# An Illustrated Dictionary of Aviation

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# A Guide to This Dictionary

The terms included in this dictionary are defined in accordance with their use in aviation disciplines. If the term is used in other discipline(s), the corresponding definition has not been included.

Some of the terms have more than one meaning. For example, *clear* has 10 meanings; the terms *hold, station*, and *track* have nine meanings each; the terms *break, crab, contact, deviation, drift*, and *horizon* have seven meanings each; each of the terms *flare, pitch, slip*, and *traffic* has six meanings, while the terms *dead space, transition*, and *halo* have five meanings each. The reader will have to extract the correct meaning by inspection and by examining the context in which the term is used.

There may be more than one word for a term. These names are indicated by the following annotations: "Also called . . . ," "Also known as . . . ," and "The same as . . . ." For example, there is an annotation "Also known as *blow back valve* and *flap overload valve*" at the end of the term *overload valve*. It means that these three terms are synonyms.

Though the meaning of a term may be complete, there may be occasions where the meaning can be further amplified by referring to some other term(s). This is indicated by the annotation at the end of the term "See also . . . ." For example, at the end of the definition of the term "*H-display*," there is an annotation, "See also *B-display*." This means that by referring to the term *B-display* the meaning of *H-display* will become clearer and the reader will be able to comprehend it easily.

Ideally each of the terms should have had an illustration of its own. But this would have led to repetition of illustrations and in some cases the same illustration would have appeared more than once on the same page. This would have also made the book unwieldy to handle. To avoid these problems the annotation "See . . ." at the end of the term means that the reader should refer to the illustration next to the

term mentioned in italics. For example, there appears "See *laminar boundary layer*" at the end of the term *laminar flow*. This means that the terms *laminar flow* and *laminar boundary layer* have the same illustration and the reader should refer to the illustration for the term *laminar boundary layer*.

Some of the terms have an asterisk at the end. The asterisk is added to a term which appears in an annotation such as "Also called . . ." and "The same as . . . ." It means that the illustration for the term in question and the one having the asterisk is the same. For example, there is an annotation "originally called an *aerothermodynamic duct**" at the end of the definition of ramjet. The asterisk means that the illustration for *aerothermodynamic duct* and *ramjet* is the same and it appears against the term *aerothermodynamic duct*.

Wherever an acronym or abbreviation has been used, its full form has been indicated in brackets when it appears the very first time in the definition of the term. However, the following acronyms have been used without giving their full form.

| | |
|---|---|
| ICAO | International Civil Aviation Organization |
| rpm | revolution per minute |
| kg | kilogram |
| lb | pound |
| mi | mile |
| NM | nautical mile |
| m | meter |
| km | kilometer |
| in | inch |
| ft | feet |
| mph | miles per hour |
| h | hour |
| min | minute |
| s | second |
| Hz | hertz |
| kHz | kilohertz |
| MHz | megahertz |
| GHz | gigahertz |

The systems described in the dictionary are not of any particular aircraft or weapon system. The illustrations are representative in nature and are meant for explanation only. The readers are advised to refer to the manufacturer's publications for each aircraft or system.

There are certain terms which have been attributed to the International Civil Aviation Organization (ICAO). These have been so indicated. The term has been taken from one of ICAO's publications. The subsequent definition is by the author.

# About the Editors

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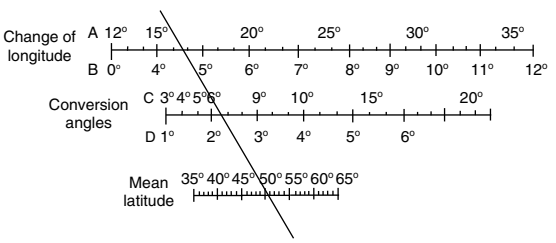
# A (Alpha)

**ABAC scale** A nomogram for determining the conversion angle to apply when plotting great-circle bearings on a Mercator projection. ABAC scales are printed on the margins of Mercator plotting charts. Scales A and C are interrelated, as are B and D. In the illustration, the ABAC scale measures the conversion angle for two places that have a 16° change of longitude between them and a mean latitude of 50°. The conversion angle in this case is 6°.

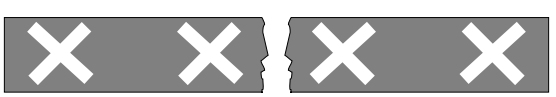



**abandon**

**i.** To bail out or eject out of an aircraft and let it crash. Used as a command, as in "abandon aircraft."

**ii.** To walk away or leave an aircraft on the ground in an emergency as when it is on fire.

**abandoned airport** An airport permanently closed to aircraft operations. It may bear the current standard marking and lighting for deceptive, closed, and hazardous areas in airports. All normal runway and taxiway markings are obliterated if the runway or taxiway is permanently closed. The standard marking has white crosses at intervals of 1000 ft (300 m) or less.

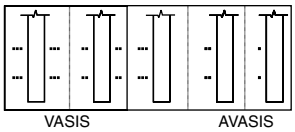


Typical marking for abandoned airport—white crosses at not more than 300 m interval.

**abbreviated flight plan** An authorization by ATC (air traffic control) requiring pilots to submit only that information needed for the purpose of ATC. It includes only a small portion of the usual IFR (instrument flight rules) flight plan; this may be only the aircraft identification, location, and pilot request. ATC may request other information if needed for separation and control purposes. Such flight plans are generally filed by airborne aircraft desiring an instrument approach and by aircraft on the ground wanting to climb to altitudes dictated by VFR (visual flight rules).

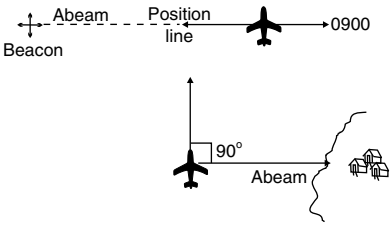
**abbreviated precision approach path indicator (APAPI)** A precision approach path indicator system consisting of only two light units situated on the left side of the runway. The aircraft is on a slope if the unit nearest the runway shows red and the unit farthest from the runway shows white, too high if both units show white, and too low if both units show red. The APAPI is always set to an eye-to-wheel height (EWH) of 10 ft (3 m).

**abbreviated visual approach slope indicator system (AVASIS)** A night-landing aid placed at the beginning of a flare path or runway. It displays different colored lights, depending on the angle from which it is viewed by a pilot approaching to land. When viewed from the correct angle of safe approach, it displays green; when the angle is too high, it displays amber; and when it is too low, red. The system, however, has fewer lights than a full-fledged system. An AVASIS generally consists of only two light units situated on the left side of the runway, one upwind and one downwind. The aircraft is on a slope if the upwind unit shows red and the downwind unit shows white, too high if both units show white, and too low if both units show red. The AVASIS is always set to an eye-to-wheel height (EWH) of 10 ft (3 m). The arrangement of lights is indicated in the illustration.



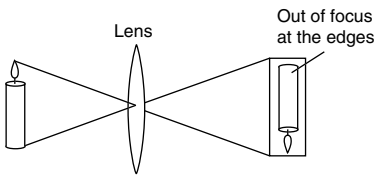

Layout of some of the visual approach slope indicator systems and those of the abbreviated visual approach slope indicator systems are indicated above.

**abeam** Objects, aircraft, and terrain features, including constructed structures at a relative bearing approximately 90° or 270°, or at right angles to the longitudinal axis of the aircraft.

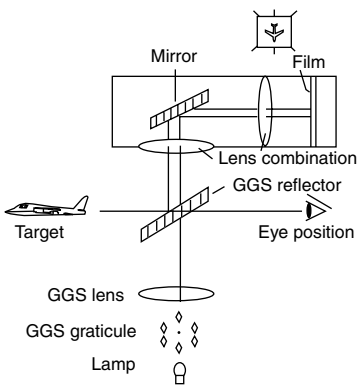



**aberration**

**i.** A condition in an optical system in which the images are imperfect or improperly located.

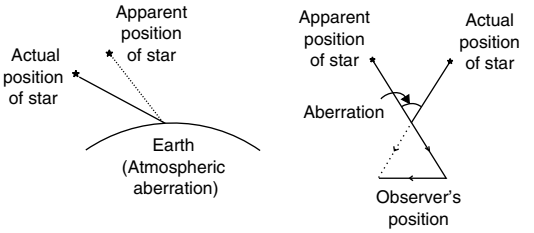



**ii.** Geometrical inaccuracy(ies) introduced by optical, IR (infrared), or similar electromagnetic systems in which radiation is processed by mirrors.




Optical diagram of a recorder camera with gyro gun sight (GGS). Aberration occurs if mirror or reflector is not in correct position resulting in out-of-focus image.

In optics, a specific deviation from perfect imagery (e.g., spherical aberration, coma, astigmatism, curvature of field, or distortion).




**iii.** The displacement of the apparent directions of the stars resulting from the motion of the observer. Also called an *atmospheric aberration*.

**ab-initio trainer** Aircraft intended for training student pilots who have no previous flying experience. Such an aircraft has the simplest and the minimum required systems and a low maximum speed, making it easier to fly.

**abort**

**i.** When used as a command, it means stop doing whatever you are doing (e.g., abort takeoff).

**ii.** To terminate a preplanned maneuver. To cut short or break off an action, mission, operation, or procedure with an aircraft, especially because of equipment failure or adverse weather conditions. It may occur at any point after the beginning of the mission and prior to its completion.

**iii.** To return or to fly to a friendly base before completing the assigned mission for reasons other than enemy action.

**iv.** To discontinue an aircraft takeoff or a missile launch.

**abort drill** A prebriefed and rehearsed sequence of actions to be taken instinctively to cope with emergency abort situations. For example, normally, the abort takeoff drill is to bring back fully the throttle(s), apply full brakes, deploy the tail chute (for those aircraft where this facility is available), and use reverse thrust on all engines consistent with the ability to steer along the runway.

**aborted landing** To discontinue a planned landing for reasons such as conflicting traffic, weather, or runway obstructions. Also called *rejected landing*, *go-around*, or *overshoot*.

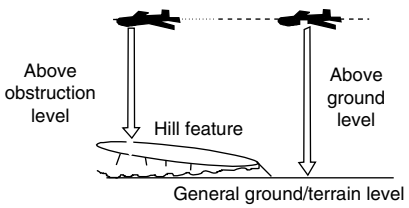
**aborted start** The termination of the engine start-up procedure because of either the RPM failing to build up to the required speed, the EGT (exhaust gases temperature) exceeding limits, or any other malfunction.

**aborted takeoff** A takeoff that has been terminated prematurely because continuing would probably jeopardize the safety of the aircraft.

**abortive mission** A mission or raid that has been turned back or flown to a friendly base before completing its assigned mission for reasons other than enemy action.

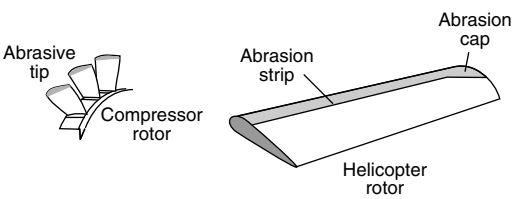
**above ground level (AGL)** The height of an aircraft above ground level. Also known as *absolute altitude*. It is measured by a radio, radar, or laser altimeter. When an aircraft is required to fly at a certain height above ground level, the AGL refers to its average height above terrain, not above certain high features and obstacles that may be in the area of operation. If the aircraft is to fly at a fixed height above all obstacles and features, then the height is *above obstruction level* (AOL), not above ground level. The former may be greater than or equal to the AGL. See *above obstruction level*.

**above obstruction level (AOL)** The height of an aircraft above terrain, structures, and obstacles in the area of operation. The height is nominated for aircraft carrying out very low flying. Pilots either take into consideration heights indicated on maps and charts when calculating the height they need to fly or use terrain-following radar, so they can maintain constant height. The height above obstacles may be equal to or higher than the height above ground level (AGL). See also *above ground level*.

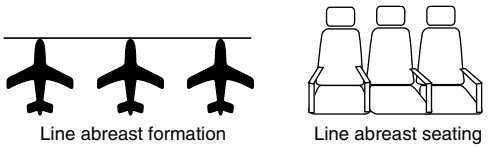



**abradable tip** The tip of some axial-flow compressor blades made in such a way that it will wear away when it contacts a compressor casing. Some fan and compressor blade tips are sealed with silicone rubber that contains a 20% filling made of fine glass beads to overcome this problem.

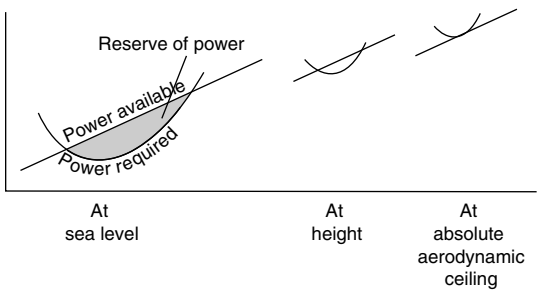
**abrasive tip** A turbine blade with a hardened insert at the tip, which is able to cut into a turbine shroud ring.




**abreast** Side by side and facing the same direction. For example, aircraft flying in line-abreast formation; side-by-side seating as in three-abreast seating. The term is often confused with *abeam*. See also *abeam*.




**absolute aerodynamic ceiling** The altitude at which an aircraft's maximum rate of climb falls to zero under specified conditions. This is the greatest height achievable except during a zoom climb. The usual conditions are ISA (international standard atmosphere); 1 g, specified weight; and pressure altitude. At this altitude, the power-available curve just about touches the power-required curve, meaning there is no reserve of power available to permit any climb. Also called *absolute ceiling*.

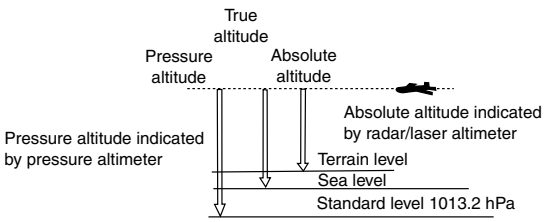



Reserve of power reduces with increase in altitude till it is zero at absolute aerodynamic ceiling.

**absolute air superiority** An obsolete term meaning an air control situation better than air supremacy. A condition in which the enemy air power is either nonexistent or unable to interfere in any way with the action of friendly air, land, and maritime forces. Also known as *absolute command of air* or *absolute control of air*.

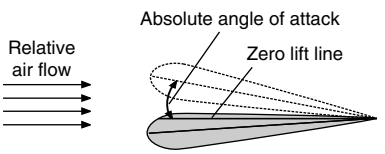
**absolute altimeter** An instrument intended to give acceptably accurate, direct indications of absolute altitude (i.e., the vertical distance of the aircraft from the surface of the earth). A radio or a radar altimeter indicates absolute altitude roughly because of its inherent errors. Theoretically, a laser altimeter should indicate correct absolute altitude and can therefore be called an *absolute altimeter*.


A radio altimeter roughly indicates absolute altitude.




**absolute altitude** The vertical distance of an object above the surface of the earth. It can be measured with the help of an absolute, radio, radar, or laser altimeter. See *absolute altimeter*.

**absolute angle of attack** The acute angle between the chord of an airfoil at any instant in flight and the chord of that airfoil at zero lift.



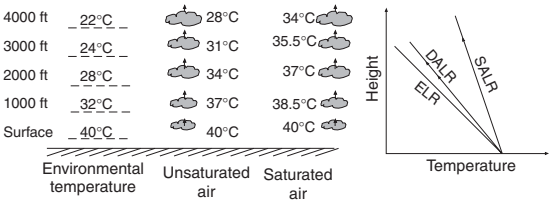

**absolute fix** A fix established by two or more position lines crossing at large angles near 90°.

**absolute ceiling** The maximum altitude at which a sustained rate of climb is no longer possible (i.e., the rate of climb is zero). At this altitude, the maximum power available curve just about touches the power-required curve, meaning there is no reserve of power available to permit any climb. Also called *absolute aerodynamic ceiling*.*

**absolute delay** The time interval between the transmissions of sequential signals. Specifically, in LORAN (long-range navigation), the time interval between transmission of a signal from the A-station and transmission of the next signal from the B-station. Also called *delay*. See also *LORAN*.

**absolute humidity** The mass of water vapor present per unit volume of space (i.e., the density of water vapor, usually expressed in $gm/m^3$). It is the actual amount of water, by weight, in water vapor in a given volume of space. Also known as *vapor concentration*.

**absolute instability** As it relates to meteorology, the state of a layer of air within the atmosphere in which a parcel of air, if given an upward push, will move away from its initial level without further outside force being applied. It is that condition in which the observed lapse rate is more than the dry and saturated adiabatic lapse rates. A mass of dry air in this case will rise until it becomes saturated and will still continue to rise, as the observed lapse rate is still greater. See also *dry adiabatic lapse rate* and *saturated adiabatic lapse rate*.

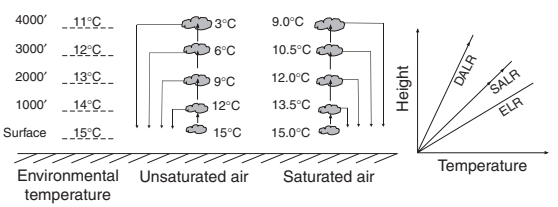



Dry adiabatic lapse rate = 3°c per thousand ft.
Saturated adiabatic lapse rate = 1.5°c per thousand ft.
In this case, environment lapse rate (ELR) > dry air lapse rate (DALR) > saturated air lapse rate (SALR). Hence, a parcel of air will continue to rise if it is given an upward push.

**absolute pressure** The pressure measured relative to zero pressure, or a total vacuum, as opposed to gauge pressure, which is pressure measured relative to ambient pressure. A manifold absolute pressure (MAP) gauge measures absolute pressure in a reciprocating engine.

**absolute pressure controller** A type of turbocharger controller that limits the maximum discharge pressure the turbocharger's compressor can build up when the aircraft is flying below its critical altitude. Absolute pressure is indicated by a manifold absolute pressure (MAP) gauge.

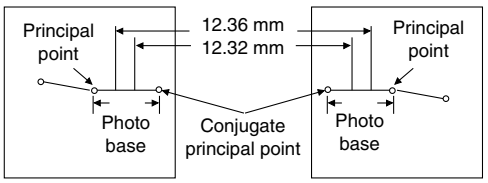
**absolute stability** As it relates to meteorology, an atmospheric condition in which the observed lapse rate is less than the saturated adiabatic lapse rate. A mass of air once pushed up will tend to come back to its original level and not rise. This is because it will be cooler than the surrounding air, as its lapse rate is less than the dry and saturated adiabatic lapse rates.




Environment lapse rate (ELR) < dry air lapse rate (DALR) < saturated air lapse rate (SALR).
A parcel of air once pushed up will tend to come back to its original level and will not rise.

**absolute stereoscopic parallax** The change in position of an image from one photograph to the next overlapping photograph caused by the aircraft's

motion. It is the algebraic difference between their respective nadirs, measured in a horizontal plane and perpendicular to the air base. It is also the algebraic sum of the distances of corresponding images from their respective nadirs. It is always measured parallel to the flight line. Also called x-*parallax, linear parallax, horizontal parallax, absolute parallax, stereoscopic parallax*, and *primary parallax*.



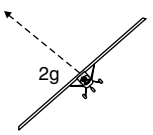

In the above illustration, the principal points of the photographs can be accepted as the nadir positions. Both the top and base objects are clearly visible. The absolute stereoscopic parallax is 12.36 mm in this case, i.e., the sum of the distances of the corresponding images from their respective nadirs. Differential parallax in this case is the difference in the absolute stereoscopic parallax at the top and base objects being measured, i.e., 12.3 – 12.32 = 0.04.

**absolute temperature** The temperature value relative to absolute zero. The absolute zero is the theoretical temperature at which molecular motion vanishes and a body would have no heat energy; the zero point of the Kelvin and Rankine temperature scales. Absolute zero may be interpreted as the temperature at which the volume of a perfect gas vanishes or, more generally, as the temperature of the cold source that would render a Carnot cycle 100% efficient. The value of absolute zero is now estimated to be −273.15°C, −459.67°F, 0 K, and 0°R.

| | Kelvin | Celsius | Rankine | Fahrenheit |
|---|---|---|---|---|
| Steam/boiling point of water | 373° | 100° | 672° | 212° |
| Ice/freezing point of water | 273° | 0° | 492° | 32° |
| Solid $CO_2$ | 195° | −78° | 351° | −109° |
| Liquid oxygen point | 90° | −183° | 162° | −297° |
| Absolute zero | 0° | −273° | 0° | −460° |

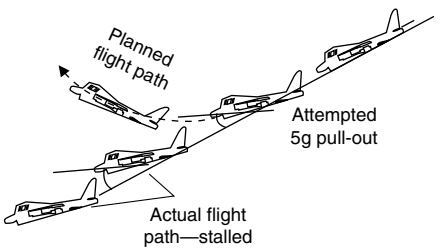
Absolute temperature

**accelerated flight** Acceleration in a plane perpendicular to the flight path, especially in a vertical plane. Normally, an aircraft is said to accelerate if it gains or loses speed. However, in aviation, the term normally refers to acceleration in a plane perpendicular to the flight path.

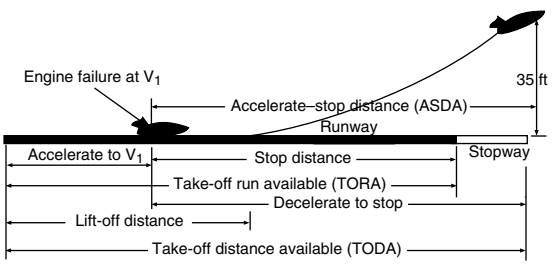



Aircraft in accelerated flight with +2g acceleration.

**accelerated stall** A stall entered during accelerated flight (i.e., during maneuvers). During such maneuvers, when the stalling angle is reached, the aircraft stalls at higher speeds than it would during a normal stall in straight and level flight; the speed is directly proportional to the square root of the applied load factor. For example, an aircraft whose stalling speed during level flight is 150 knots will stall at 300 knots when it is pulled out of a dive with 4 *g* force. Also known as *high-speed stall*.




**accelerate-stop distance available (ASDA)** The runway length required for an aircraft to accelerate to a specified speed and, then, in the case of an engine failure, be able to stop safely on the runway. It is equal to the length of the takeoff run available plus the length of the stopway, if provided. The ASDA is dependent on factors such as aircraft weight, ambient temperature, altitude of the airfield, and wind. Its values are given in aircraft manuals. Also called *emergency distance*.




**accelerating pump** A pump in a carburetor of a reciprocating engine that provides a rich fuel-air mixture when the throttle is suddenly opened. This permits proper acceleration of the engine. Also called an *accelerator pump*.

**acceleration check**

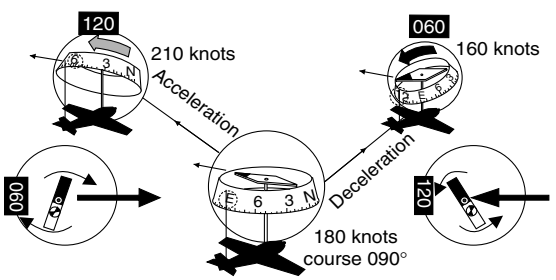
**i.** One of the checks to ascertain the serviceability of a gas turbine engine. The throttle is advanced from idle (or any other specified setting) rapidly to the maximum power setting, and the total time taken is compared with the standard time specified by the manufacturer.

**ii.** When the acceleration of an aircraft is checked during takeoff at a predetermined distance from the point of commencement of the takeoff run. The aircraft should accelerate to the specified speed by this distance if the engine is developing full power. The specified speed is given by the manufacturer in the aircraft operating manual.

**acceleration control unit (ACU)** A component in the fuel control unit of a gas turbine engine that regulates the rate of increase of fuel to the nozzles when the engine control calls for acceleration. The ACU ensures that the engine does not stall during rapid engine acceleration.

**acceleration error**

**i.** An error in magnetic compasses caused by acceleration forces acting on the dip-compensating weight when an aircraft is flying in an east-west direction. In the Northern Hemisphere, when the aircraft accelerates in an east-west direction the compass indicates the aircraft is turning north; it indicates south when decelerating on these headings. The error occurs because the magnet is being pivoted and the point of the pivot and the center of gravity are not coinciding. The errors are in the opposite direction if the compass is correctly decompensated for operations in the Southern Hemisphere.



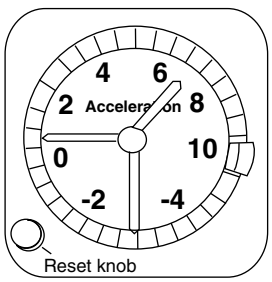

Aircraft accelerates from 180 knots to 210 knots when on course of 090°. The magnetic compass, however, shows as if aircraft has turned from 090 to 120°. Similarly, when aircraft decelerates from 180 knots to 160 knots in a straight and level flight, the compass shows a turn to the left—in this case to 060°. In both cases, compass comes back to the original course as soon as the acceleration/deceleration has stopped.

*Note*: These changes are for the Northern Hemisphere. The changes will be reversed if the aircraft is operating in the Southern Hemisphere and if the compass has been correctly dip-compensated for the Southern Hemisphere.

**ii.** An error in a bubble sextant caused by mechanical inertia during changes in an aircraft's velocity.

**acceleration switch** A switch actuated when there is unusual acceleration. These switches are normally located in emergency locator beacons that operate when an aircraft crashes or is subject to abnormal deceleration.

**accelerometer** An instrument for measuring acceleration along the normal (vertical), longitudinal, or lateral axis of an aircraft or missile. Accelerometers, which are fitted in aircraft cockpits, are called *g* meters. Most aircraft accelerometers indicate instantaneous acceleration, as well as the maximum positive and negative *g* applied since the instrument was last set.




The accelerometer shows that the aircraft has recorded +7.5 and −3 g. Presently, the aircraft has 0.5 g.

**acceptable alternative product** A product that may be used in place of another one for extended periods without technical advice.

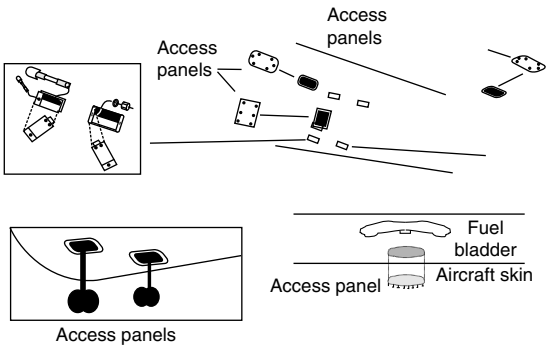
**acceptance test** A hardware test witnessed by customers or their representatives to demonstrate the product's acceptability. The term also is used to describe air tests conducted on aircraft before they are accepted by the customer. The latter meaning is used in military circles only.

**accepting unit/controller** Air traffic control unit/air traffic controller next to take control of an aircraft (ICAO). The unit/controller is thereafter responsible for providing air traffic services. The radio boundaries of control or service units at which transfer of control takes place are indicated on the aeronautical charts as shown in the illustration.

**access/egress link** As used in the passenger-handling system, the link that includes all of the ground transportation facilities, vehicles, and other modal transfer facilities required to move the passengers to and from the airport.

**access panel** Either a replaceable or interchangeable type of quickly removable aircraft-skin panel.

Removed to provide access to the interior of the airframe or engine for inspection, servicing, and repairs of components therein.

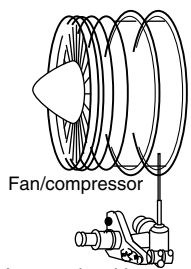



A view of various panels on the skin of an aircraft.

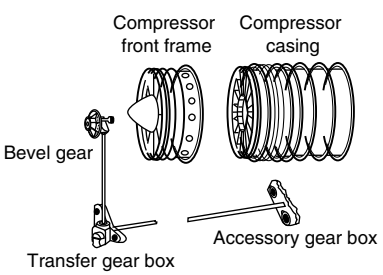
**access taxiway** A taxiway that provides access to a particular location or area.

**accessories** System components that form a functioning, integral part of an aircraft. Components generally included as accessories are fuel, oil, air and hydraulic pumps and generators, and other power-generating devices, valves, gauges, and motors. However, items like tanks and pipes do not constitute accessories.

**accessories drive** A special driveshaft from the engine for driving rotary accessories such as fuel, hydraulic, and oil pumps and generators.




**accessory gearbox** The section of an aeroengine that contains the devices to operate such accessories as fuel pump(s), hydraulic and air pumps, and generators. An accessory gearbox is driven by a driveshaft from a bevel bearing connected to a compressor shaft in some gas turbine engines.




**accident** An occurrence associated with the operation of an aircraft that takes place between the time any person boards the aircraft with the intention of flying until the time that all such persons have disembarked, in which

- **i.** A person is fatally or seriously injured as a result of (a) being in the aircraft; (b) direct contact with any part of the aircraft, including parts that have become detached; or (c) direct exposure to jet blast, except when the injuries are the result of natural causes, self-inflicted, inflicted by other persons, or to stowaways hiding outside the areas normally available to the passengers and crew. For statistical uniformity only, an injury resulting in death within 30 days of the accident is classified as fatal.
- **ii.** The aircraft sustains damage or structural failure that (a) adversely affects its structural strength, performance, or flight and (b) would normally require major repairs or replacement of the affected component, except for engine failure or damage limited to the engine, its cowlings, or accessories; propellers; wing tips; antennae; tires; brakes; fairings; small dents; or puncture holes in the aircraft skin.
- **iii.** The aircraft is missing or is completely inaccessible. An aircraft is considered missing when the official search has been terminated and the wreckage has not been located.

**accident rate** The number of accidents in a given period of time against benchmarked hours flown/takeoffs completed/passenger-miles or kilometers/stage flights. In military aviation, the term refers to the number of accidents per 100,000 flying hours. Some air forces use 10,000 h as the benchmark. In commercial aviation, this refers to the number of accidents per 100 million passenger-miles or kilometers or per 100,000 stage flights. In general aviation, it is the number of accidents per 100,000 takeoffs. The reckoning period is generally a financial year or a calendar year and, in some cases, it is a five-year moving average. Accident rates are further subclassified as human error by the aircrew, ground crew error, and material failure, in addition to write-offs (damaged beyond economical repairs) and fatal accidents.

**accommodation**

- **i.** The ability of the human eye to adjust itself to give sharp images for different object distances. It is the process by which the lens of the eye can be flattened to focus distant points on the retina or made more convex to focus nearby points on the retina.