



# DICTIONARY OF AERONAUTICAL TERMS

Over 11,000 entries

Based on the original compilation by

DALE CRANE

SIXTH EDITION



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*Dictionary of Aeronautical Terms, Sixth Edition*

Based on all previous editions by Dale Crane, and continually revised and edited by ASA Editorial Staff.

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# Contents

<b>Preface</b> .....	<i>vii</i>
<b>Definitions</b> .....	<i>1</i>
<b>Appendices</b>	
Appendix 1 <b>Acronyms and Abbreviations</b> .....	729
Appendix 2 <b>Periodic Table of Chemical Elements</b> .....	769
Appendix 3 <b>Trigonometric Functions</b> .....	771
Appendix 4 <b>International Phonetic Alphabet and Morse Code</b> .....	773

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## Preface to the Sixth Edition

There is no aspect of modern technology that encompasses so many disciplines as aviation: physics, chemistry, aerodynamics, thermodynamics, structural and fluid mechanics, electronics, acoustics, reciprocating and turbine engine technology, meteorology, and navigation. In addition, aviation is governed by an extremely complex set of federal regulations.

Each discipline and regulation has its own unique vocabulary, and it is difficult to find a single reference source that includes terms specific to the aviation application of these fields. To this end, ASA's editors have searched aviation periodicals, aviation-related textbooks, service manuals, manufacturers' literature, engineering reports, military training manuals, and especially all of the publications produced by the FAA for applicable terms.

This sixth edition of ASA's *Dictionary of Aeronautical Terms* is more than a lexicon; it explains as well as defines over 11,000 accurate, aviation-specific terms and includes nearly 500 illustrations and four appendices. Expanded coverage for this edition reaches into the terms associated with pilot and drone operations, other current developments in the industry, and changes to regulations and procedures. Especially helpful is the list of acronyms and abbreviations in the Appendix; for an unfamiliar acronym go there first to find the fully spelled-out term, and then look up the definition in the main text.

The officially recognized definitions for many of the aviation terms are included in 14 CFR Part 1 *Definitions and Abbreviations*. In all instances where a definition in this dictionary is taken directly from this document, it is identified by the prefix **14 CFR Part 1:**, and the definition is in quotation marks. In addition, there are now terms from 14 CFR §401.5, *Commercial Space Transportation – Definitions* and these are identified in the same manner.

The information contained here is as accurate and up-to-date as it has been possible to make it, but because of the speed with which changes are taking place in aviation, some of the terms are taking on new meanings, and their relative importance is changing. Because of this, and because of ASA's dedication to working together for excellence, we will appreciate any criticism, or suggestion you have that will make subsequent revisions of this work more useful for you.

**Editor's Note:** If you do not find a word or acronym you were looking for in the *Dictionary of Aeronautical Terms*, please email ASA at [feedback@asa2fly.com](mailto:feedback@asa2fly.com) and we will try to find the definition for you. Also, be sure to visit the "Reader Resource" webpage for this book ([www.asa2fly.com/reader/dat](http://www.asa2fly.com/reader/dat)) to check for updates as new terms and definitions are collected in between book printings.

**AAM (air-to-air missile).** A missile carried on an aircraft for use against other aircraft. The missile is guided to its target by radar or infrared sensors.

**AAR (airport acceptance rate) (air traffic control).** A dynamic input parameter specifying the number of arriving aircraft which an airport or airspace can accept from the ARTCC per hour. The AAR is used to calculate the desired interval between successive arrival aircraft.

**A & B hydraulic brake system.** A form of backup brake system used in some large aircraft multiple-disk power brake installations. Wheels using the A & B system have several small actuating cylinders built into the brake housing. Half of the cylinders are actuated by fluid from the A-hydraulic system and the others by fluid from the B-system. The brakes operate normally with either system.

**A & P mechanic.** A person who holds an aircraft mechanic certificate with both the airframe and powerplant ratings. This certification is issued by the Federal Aviation Administration under the provisions of 14 CFR Part 65.

Mechanic certification with an A&P rating is now referred to as Aviation Maintenance Technician (AMT) certification.

**AAS (airport advisory service).** A service provided by FAA Flight Service Stations located at airports not served by a control tower.

AAS provides information to arriving and departing aircraft concerning wind direction and speed, favored runway, altimeter setting, pertinent known traffic, pertinent known field conditions, airport taxi routes, traffic patterns, and authorized instrument approach procedures. AAS information is advisory in nature and does not constitute an ATC clearance.

**abampere.** A basic unit of electrical current in the electromagnetic-centimeter-gram-second system. One abampere is equal to 10 amperes in the absolute meter-kilogram-second-ampere system. The abbreviation for abampere is aA.

**A-battery.** A dry-cell battery used in vacuum tube radios to supply power to the heaters, or filaments, of the tubes.

A-batteries usually have a voltage ranging between 1.5 to 6.0 volts and are capable of supplying a reasonable amount of current.

**abbreviated briefing.** In meteorology, this is a shortened weather briefing to supplement the widely-disseminated aviation weather data.

**abbreviated IFR flight plan (air traffic control).** An authorization by ATC requiring pilots to submit only that information needed for the purpose of separation and control. An abbreviated flight plan includes only a small portion of the usual IFR flight plan information which may be only aircraft identification, location, and pilot request.

Abbreviated flight plans are frequently used by aircraft which are airborne and desire an instrument approach, or by aircraft which are on the ground and desire a climb to VFR-On-Top.

**abcoulomb.** A basic unit of electrical charge in the electromagnetic-centimeter-gram-second system. One abcoulomb is equal to 10 coulombs in the absolute meter-kilogram-second-ampere system. The abbreviation for abcoulomb is aC.

**abeam.** A relative location approximately at right angles to the longitudinal axis of an aircraft. When an object is beside the aircraft, it is said to be abeam of it.

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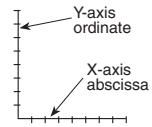
**abeam**

- abeam fix.** A fix, NAVAID, point, or object positioned approximately 90 degrees to the right or left of the aircraft track along a route of flight. Abeam indicates a general position rather than a precise point.
- abfarad.** A basic unit of electrical capacitance in the electromagnetic-centimeter-gram-second system. One abfarad is equal to  $10^9$  farads in the absolute meter-kilogram-second-ampere system. The abbreviation for abfarad is aF.
- abhenry.** A basic unit of electrical inductance in the electromagnetic-centimeter-gram-second system. One abhenry is equal to  $10^{-9}$  henries in the absolute meter-kilogram-second-ampere system. The abbreviation for abhenry is aH.
- abmho.** A basic unit of electrical conductance in the electromagnetic-centimeter-gram-second system. One abmho is equal to  $10^9$  mhos in the absolute meter-kilogram-second-ampere system. The abbreviation for abmho is  $(a\Omega)^{-1}$ . An abmho is also known as an absiemens, aS.
- abort.** To terminate an operation prematurely when it is seen that the desired results will not be obtained.
- aborted start (gas turbine engine operation).** Termination of the start procedures in a gas turbine engine when it is seen that normal combustion has not taken place within the prescribed time limits.
- aborted takeoff.** A takeoff terminated prematurely when it is determined that some condition exists which makes takeoff or further flight dangerous.
- abradable seal (gas turbine engine component).** A general term for a knife-edge seal inside a gas turbine engine that wears away (abrades) slightly to produce an extremely close fit between a rotating and a stationary part of the engine.
- abradable shroud (gas turbine engine component).** A special shroud ring built into the outer turbine case of a gas turbine engine. The shroud fits tightly around the outside of the turbine wheel, which is equipped with special knife edges around its periphery. If the turbine blades creep (grow in length because of heat and high centrifugal loads), the knife edges will wear away the abradable shroud and do no damage.
- abradable strip (gas turbine engine component).** A strip of material in the compressor housing of some axial-flow gas turbine engines. The tip of the compressor blade touches the abradable strip and actually wears, or abrades, a groove in it. This groove ensures that the blade operates with the minimum amount of tip clearance.
- abradable tip (compressor blade tip).** The tip of some axial-flow compressor blades made in such a way that it will abrade, or wear away, when it contacts the compressor housing. The abradable tip wears away to allow the engine to have a minimum amount of tip clearance between the blade and the housing.
- abrade.** To wear away a surface or a part by mechanical or chemical action. A rough surface may be made smooth by mechanically abrading it with sandpaper. Extremely smooth surfaces may be roughened enough for paint to adhere by rubbing the surface with abrasive paper or by chemically abrading it with an etching solution.
- abrasion.** A form of damage to a surface made by roughening or wearing it away with scratches or gouges. Abrasion is often caused by foreign matter trapped between two surfaces having relative motion between them.
- abrasion resistant.** The ability of a material to resist damage by abrasion.
- abrasive.** A material containing minute particles of a hard substance used to wear away a softer surface. Aluminum oxide, silicon carbide, and glass beads are abrasives commonly used in aircraft maintenance.
- abrasive blasting.** A method of removing carbon and other contaminants from machine parts. In abrasive blasting, the parts are sprayed with a high-velocity blast of air containing fine particles of abrasive material such as sand, aluminum oxide, or glass beads.

**abrasive tip (turbine blade).** A turbine blade with a hardened insert at the tip that is able to cut into the turbine shroud ring. *See* abradable shroud.

**abscissa.** A coordinate representing the distance from the Y-, or vertical, axis in a plane Cartesian coordinate system.

The abscissa is measured along the X-, or horizontal, axis and the ordinate along the Y-, or vertical, axis.



abscissa

**absolute accuracy.** The ability to determine present position in space independently, most often used by pilots.

**absolute altimeter.** An electronic altimeter used to indicate the exact height of an aircraft above the terrain. *See* radio altimeter.

**absolute altitude.** The actual distance between an aircraft and the terrain over which it is flying. Absolute altitude is measured with an electronic altimeter.

**absolute ceiling.** The maximum height above sea level at which an aircraft can maintain level flight under standard atmospheric conditions.

**absolute humidity.** The actual amount of water vapor present in a specific volume of air. If one cubic meter of air contains 100 grams of water, the absolute humidity of the air is 100 grams per cubic meter.

**absolute instability (meteorology).** The state of a layer of air within the atmosphere in which the vertical distribution of temperature is such that a parcel of air, if given an upward or downward push, will move away from its initial level without further outside force being applied.

**absolute pressure.** Pressure measured relative to zero pressure, or a vacuum. Absolute pressure is measured with a barometer, and in aviation usage is often expressed in inches of mercury. Manifold pressure in a reciprocating engine is an example of an absolute pressure.

**absolute pressure controller (reciprocating engine control).** A type of turbocharger controller which limits the maximum discharge pressure the turbocharger compressor can produce while the aircraft is flying below its critical altitude.

**absolute pressure gage.** A pressure measuring instrument that measures pressure referenced from a vacuum. An aneroid barometer is one of the more accurate types of absolute pressure gages. It measures the changes in the dimensions of an evacuated bellows as it is affected by the pressure of the ambient air.

**absolute pressure regulator (pneumatic system component).** A regulator valve at the compressor inlet in an aircraft high-pressure pneumatic system. Regulating the inlet air pressure prevents excessive speed variation and/or compressor overspeeding.

**absolute temperature.** Temperature referenced from absolute zero, the temperature at which all molecular movement has ceased.

There are two absolute temperature scales, Kelvin and Rankine. The Kelvin scale uses the same size increments as the Celsius scale, and the Rankine scale uses the same size increments as the Fahrenheit scale. *See* temperature.

**absolute value.** The numerical value of a number without considering whether its sign is plus or minus. For example, positive eight (+8) has the same absolute value as negative eight (−8).

**absolute vorticity (meteorology).** The swirling motion, or vorticity, imparted to the atmosphere by the combination of the rotation of the earth and the circulation of the air relative to the earth.

**absolute zero.** The temperature at which all molecular movement inside a material stops. Absolute zero is 0° Kelvin, 0° Rankine, −273° Celsius, and −460° Fahrenheit.

**absorbance (electromagnetic radiation).** The ratio of the total unabsorbed radiation to the total amount of radiation falling on the object whose absorbance is being measured.

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**aerodynamic**

**aerodynamic lift.** A force produced by air moving over a specially shaped surface called an airfoil. Lift acts in a direction perpendicular to the direction the air is moving. Airplane wings and helicopter rotors produce vertical lift, and propellers produce aerodynamic lift (thrust) in a horizontal plane.

The amount of aerodynamic lift is determined by the density of the air, the speed of the air, and the direction the air is flowing as it approaches the airfoil.

$$L = \frac{C_L \sigma V^2 S}{295}$$

L = Lift (pounds)

CL = Coefficient of lift (dimensionless)

$\sigma$  = Air density ratio (dimensionless)

V<sup>2</sup> = Square of airstream velocity (knots)

S = Airfoil planform area (square feet)

295 = A constant used when velocity is given in knots

**aerodynamics.** The branch of science that deals with the forces produced by air flowing over specially shaped surfaces called airfoils. Wings and helicopter rotors produce a vertical aerodynamic force, and propellers produce a horizontal force. Aerodynamic forces inside a turbojet engine produce pressure and velocity changes in the air as it passes through the compressor and turbine.

**aerodynamic shape.** The shape of an object with reference to the airflow over it. Certain shapes cause an air pressure difference across the surface which produces lift. Other shapes are designed in such a way that they produce the minimum amount of drag.

**aerodynamic twisting force.** *See* ATF.

**aerodynamic twisting moment.** The tendency of a propeller or rotor blade to twist toward high pitch. Centrifugal twisting moment opposes aerodynamic twisting moment.

**aeroelastic tailoring.** The design of an aerodynamic surface whose strength and stiffness are matched to the aerodynamic loads imposed upon it.

**Aerofiche.** The registered trade name for a form of microfiche used in the aircraft industry. Two hundred and eighty-eight frames of information can be placed on a single four-by-six card of film called a fiche.

**Aeromatic propeller.** A patented propeller that has counterweights around the blade shanks and the blades angled back from the hub to increase the effects of aerodynamic and centrifugal twisting forces. This propeller automatically maintains a relatively constant RPM for any throttle setting.

**aeronaut.** A person who operates or travels in a balloon or airship.

**aeronautical beacon.** A visual navigational aid displaying flashes of white and/or colored light. These flashes indicate the location of an airport, a heliport, a landmark, a certain point of a Federal airway in mountainous terrain, or an obstruction.

The colors and meaning of the more commonly used beacons are:

Color	Meaning
white and green .....	lighted land airport
green .....	lighted land airport
white .....	unlighted land airport
white and yellow .....	lighted water airport
yellow .....	lighted water airport
green, yellow and white .....	lighted heliport
white (dual peaked) and green .....	military airport
white and red .....	landmark or navigation point

**aeronautical chart.** A map used in air navigation containing all or part of the following: topographic features, hazards and obstructions, navigation aids, navigation routes, designated airspace, and airports.



**aeronautical data.** A representation of aeronautical facts, concepts, or instructions in a formalized manner suitable for communication, interpretation, or processing.

**aeronautical decision making (ADM).** A systematic approach to the mental processes used by pilots to consistently determine the best course of action in response to a given set of circumstances. The direct and best result of this type of decision-making is the action a pilot intends to take based on the latest information he or she has and processes correctly.

**aeronautical information (AI).** Information resulting from the assembly, analysis, and formatting of aeronautical data.

**Aeronautical Information Manual.** *See* AIM.

**aeronautical information service (AIS).** A service established within the defined area of coverage responsible for the provision of aeronautical information/data necessary for the safety, regularity, and efficiency of air navigation.

**aeronautics.** The branch of science that deals with flight and with the operation of all types of aircraft. Aerodynamics and aerostatics are both branches of aeronautics.

**AeroNav (Aeronautical Navigation Products).** Previously the National Aeronautical Charting Office (NACO), now “AeroNav,” or AeroNav Products. This FAA office (AJV-372) supports pilots, air traffic controllers, and aviation planners with products and services to promote safe aeronautical navigation. AeroNav develops and maintains the FAA’s instrument flight procedures, performance-based navigation procedures to support NextGen, and is responsible for the creation and publication of aeronautical charts and maintaining their distribution to the aviation industry.

**aerosol.** A liquid or solid that is divided into extremely fine particles and dispersed into the air. Smoke is an aerosol of carbon and ash, and a cloud in the sky is an aerosol of water droplets.

Modern aerosol products such as paint, hair spray, and insecticides are usually liquids broken into tiny drops and sprayed into the air by the use of a gaseous propellant such as carbon dioxide, nitrogen, or Freon.

**aerospace.** The branch of science and technology that deals with travel in the space above the surface of the earth. Aerospace includes travel in the atmosphere, as well as in the vast regions outside of the earth’s atmosphere.

**aerospace vehicle.** A flight vehicle capable of flight in both the atmosphere surrounding the earth and in the space beyond the atmosphere. The space shuttle is an aerospace vehicle.

**aerostat.** A device supported in the air by displacing more than its weight of air. Balloons and dirigibles are examples of aerostats.

**aerostatics.** The branch of science that deals with the flight of lighter-than-air vehicles, such as balloons, dirigibles, or blimps. These vehicles are filled with hot air or with a gas lighter than the air surrounding it. This gas enables the balloon to rise in the air by displacing more than its own weight of air.

Aerostatic lift, which is produced by displacing a mass of air, is different from aerodynamic lift in that it does not require relative motion between the lifting body and the air.

**aero-thermodynamic duct.** *See* athodyd.

**AFCS (automatic flight control system).** The full system of automatic flight control which includes the autopilot, flight director, horizontal situation indicator, air data sensors, and other avionics inputs. An aircraft with an AFCS can be flown in a completely automatic mode.

**affective domain.** A grouping of learning levels associated with a person’s attitudes, personal beliefs, and values that range from receiving (at the most basic level) to responding, valuing, organization, and characterization.

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## air-breathing

**air-breathing engine (heat engine).** An engine that requires an intake of air to supply the oxygen it needs to operate. Reciprocating and turbine engines are both air-breathing engines, but most rockets carry an oxidizing agent with their fuel. The oxidizing agent furnishes the needed oxygen.

**air capacitor (electrical component).** A capacitor that uses air as the dielectric. A variable tuning capacitor in a radio is an example of an air capacitor.

**air carrier.** An organization or person involved in the business of transporting people or cargo by air for compensation or hire.

*14 CFR Part 1:* “A person who undertakes directly by lease, or other arrangement, to engage in air transportation.”

**Air Carrier District Office.** *See* ACDO.

**air commerce.** The portion of the transportation industry that deals with the carriage of people or cargo by air for compensation or hire. *14 CFR Part 1:* “Interstate, overseas, or foreign air commerce or the transportation of mail by aircraft or any operation or navigation of aircraft within the limits of any Federal airway or any operation or navigation of aircraft which directly affects, or which may endanger safety in, interstate, overseas, or foreign air commerce.”

**air conditioning.** The process of treating the air in a building or compartment to control its temperature, humidity, cleanliness, and velocity of its movement. Air conditioning in an aircraft also includes the pressurization of the air inside the cabin.

**air conditioning system.** An environmental control system whose function is to maintain a comfortable air temperature within the aircraft fuselage. It is designed to perform any or all of the following functions: (1) Supply ventilation air, (2) supply heated air, and (3) supply cooling air.

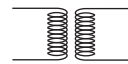
**air-cooled engine.** A reciprocating engine whose excess heat is removed by transferring it directly into the air flowing over the engine. The cylinders of an air-cooled engine are fitted with fins to increase the surface area exposed to the air.

**air-cooled oil cooler.** An oil-to-air heat exchanger in the lubrication system of an aircraft engine. Heat is removed from the oil and transferred into the air flowing through the cooler.

**air-cooled turbine blades.** Hollow blades on the turbine wheel of certain high-power gas turbine engines. These blades are cooled by compressor bleed air flowing through them.

**air cooling.** The removal of unwanted heat by transferring it directly into the air that flows over the component.

**air-core transformer (electrical transformer).** A transformer containing two or more coils wound on a core of paper or other nonmagnetic material. Air-core transformers are normally used for radio-frequency alternating current.



**air-core transformer**

**aircraft.** Any weight-carrying device designed to be supported by the air. Airplanes, helicopters, gliders, and balloons are all types of aircraft.

*14 CFR Part 1:* “A device that is used or intended to be used for flight in the air.”

**aircraft accident.** Any damage or injury that occurs when an aircraft is moving with the intention of flight, and in which any person suffers death or serious injury, or in which the aircraft receives substantial damage.

**aircraft alteration.** The modification of an aircraft, its structure, or its components which changes the physical or flight characteristics of the aircraft. The Federal Aviation Administration classifies all alterations as either major alterations or minor alterations. *See* major alterations, minor alterations.

**aircraft approach category.** A grouping of aircraft based on a speed of 1.3 times their stall speed in the landing configuration at maximum gross landing weight.

- Category A.....Speed less than 91 knots
- Category B.....Speed between 91 and 121 knots
- Category C.....Speed between 121 and 141 knots
- Category D.....Speed between 141 and 166 knots
- Category E.....Speed of 166 knots or more

**aircraft basic operating weight.** The basic weight of an aircraft, including the crew, ready for flight but without payload and fuel. This term is used only for transport aircraft.

**aircraft battery.** A source of electrical energy for an aircraft that may be used for starting the engine and as auxiliary electrical power when the engine-driven generator is not operating.

**aircraft checkouts.** An instructional program designed to familiarize and qualify a pilot to act as pilot in command of a particular aircraft type.

**aircraft classes (wake turbulence separation).** For the purpose of wake turbulence separation minimums, ATC has classified aircraft as heavy, large, and small:

*Heavy.* Aircraft capable of takeoff weights of more than 255,000 pounds whether or not they operate at this weight during a particular phase of flight.

*Large.* Aircraft of more than 41,000 pounds, maximum certificated takeoff weight, up to 255,000 pounds.

*Small.* Aircraft of 41,000 pounds or less maximum certificated takeoff weight.

**aircraft classification (by certification weight).** Classification of aircraft according to their maximum certificated gross weight:

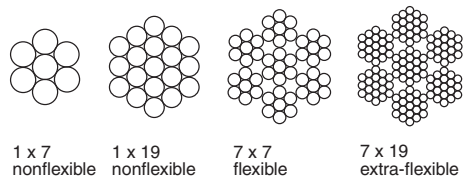
*Small aircraft.* Aircraft weighing up to 12,500 pounds certificated takeoff weight.

*Large aircraft.* Aircraft of more than 12,500 pounds maximum certificated takeoff weight.

**aircraft conflict (air traffic control).** Predicted conflict, within URET (user request evaluation tool), of two aircraft, or between aircraft and airspace. A Red alert is used for conflicts when the predicted minimum separation is 5 nautical miles or less. A Yellow alert is used when the predicted minimum separation is between 5 and approximately 12 nautical miles. A Blue alert is used for conflicts between an aircraft and predefined airspace.

**aircraft control cable.** Stranded steel cable used to actuate the controls of an aircraft. Aircraft control cable is made of either stainless steel or galvanized carbon steel. There are three types of aircraft control cable: nonflexible, flexible, and extra-flexible cable. Nonflexible cable is made of seven (1 x 7) or 19 (1 x 19) strands of steel wire. Flexible cable is made of seven strands of wire, with each strand having seven separate wires. This is called 7 x 7 cable.

Extra-flexible cable, the one most generally used, is made of seven strands of wire, with each strand made of 19 small wires. Extra-flexible cable is called 7 x 19 cable and is used in locations where the cable must pass over a pulley.



**aircraft control cable**

**aircraft engine. 14 CFR Part 1:** “An engine that is used or intended to be used for propelling aircraft. It includes turbosuperchargers, appurtenances, and accessories necessary for its functioning, but does not include propellers.”

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## aluminum

**aluminum alloy.** Aluminum to which has been added one or more other chemical elements. These alloying elements increase the hardness, toughness, durability, or resistance to fatigue of the aluminum.

Aluminum alloys are the primary metals used in the construction of aircraft and other structures which require high strength and light weight.

**aluminum electrolytic capacitor (electronic component).** An electrolytic capacitor which uses strips of aluminum as the plates. An oxide film formed on the surface of the aluminum acts as the dielectric. The aluminum plates are separated by layers of absorbent paper saturated with a liquid electrolyte.

**aluminum oxide.** A compound of aluminum and oxygen whose chemical formula is  $Al_2O_3$ . Aluminum oxide is extremely hard and is used as an abrasive.

**aluminum paste (aircraft finishing material).** Extremely fine flakes of aluminum suspended in a vehicle such as an oil. Aluminum paste is mixed with clear dope to make aluminum-pigmented dope.

**aluminum-pigmented dope (aircraft finishing material).** Clear aircraft dope in which tiny flakes of aluminum are suspended. When aluminum-pigmented dope is sprayed over the clear dope used on aircraft fabric, the tiny flakes of aluminum spread out and form an opaque coating that prevents ultraviolet rays from the sun damaging the clear dope and the fabric.

**aluminum wool.** Shavings of aluminum formed into a pad. Aluminum wool can be used to remove corrosion products from aluminum alloy parts and also to smooth out minor scratches on the surface of aluminum sheets or tubing.

**AM (amplitude modulation).** A system of changing the voltage of a radio-frequency carrier to allow it to carry information.

The amplitude of the carrier is changed (modulated) by superimposing an information-carrying audio-frequency signal on it. The amplitude of the modulated carrier varies in the same way as the amplitude of the audio-frequency information wave.

**amalgam.** A mixture of different elements or ingredients that have been merged into a single body as a physical mixture, rather than a chemical compound. Concrete is an example of an amalgam of sand, portland cement, and gravel.

**amalgamate.** To combine or join ingredients to form a single body.

**amateur-built aircraft.** Aircraft built by individuals as a hobby rather than by factories as commercial products. Amateur-built, or homebuilt, aircraft are not required to meet the stringent requirements imposed on FAA-certificated commercially built aircraft.

**amateur rocket.** An unmanned rocket that: (1) is propelled by a motor or motors having a combined total impulse of 889,600 newton-seconds (200,000 pound-seconds) or less; and (2) cannot reach an altitude greater than 150 kilometers (93.2 statute miles) above the earth's surface.

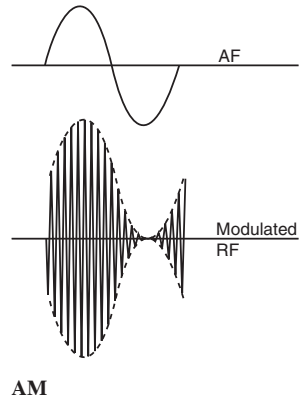
**amber.** A hard, yellowish, translucent, fossilized tree resin that is currently used to make small ornaments. Centuries ago it was discovered that when a piece of amber was rubbed with wool, it attracted small bits of straw and was thus one of the materials used in early studies of electricity.

**ambient.** Surrounding.

**ambient air.** Air that surrounds an object.

**ambient air pressure.** The pressure of the air that surrounds an object.

**ambient air temperature.** The temperature of the air surrounding an object.



**ambient light.** The visible light that falls on a surface.

**ambiguity.** Not having a clear meaning. In radio navigation, 180° ambiguity is an error inherent in some of the simpler types of direction finding equipment. Because of this error, the equipment does not show whether the station being received is directly ahead of or directly behind the aircraft.

**AMC (automatic mixture control).** The device in a fuel metering system such as a carburetor or fuel injection system that keeps the fuel-air mixture ratio constant as the density of the air changes with altitude.

**AME.** See aviation medical examiner.

**amendment status.** The circulation date and revision number of an instrument approach procedure, printed above the procedure identification.

**American Standards.** Dimensional standards for fasteners issued by the American Standards Association (ASA).

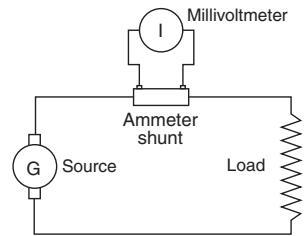
**American Wire Gage.** See AWG.

**americium.** A chemical element in the actinide series. The symbol for americium is Am, its atomic number is 95, and the mass number of its isotope having the longest half life is 243.

**ammeter.** An instrument installed in series with an electrical load to measure the amount of current flowing through the load. Ammeters which measure very small rates of flow are called milliammeters (thousandths of an ampere) and microammeters (millionths of an ampere).

**ammeter shunt.** A low-resistance precision resistor installed in parallel with an ammeter between a source of electrical energy and an electrical load to allow the meter to read a flow of current which exceeds the limit of the instrument.

Most of the current in the circuit flows through the shunt and produces a voltage drop. The ammeter, acting as a millivoltmeter, measures the voltage drop across the shunt and indicates, on a special scale, the amount of current flowing through the circuit.



**ammeter shunt**

**ammonia.** A pungent, invisible gas made up of one atom of nitrogen and three atoms of hydrogen (NH<sub>3</sub>). Ammonia becomes a liquid at -28°F and freezes at -107.6°F.

Ammonia is used to case harden steel by the nitriding process. In this process, the ammonia combines with aluminum, which has been alloyed with the steel, to form aluminum nitride. Aluminum nitride gives the steel a very hard surface.

**amorphous.** Without shape (“a” means without, and “morphous” means shape) or without a definite character or nature. Clay is a form of amorphous soil, but sand, which is made of crystals, is not amorphous. The crystals have a definite shape.

**ampere (A).** A measure of electron (current) flow. One ampere is equal to a flow of one coulomb (6.28 billion billion electrons) past a point in one second. One ampere is also the amount of current that can be forced through one ohm of resistance by a pressure of one volt. See coulomb.

**ampere-hour.** The quantity of electricity that passes through a circuit when one ampere flows for one hour.

**ampere-hour capacity.** A rating that indicates the amount of electrical energy a battery can supply. The ampere-hour rating is the product of the current flow in amperes, multiplied by the length of time, in hours, the battery can supply this current. A 35-ampere-hour battery can supply seven amperes of current for five hours, or one ampere for 35 hours.

**ampere-hour meter.** An electrical meter that measures the amount of current per unit of time used in a circuit.

**angle of attack ( $\alpha$ ).** The acute angle formed between the chord line of an airfoil and the direction of the air that strikes the airfoil.



**angle of attack (gas turbine engine compressor).** The acute angle formed between the chord line

**angle of attack**

of the compressor blades and the direction the air strikes the blades. This angle of attack is affected by both the velocity of the air flowing through the compressor and the RPM of the compressor.

If the RPM of the compressor is too high for the velocity of the air flowing through the engine, the angle of attack will be excessively high, and the compressor blades can stall.

**angle of attack (propeller).** The acute angle between the chord line of a propeller blade and the relative wind. The angle of attack is affected by both the engine RPM and the forward speed of the aircraft.

**angle of attack indicator (aircraft flight instrument).** An instrument that measures the angle between the local airflow around the direction detector and the fuselage reference plane.

**angle of azimuth.** An angle, measured in a horizontal plane, clockwise from north.

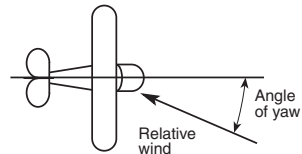
**angle of bank.** The angle formed by the lateral axis of an aircraft and a horizontal plane.

**angle of departure (radio propagation).** The angle, measured at the transmitting antenna, between the angle of propagation of a radio wave and a horizontal plane.

**angle of incidence (airplane specification).** The acute angle formed between the chord line of an airfoil and the longitudinal axis of the aircraft on which it is mounted.

**angle of incidence (electromagnetic energy).** The angle between a beam of electromagnetic radiation and a line perpendicular to the surface the beam strikes.

**angle of refraction (light).** The angle between a beam of light as it passes through a medium and a line perpendicular to the surface of the medium.



**angle of yaw.** The acute horizontal angle formed between the plane of symmetry of an aircraft and the direction from which the wind is striking the aircraft.

**angle of yaw**

**angstrom.** A convenient unit used to measure the wavelength of light. One angstrom, or  $\text{\AA}$ , is one ten-millionth of a micron. This is  $0.000\ 000\ 01$  ( $10^{-8}$ ) centimeters. The wavelength of visible light extends from about 4,000 to 8,000 angstroms.

**angular acceleration.** The rate at which a rotating object increases its rotational speed.

**angular measurement.** Units of measurement used to specify the difference in direction of two lines that radiate from a common point. Three units of angular measurements are commonly used: The degree, the radian, and the grad:

*One degree* is the amount of separation between two lines that is equal to  $1/360$  of a circle.

*One radian* is the amount of separation between two lines that is equal to  $360^\circ \div 2\pi$ , or  $57.3^\circ$ .

*One grad* is the amount of separation between two lines that is equal to  $1/400$  of a circle, or  $1/100$  of a right angle.

**angular momentum.** The momentum possessed by a body because of its rotation.

**angular velocity.** The rate of change of angle as a shaft rotates. Angular velocity is measured in degrees per second, or in radians per second.

**AN hardware.** Standard hardware items such as bolts, nuts, screws, and rivets made according to standards established by the Air Force and Navy. AN hardware is approved for use in both military and civilian aircraft.

**anhedral.** A downward slant from root to tip of an aircraft's wing or horizontal tail surface. This is also called cathedral, or negative dihedral.

**anhydrous.** A material that contains no water.

**anion.** A negative ion that moves toward the anode (the positive electrode) in the process of electrolysis.

**anisotropic.** The property of being directionally dependent. In composite construction an anisotropic material has the fibers oriented in such a way that they provide the greatest strength for the particular application.

**anneal.** To soften a plastic or metal by means of heat treatment.

**annealed wire.** Wire that has been softened by heat after its diameter has been decreased by drawing it through dies. Annealed copper wire is used as electrical hookup wire.

**annealing (metal heat treatment).** A method of heat treatment in which a metal is softened so it loses some of its hardness and brittleness. Steel is annealed by heating it to a specified temperature and allowing it to cool very slowly, in an oven. Copper is annealed by heating it red-hot and quenching it in water.

**annual inspection (aircraft inspection).** A complete inspection of the airframe and powerplant required for FAA-certificated aircraft operating under 14 CFR Part 91 (*General Operating and Flight Rules*) that are not on one of the authorized special inspection programs.

An annual inspection must be conducted every 12 calendar months by an Aviation Maintenance Technician who holds an Aircraft rating with an Inspection Authorization. The scope of an annual inspection is the same as that of a 100-hour inspection.

**annual rings.** The rings that appear in the end of a log cut from a tree. The number of annual rings per inch gives an indication of the strength of the wood. The more rings there are and the closer they are together, the stronger the wood.

The alternate light and dark rings are caused by the difference in the growth rate of the tree. A tree grows fast in the spring and summer, producing the light-colored, less dense rings. The slower growth during the fall and winter produces the dark-colored, denser rings.

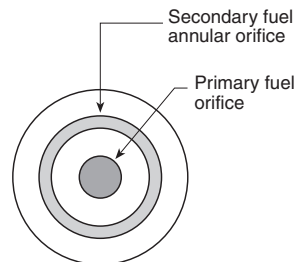
**annular combustor (gas turbine engine component).** A single-piece combustor for a gas turbine engine made in the shape of a ring or a cylinder. Fuel is sprayed from nozzles mounted around a fuel manifold into the inner liner of the combustor. There, it is mixed with air from the compressor and burned.

Annular combustors make the most effective use of the space they occupy, and they are the most efficient type of combustor used in both large and small gas turbine engines.

**annular duct.** A duct, or passage, that surrounds an object. An annular fan-discharge duct surrounds the gas generator of a turbofan engine.

**annular orifice.** A ring-shaped orifice, normally one that surrounds another orifice.

**annulus.** A ring or groove cut around the outside of a circular body or shaft. An annulus gets its name from its resemblance to the circular shape of the annual rings (the growth rings) which form in the trunk of a tree.



**annular orifice**

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## Appendix 1

# Acronyms and Abbreviations

2-DOF ..... Two Degrees of Freedom  
3-DOF ..... Three Degrees of Freedom

## A

A&P ..... Airframe and Powerplant  
AAC ..... Aircraft Administration Communications  
AAE ..... American Association of Airport Executives  
AAI ..... Arrival Aircraft Interval  
AAM ..... Air-to-Air Missile  
AAR ..... Airport Acceptance Rate  
AAS ..... Airport Advisory Service  
AAUP ..... Attention All Users Page  
AB ..... Afterburner  
ABC ..... After Bottom Center  
ABS ..... Absolute  
AC ..... Advisory Circular  
A/C ..... Air Conditioning  
AC ..... Air Corps (an obsolete abbreviation)  
AC ..... Alternating Current  
ACARS ..... ARINC Communication Addressing and Reporting System  
ACAS ..... Airborne Collision and Avoidance System  
ACC ..... Active Clearance Control  
ACC ..... Area Control Center  
ACCEL ..... Acceleration  
ACDO ..... Air Carrier District Office  
ACESS ..... Advanced Cabin Entertainment and Service System  
ACLS ..... Automatic Carrier Landing System  
ACLT ..... Actual Calculated Landing Time  
ACM ..... Air Cycle Machine  
ACMI ..... Air Combat Maneuvering Instrumentation  
ACMS ..... Aircraft Condition Monitoring System  
ACS ..... Airman Certification Standards  
ACT ..... Active Control Technology  
ACU ..... Acceleration Control Unit  
ACU ..... Antenna Coupling Unit  
AD ..... Airworthiness Directive  
A/D ..... Analog-to-Digital  
ADAHRS ..... Air Data Attitude and Heading Reference System  
A/D Conv ..... Analog-to-Digital Converter  
ADC ..... Analog-to-Digital Converter  
ADC ..... Air Data Computer  
ADDS ..... Aviation Digital Data Service



# Periodic Table of Chemical Elements

## Periodic Table of Elements

Period	Light Metals		Heavy Metals										Nonmetals							Inert Gases							
	I A	II A	III B	IV B	V B	VI B	VII B	VIII	IB	II B	III A	IV A	V A	VI A	VII A	VIII A											
1	<b>H</b> 1.00794															<b>He</b> 4.0026											
2	<b>Li</b> 6.941	<b>Be</b> 9.0122												<b>B</b> 10.811	<b>C</b> 12.0107	<b>N</b> 14.0067	<b>O</b> 15.9994	<b>F</b> 18.9984	<b>Ne</b> 20.1797								
3	<b>Na</b> 22.9898	<b>Mg</b> 24.305																		<b>Al</b> 26.9815	<b>Si</b> 28.086	<b>P</b> 30.9737	<b>S</b> 32.065	<b>Cl</b> 35.453	<b>Ar</b> 39.948		
4	<b>K</b> 39.0983	<b>Ca</b> 40.078																			<b>Ga</b> 69.723	<b>Ge</b> 72.64	<b>As</b> 74.9216	<b>Se</b> 78.96	<b>Br</b> 79.904	<b>Kr</b> 83.798	
5	<b>Rb</b> 85.4678	<b>Sr</b> 87.62																			<b>In</b> 114.818	<b>Sn</b> 118.710	<b>Sb</b> 121.76	<b>Te</b> 127.60	<b>I</b> 126.9045	<b>Xe</b> 131.293	
6	<b>Cs</b> 132.905	<b>Ba</b> 137.327																			<b>Tl</b> 204.383	<b>Pb</b> 207.2	<b>Bi</b> 208.980	<b>Po</b> (209)	<b>At</b> (210)	<b>Rn</b> (222)	
7	<b>Fr</b> (223)	<b>Ra</b> (226)																			<b>Nh</b> (284)	<b>Ni</b> (284)	<b>Fl</b> (289)	<b>Mc</b> (288)	<b>Lv</b> (293)	<b>Ts</b> (294)	<b>Og</b> (294)

4 ← Atomic number  
Be ← Symbol  
9.0122 ← Atomic weight

Transition Elements

Group VIII

Atomic weights in ( ) are mass numbers of the most stable isotope of that element.


Rare Earth Elements	<b>Ce</b> 140.116	<b>Pr</b> 140.907	<b>Nd</b> 144.242	<b>Pm</b> (145)	<b>Sm</b> 150.36	<b>Eu</b> 151.964	<b>Gd</b> 157.25	<b>Tb</b> 158.925	<b>Dy</b> 162.50	<b>Ho</b> 164.930	<b>Er</b> 167.259	<b>Tm</b> 168.934	<b>Yb</b> 173.054	<b>Lu</b> 174.967
	<b>Th</b> 232.038	<b>Pa</b> 231.0359	<b>U</b> 238.03	<b>Np</b> (237)	<b>Pu</b> (244)	<b>Am</b> (243)	<b>Cm</b> (247)	<b>Bk</b> (247)	<b>Cf</b> (251)	<b>Es</b> (252)	<b>Fm</b> (257)	<b>Md</b> (258)	<b>No</b> (259)	<b>Lr</b> (262)

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