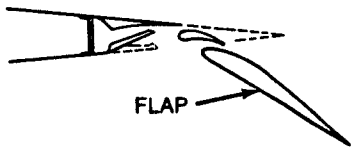
FILLET. A filler that smooths the angle formed by two intersecting surfaces and eliminates an abrupt change of direction. Used on forged or machined parts to prevent stress concentration at the "corner." Used aerodynamically to eliminate angular joints between components.



FLAP, LEADING EDGE. Hinged section of the under side of the leading edge that, when extended, prevents airflow separation over the top of the wing. Leading edge flaps hinge at the leading edge of the airfoil.



FLAP, TRAILING EDGE. Hinged section of the trailing edge of the wing that can be lowered and extended. When lowered, flaps increase airplane lift at low speeds.

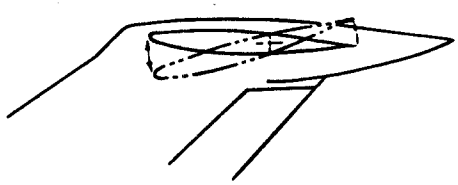


FLAP TRACK. A steel track on which the main landing flaps operate by means of rollers. The curvature of the flap track determines the deflection and position of the landing flaps when they are extended.

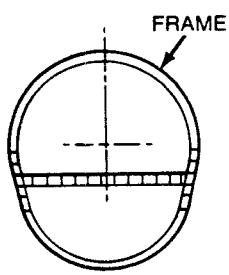
FLAT PATTERN. The overall shape or outline of a sheet metal part before bending operations.

FLYING TAIL. A horizontal stabilizer that is movable and controllable. The entire horizontal tail angle of incidence can be changed to trim the airplane.

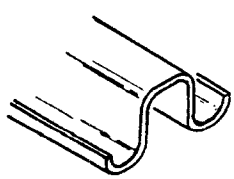
HORIZONTAL TAIL MOVEMENT, 727



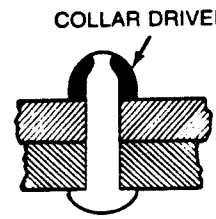
FRAME. A circumferential structural member in the body that supports the stringers and skin. Used in semimonocoque construction (see MONOCOQUE).



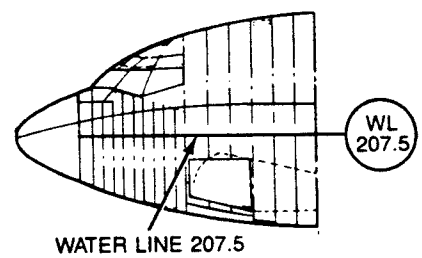
HAT SECTION. The cross-section shape of the stringers used in the fuselage. A common rolled shape that looks like a top hat with the brim curled up.



HI-SHEAR RIVET. Trade name for high-shear-strength steel fasteners used in the airplane where heavy loads are encountered. Installed with a swaged collar instead of being upset by a bucking bar. Used in shear applications.

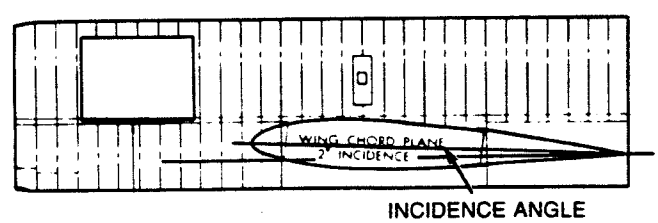


HRL (horizontal reference line). Will sometimes refer to a water line or can be a special horizontal line to locate a particular plane or points in the airplane's horizontal axis (see WATER LINE).

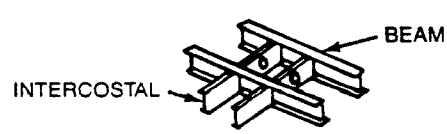


INBOARD. A term applying to the inside. An item nearest to the fuselage centerline (antonym: OUTBOARD).

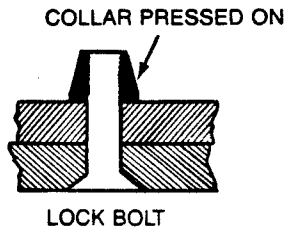
INCIDENCE, ANGLE OF. The fixed angle at which the wing chord plane is set relative to the horizontal datum line of the aircraft. Sometimes erroneously called the angle of attack; angle of attack rightfully refers to the angle of the entire aircraft to relative wind. The angle of attack can be changed by the elevators on the horizontal tail surfaces.



INTERCOSTAL. A small stabilizing beam between and at right angles to larger beams or bulkheads.

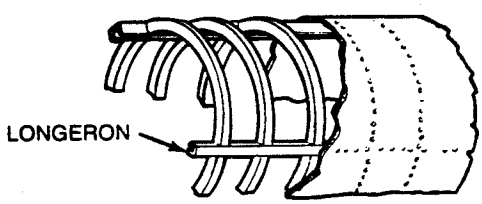


LOCK BOLT. A high-strength steel fastener with a swaged collar on the shank for retention rather than a nut. Used in tension and shear applications.



LOFT LINE. The line or lines that establish and control the shape of an object so that all intersecting cutting planes are smoothly faired.

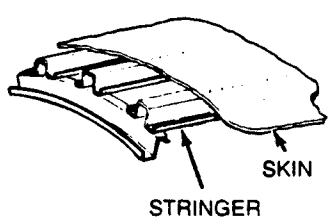
LONGERON. A principal longitudinal member of the framing of an aircraft fuselage or nacelle. Usually continuous across a number of points of support.



MACH NUMBER. A number representing the ratio of the speed of a body to the speed of sound in the surrounding atmosphere. For subsonic speed, the mach number is less than 1 and for supersonic speed it is greater than 1.

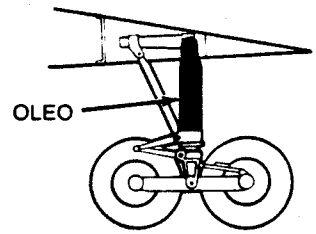
MLG. Abbreviation for main landing gear.

MONOCOQUE. A single-shell construction in which the skin carries all shear and bending stresses. In semimonocoque construction, shear and bending loads in the skin are transmitted to stringers and frames.



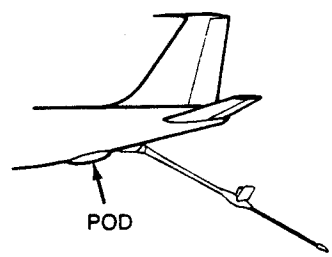
OIL CAN. A term commonly used to describe a buckling or wrinkling in the metal skin of an airplane. The skin normally should be smooth.

OLEO STRUT. A main weight-carrying strut in the landing gear that absorbs the shock of landing by the flow of oil through an orifice in the cylinder of the strut.



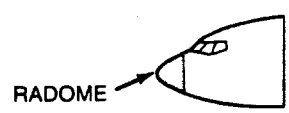
PITOT-STATIC. An airspeed indicating system that operates from ram air pressure in the pitot tube and static pressure of the atmosphere. Gives an airspeed reading that is corrected for altitude.

POD. A term sometimes used for engine nacelle. Indicates an enclosure such as the boom operator's pod on the KC-135 that encloses the boom operator and equipment in a streamlined fairing.

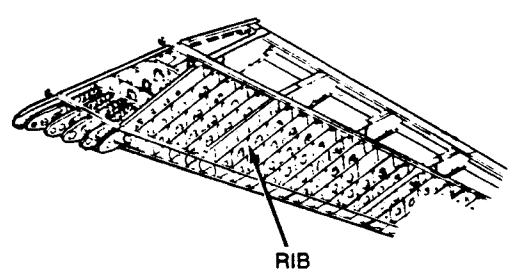


PRESSURE WEB. A web that seals an area to retain cabin pressurization.

RADOME. Coined term for radar dome. A nonmetallic streamlined fairing to cover the radar sweep.

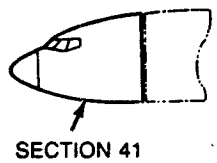


RIB. A fore and aft member of an airfoil structure (wing or aileron) of an aircraft used to give the airfoil section its form and to transmit that load from the skin to the spars.



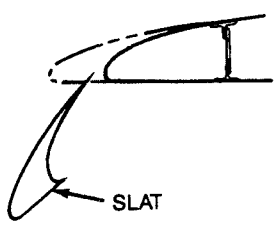
RUDDER. A hinged or movable auxiliary airfoil, attached to the vertical fin, that controls yaw.

SECTION. Any of the large subassemblies of the airplane that are built separately and then joined to form the complete airplane. The airplane is built in sections to ease production and handling problems.

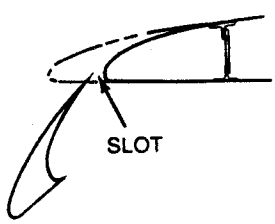


SKIN. The outside covering of an aircraft.

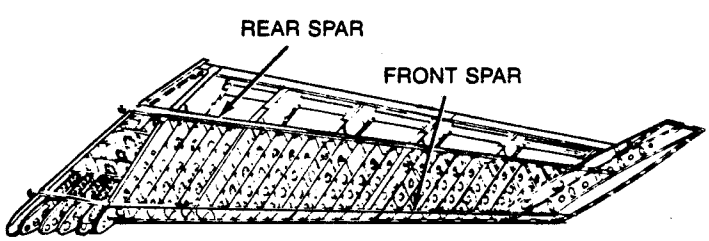
SLAT. A movable auxiliary airfoil attached to the leading edge of the wing. When closed, it forms part of the normal contour of the wing; when opened, it forms a slot and increases lift.



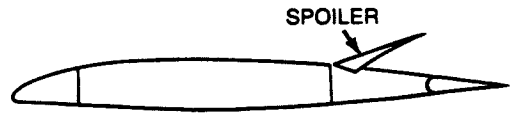
SLOT. An elongated passage through a wing whose primary function is to improve the airflow over the wing at high angles of attack.



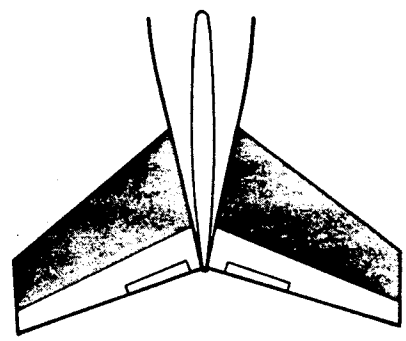
SPAR. A principal spanwise beam in the structure of a wing, stabilizer, rudder, or elevator. It is usually a primary load-carrying member in the structure.



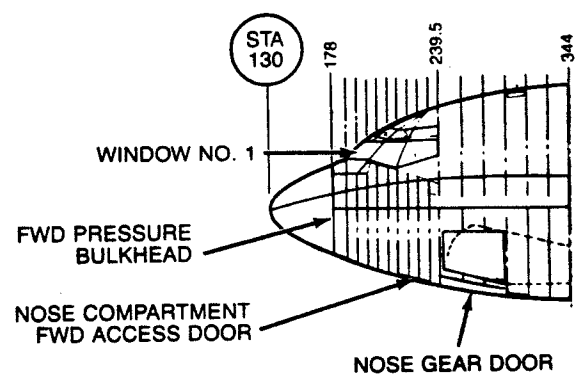
SPOILER. A hinged panel on the upper surface of a wing that "spoils" wing lift when raised. Left and right spoilers can be raised alternately for high-speed lateral control or can be raised together as speed brakes during landing.



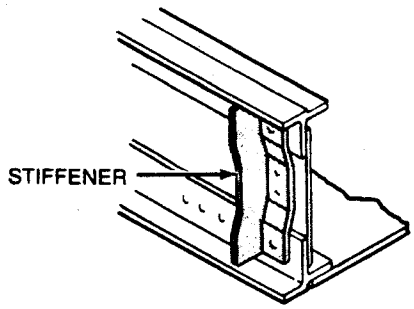
STABILIZER. A fixed horizontal tail surface that maintains stability around the lateral axis of an aircraft.



STATION LINE. All parts of an airplane are identified by a location or station number in inches from a beginning point. Station lines in the fuselage start forward of the nose; those for the wing usually start at the centerline of the fuselage. This forms a locating system that divides the aircraft cross-sectionally into a series of reference planes at right angles to the vertical centerline of the aircraft.

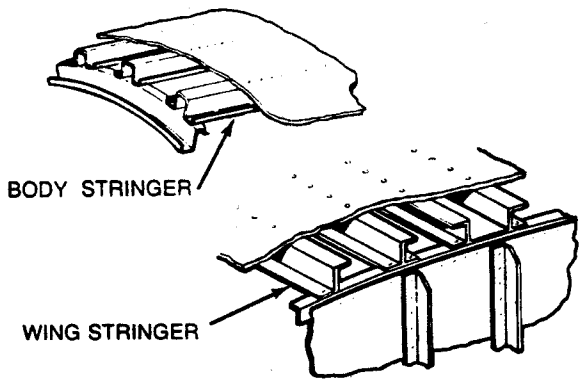


STIFFENER. A metal part, other than flat sheet, formed or extruded and used in the framing of a structure to provide rigidity.

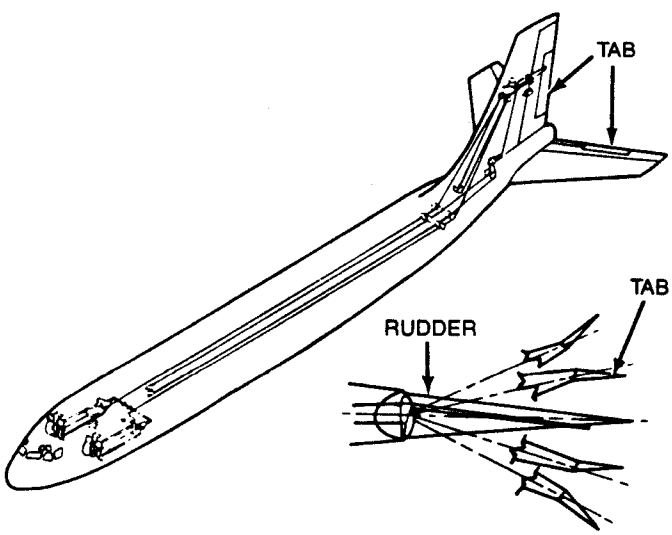


STRETCH FORM. A method used to shape skins or parts by stretching the flat sheet over a die to provide the shape.

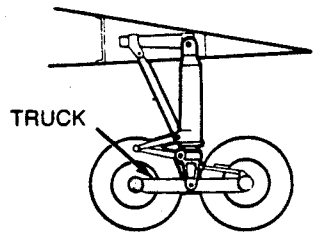
STRINGER. Longitudinal members in the fuselage or spanwise members in the wing to transmit skin loads into the body frames or wing ribs.



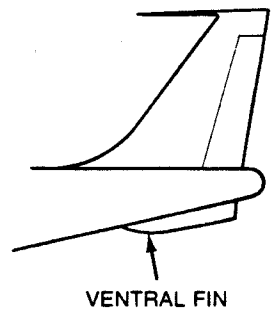
TAB. A small, hinged, auxiliary control surface attached to a primary control surface such as an aileron, rudder, or elevator. When deflected, it moves the primary surface to which it is attached. The primary surface will react in the direction opposite the control tab's deflection.



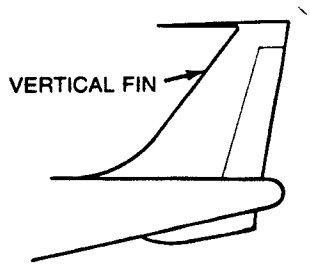
TRUCK. The portion of the main landing gear that is composed of a swiveling beam with an axle and two wheels on each end.



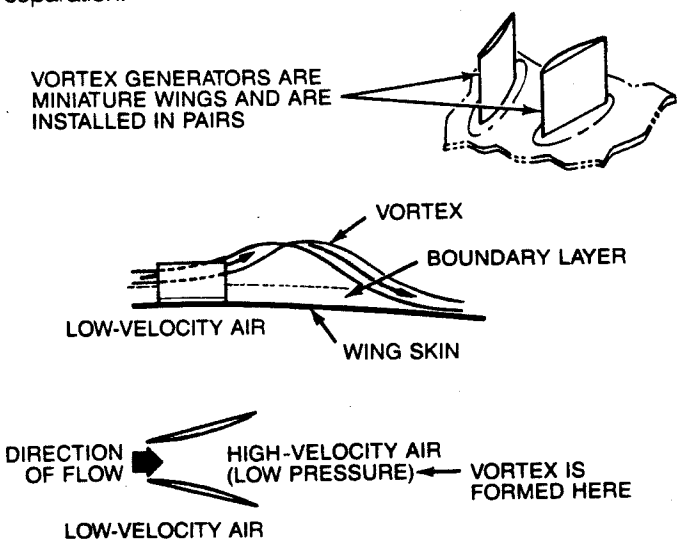
VENTRAL FIN. A stabilizing surface attached to the bottom of the fuselage near the tail.



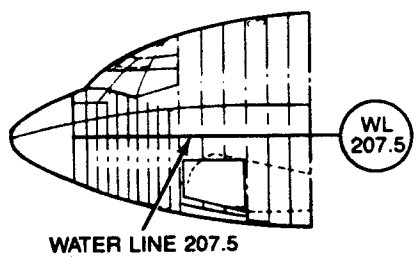
VERTICAL FIN. Sometimes referred to as vertical stabilizer. It is fixed to provide directional stability. The trailing edge is hinged to form the rudder.



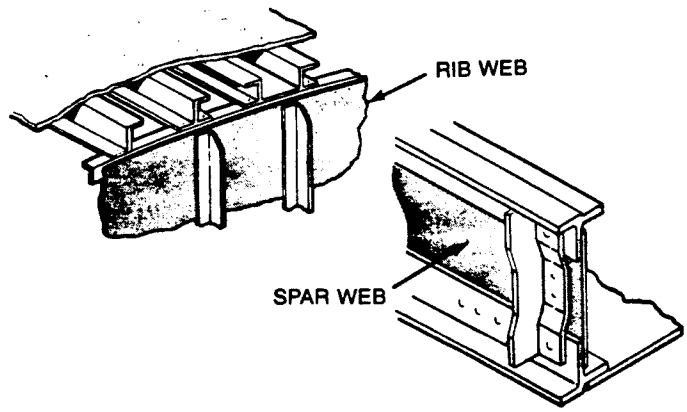
VORTEX GENERATOR. A device used on the wings and tail surfaces to decrease drag caused by the separation of the air flowing over the flight surfaces. Vortex generators appear as a row of small metal tabs set at angles to the air stream. The vortex formed by the tabs pushes the air down to the skin of the flying surface and delays drag producing separation.



WATER LINE. A reference line or horizontal plane parallel to the ground used to locate points vertically.



WEB. A thin-gage plate of sheet, when supported by stiffening angles and framing, provides great shear strength for its weight. Used in many applications throughout an aircraft because of its strength-to-weight ratio.



NOTES