Glossary

A

Abradable strip. 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 wears, or abrades a groove in it. This groove ensures the minimum tip clearance.

Abradable tip (compressor blade tip). The tip of some axial-flow compressor blades constructed so that it will abrade, or wear away, upon contact with the compressor housing, which ensures the minimum tip clearance between the blade and the housing.

Absolute pressure. Pressure referenced from zero pressure or a vacuum.

AC. Alternating current. Electrical current in which the electrons continually change their rate of flow and periodically reverse their direction.

ACC. Active clearance control. A system for controlling the clearance between tips of the compressor and turbine blades and the case of high-performance turbofan engines. When the engine is operating at maximum power, the blade tip clearance should be minimum, and the ACC system sprays cool fan discharge air over the outside of the engine case. This causes the case to shrink enough to decrease the tip clearance. For flight conditions that do not require such close clearance, the cooling air is turned off, and the case expands to its normal dimensions. The control of the ACC system is done by the FADEC, or full-authority digital electronic control.

Acceleration. The amount the velocity of an object is increased by a force during each second it is acted upon by that force. Acceleration is usually measured and expressed in terms of feet per second, per second (fps^2).

Accessory end. The end of a reciprocating engine on which many of the accessories are mounted. Also, called the anti-propeller end.

Accumulator. A hydraulic component that stores a non-compressible fluid, such as oil, under pressure. An accumulator has two compartments separated by a flexible or movable partition with one compartment containing compressed air. When oil is pumped into the other compartment, the partition moves over, further compressing the air which holds pressure on the oil.

AD (ashless dispersant) oil. A mineral-based lubricating oil used in reciprocating engines. This oil does not contain any metallic ash-forming additives, but has additives that disperse the contaminants and hold them in suspension until they can be removed by filters.

ADC. Air data computer. An electronic computer in an aircraft that senses pitot pressure, static pressure, and total air temperature. It produces an indication of altitude, indicated airspeed, true airspeed, and Mach number. The output of ADC is usable by any of the engine or flight control computers.

ADI (antidetonation injection) system. A system used with some large reciprocating engines in which a mixture of water and alcohol is sprayed into the engine with the fuel when operating at extremely high power. The air/fuel mixture is leaned to allow the engine to develop its maximum power, and the ADI fluid absorbs excessive heat when it vaporizes.

Adiabatic change. A physical change that takes place within a material in which heat energy is neither added to the material, nor taken away. If a container of gas is compressed, with no heat energy added to or taken from it, the gas will become hotter; its temperature will rise.

Aeromatic propeller. A patented variable-pitch propeller that has flyweights 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.

Aft-fan engine. A turbofan engine with the fan mounted behind the compressor section. The blades of an aft-fan are normally extensions of the free turbine blades.

Afterburner. A component in the exhaust system of a turbojet or turbofan engine used to increase the thrust for takeoff and for special flight conditions. Since much of the air passing through a gas turbine engine is used only for cooling, it still contains a great deal of oxygen. Fuel is sprayed into the hot, oxygen-rich exhaust in the afterburner, where it is ignited and burned to produce additional thrust.

Air bleed (carburetor component). A small hole in the fuel passage between the float bowl and the discharge nozzle of a float carburetor. Air drawn into the liquid fuel through the air bleed breaks the fuel up into an emulsion, making it easy to atomize and vaporize.

Air cooling. The removal of unwanted heat from an aircraft engine by transferring the heat directly into the air flowing over the engine components.

Air/fuel mixture ratio. The ratio of the weight of the air to that of the fuel in the mixture fed into the cylinders of an engine.

Air impingement starter. A turbine engine starter that basically consists of a nozzle that blows a stream of compressed air against the turbine blades to rotate the compressor for starting the engine.

Air-oil separator. A component in a turbine engine lubrication system that removes the air from the scavenged oil before it is returned to the oil tank.

Airworthiness Directive. Airworthiness Directives (ADs) are legally enforceable regulations issued by the FAA in accordance with 14 CFR part 39 to correct an unsafe condition in a product. Part 39 defines a product as an aircraft, engine, propeller, or appliance.

All-weather spark plug. A shielded spark plug designed for high altitude operation. The ceramic insulator is recessed into the shell to allow a resilient grommet on the ignition harness to provide a watertight seal. All weather spark plugs, also called high-altitude spark plugs, are identified by their 3/4-20 shielding threads.

Alpha control range (alpha mode). The flight operating mode from takeoff through landing for a turbo-prop engine. Alpha mode includes operations from 95% to 100% of the engine's rated rpm.

Altitude engine. An aircraft reciprocating engine equipped with a supercharger that allows it to maintain its rated sea-level horsepower to an established higher altitude.

Amateur-built aircraft. Aircraft built by individuals as a hobby rather than by factories as commercial products. Amateur-built or home-built aircraft do not fall under the stringent requirements imposed by the FAA on commercially built aircraft.

Ambient air pressure. The pressure of the air that surrounds an object.

Analog indicator. An indicator that shows the value of the parameter being measured by a number marked on a graduated dial aligned with a movable pointer.

Angle of attack. The acute angle between the chordline 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.

Annual 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, and not on one of the authorized special inspection programs. An annual inspection must be conducted every 12 calendar months, and it must be conducted by an aviation maintenance technician who holds an Airframe and Powerplant rating and an Inspection Authorization. The scope of an annual inspection is the same as that of a 100-hour inspection.

Annular duct. A duct, or passage, that surrounds an object. The annular fan-discharge duct surrounds the core engine.

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

Annulus. A ring or groove around the outside of a circular body or shaft, or around the inside of a cylindrical hole.

Annunciator panel. A panel of warning lights visible to the flight crew. The lights are identified by the name of the system they represent and are often covered with colored lenses. Red lights indicate a dangerous condition and green indicate a safe condition.

Anodizing. A hard, airtight, unbroken oxide film electrolytically deposited on an aluminum alloy surface to protect it from corrosion.

Anti-icing. Prevention of the formation of ice on a surface.

Anti-propeller end. The end of a reciprocating engine that does not attach to the propeller. Also called the accessory end.

APC. Absolute pressure controller.

APU. Auxiliary power unit. A small turbine- or reciprocating-engine-powered generator, hydraulic pump, and air pump. APUs are installed in the aircraft and are used to supply electrical power, air, and hydraulic pressure when the main engines are not running.

Aramid fiber. Fiber made from an organic compound of

carbon, hydrogen, oxygen, and nitrogen. It has high strength and low density. It is flexible under load and is able to withstand impact, shock, and vibration. Kevlar is a well-known aramid fiber.

Aromatic compound. A chemical compound such as toluene, xylene, and benzene that is blended with gasoline to improve its anti-detonation characteristics.

Articulating rod. See link rod.

Aspect ratio. The ratio of the length of an airfoil, such as a compressor blade, to its width.

Asymmetrical loading. The loading of a propeller disc that causes one side to produce more thrust than the other side.

ATF. Aerodynamic twisting force. The aerodynamic force that acts on a rotating propeller blade to increase its blade angle. The axis of rotation of a blade is near the center of its chordline, and the center of pressure is between the axis and the leading edge. Aerodynamic lift acting through the center of pressure tries to rotate the blade to a higher pitch angle.

Atomize. The process of breaking a liquid down into tiny droplets or a fine spray. Atomized liquids vaporize easily.

Augmentor tube. A long, specially shaped stainless steel tube mounted around the exhaust tail pipe of a reciprocating engine. As exhaust gases flow through the augmentor tube, they produce a low pressure in the engine compartment that draws in cooling air through the cylinder fins.

Automatic intake valve. An intake valve opened by low pressure created inside the cylinder as the piston moves down. There is no mechanical means of opening it.

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

Autosyn system. The registered trade name of a remote indicating instrument system. An Autosyn system uses an electromagnet rotor, excited with 400-hertz AC, and a three-phase distributed-pole stator.

Axial bearing load. The load on a bearing parallel to the shaft on which the bearing is mounted. Thrust produces an axial load on a bearing.

Axial turbine. A turbine that is turned by a fluid flowing through it in a direction that is approximately parallel to the shaft on which the turbine wheel is mounted.

Axial-flow compressor. A type of compressor used in gas turbine engines. Air passes through the compressor in essentially a straight line, parallel to the axis of the compressor. The compressor is made of a number of stages of rotating compressor blades between stages of stationary stator vanes.

Axis of rotation. The center line about which a propeller rotates.

B

Babbitt. A soft silvery metal used for main bearing inserts in aircraft reciprocating engines. Babbitt is made of tin with small amounts of copper and antimony.

Back (propeller nomenclature). The curved surface of a propeller blade. The back of a propeller blade corresponds to the upper surface of an airplane wing.

Back-suction mixture control. A type of mixture control used in some float carburetors that regulates the air/fuel mixture by varying the air pressure above the fuel in the float bowl.

Baffle. A thin sheet metal shroud or bulkhead used to direct the flow of cooling air between and around the cylinder fins of an air-cooled reciprocating engine.

Bayonet stack. An exhaust stack with an elongated and flattened end. The gases leave the stack through a slot perpendicular to its length. Bayonet stacks decrease both exhaust back pressure and noise.

BDC. Bottom dead center. The position of a piston in a reciprocating engine when the piston is at the bottom of its stroke, and the wrist pin, crankpin, and center of the crankshaft are all in line.

Bell mouth. The shape of the inlet of an augmentor tube that forms a smooth converging duct. The bell mouth shape allows the maximum amount of air to be drawn into the tube.

Bell mouth inlet duct. A form of convergent inlet-air duct used to direct air into the compressor of a gas turbine engine. It is extremely efficient, and is used where there is little ram pressure available to force air into the engine. Bell mouth ducts are used in engine test cells and on engines installed in helicopters.

Benzene. A colorless, volatile, flammable, aromatic

hydrocarbon liquid which has the chemical formula C_6H_6. Benzene, which is sometimes called benzoil, is used as a solvent, a cleaning fluid, and a fuel for some special types of reciprocating engines.

Bernoulli's principle. A physical principle that explains the relationship between kinetic and potential energy in a stream of moving fluid. When energy is neither added to nor taken from the fluid, any increase in its velocity (kinetic energy) will result in a corresponding decrease in its pressure (potential energy).

Beta control range (Beta mode). The range of operation of a turboprop powerplant used for in-flight approach and ground handling of the engine and aircraft. Typically, the Beta mode includes operations from 65% to 95% of the engine's rated rpm.

Beta tube. A tube in a Garrett TPE331 turboprop powerplant that extends into the propeller pitch control to act as a follow-up device. It provides movement of the propeller blades in proportion to movement of the power lever.

Bezel. The rim which holds the glass cover in the case of an aircraft instrument.

BHP. Brake horsepower. The actual horsepower delivered to the propeller shaft of a reciprocating or turboprop engine.

Bidirectional fibers. Fibers in a piece of composite material arranged to sustain loads in two directions.

Bimetallic hairspring. A flat, spiral-wound spring made of two strips of metal laid side-by-side and welded together. The two metals have different coefficients of expansion, and as the temperature changes, the spiral either tightens or loosens. A bimetallic hair spring is used in a thermocouple temperature changes at the reference junction.

Bimetallic strip. A metal strip made of two different types of metal fastened together side by side. When heated, the two metals expand different amounts and the strip warps or bends.

BITE. Built-in test equipment. A troubleshooting system installed in many modern electronic equipment. BITE equipment monitors engine and airframe systems, and when a fault is found, isolates it and provides maintenance personnel with a code that identifies the LRU (line replaceable unit) that contains the fault.

Blade. The component of a propeller that converts the rotation of the propeller shaft into thrust. The blade of a propeller corresponds to the wing of an airplane.

Blending. A method of repairing damaged compressor and turbine blades. The damage is removed and the area is cleaned out with a fine file to form a shallow depression with generous radii. The file marks are then removed with a fine abrasive stone so the surface of the repaired area will match the surface of the rest of the blade.

Blisk. A turbine wheel machined from a single slab of steel. The disc and blades are an integral unit.

Blow-in doors. Spring-loaded doors in the inlet duct of some turbojet or turbofan engine installations that are opened by differential air pressure when inlet air pressure drops below that of the ambient air. Air flowing through the doors adds to the normal inlet air passing through the engine and helps prevent compressor stall.

BMEP. Brake mean effective pressure. The average pressure inside the cylinder of a reciprocating engine during the power stroke. BMEP, measured in pounds per square inch, relates to the torque produced by the engine and can be calculated when you know the brake horsepower.

Boost. A term for manifold pressure that has been increased above the ambient atmospheric pressure by a supercharger.

Bootstrapping. An action that is self-initiating or self-sustaining. In a turbocharger system, bootstrapping describes a transient increase in engine power that causes the turbocharger to speed up, which in turn causes the engine to produce more power.

Bore. The diameter of a reciprocating engine cylinder.

Borescope. An inspection tool for viewing the inside of a turbine engine without disassembling it. The instrument consists of a light, mirror, and magnifying lens mounted inside a small-diameter tube that is inserted into a turbine engine through borescope inspection ports.

Boss. An enlarged area in a casting or machined part. A boss provides additional strength to the part where holes for mounting or attaching parts are drilled.

Bottom. (verb) A condition in the installation of a propeller on a splined shaft when either the front or rear cone contacts an obstruction that prevents the cone from properly seating inside the propeller hub.

Bourdon tube. The major component in a gage-pressure measuring instrument. It is a thin-wall metal tube that has an elliptical cross section and is formed into a curve. One end of the tube is sealed and connected to an arm that moves

the pointer across the instrument dial, and the open end is anchored to the instrument case. The pressure to be measured is directed into the open end, which causes the elliptical cross section to become more circular. As the cross section changes, the curve straightens and moves the pointer over the dial by an amount proportional to the amount of pressure.

Brayton cycle. The constant-pressure cycle of energy transformation used by gas turbine engines. Fuel is sprayed into the air passing through the engine and burned. Heat from the burning air/fuel mixture expands the air and accelerates it as it moves through the engine. The Brayton cycle is an open cycle in that the intake, compression, combustion, expansion, and exhaust events all take place at the same time, but in different locations within the engine.

British thermal unit (Btu). The basic unit of heat energy in the English system. One Btu is the amount of heat energy needed to raise the temperature of one pound of pure water from 60 ˚F to 61˚F.

BSFC. Brake specific fuel consumption. A measure of the amount of fuel used for a given amount of power produced by a heat engine. BSFC is expressed in pounds of fuel burned per hour for each brake horse-power the engine is producing.

Buckets. The portions of aft-fan blades that are in the exhaust of the core engine. Buckets drive the fan from energy received from hot gases leaving the core engine.

Bungee cord. An elastic cord made of small strips of rubber encased in a loosely braided cloth tube that holds and protects the rubber, yet allows it to stretch. The energy in a stretched bungee cord may be used to crank a large aircraft engine.

Burner. See combustor.

Burnish. To smooth the surface of a metal part that has been damaged by a deep scratch or gouge. Metal piled at the edge of the damage is pushed back into the damage with a smooth, hard steel burnishing tool.

Butterfly valve. A flat, disc-shaped valve used to control the flow of fluid in a round pipe or tube. When the butterfly valve is across the tube, the flow is shut off, and when it is parallel with the tube, the obstruction caused by the valve is minimum, and the flow is at its greatest. Butterfly-type throttle valves are used to control the airflow through the fuel metering system.

Bypass engine. Another name for a turbofan engine. See turbofan engine.

Bypass ratio. The ratio of the mass of air moved by the fan to the mass of air moved by the core engine.

C

Calendar month. The measurement of time used by the FAA for inspection and certification purposes. One calendar month from a given date extends from that date until midnight of the last day of that month.

Cam. An eccentric, or lobe, on a rotating shaft that changes rotary motion into linear motion. A cam is mounted on the magnet shaft in a magneto to push upward on the insulated breaker point to separate, or open, the points when the magnet is in a particular location.

Cam engine. A reciprocating engine with axial cylinders arranged around a central shaft. Rollers on the pistons in the cylinders press against a sinusoidal cam mounted on the shaft to produce rotation of the shaft.

Cam-ground piston. A reciprocating engine piston that is not round, but is ground so that its diameter parallel to the wrist pin is slightly smaller than its diameter perpendicular to the pin. The mass of metal used in the wrist pin boss, the enlarged area around the wrist pin hole, expands when heated, and when the piston is at its operating temperature, it is perfectly round.

Can-annular combustor. A type of combustor used in some large turbojet and turbofan engines. It consists of individual cans into which fuel is sprayed and ignited. These cans mount on an annular duct which collects the hot gases and directs them uniformly into the turbine.

Capacitance afterfiring. The continuation of the spark across the gap in a shielded spark plug after the air/fuel mixture in the cylinder is ignited. Afterfiring is caused by the return of electrical energy stored in the capacitance of the shielded ignition leads. Capacitance afterfiring is eliminated by the use of a resistor in the spark plug.

Capacitor. An electrical component, formerly called a condenser, that consists of two large-area conductors, called plates, separated by an insulator. Electrons stored on one of the plates produces an electrostatic pressure difference between the plates.

Capillary tube. A glass or metal tube with a tiny inside diameter. Capillary action causes the fluid to move within the tube.

Carbon pile voltage regulator. A voltage regulator for a high

output DC generator that uses a stack of pure carbon discs for the variable resistance element. A spring holds pressure on the stack to reduce its resistance when the generator output voltage is low. This allows maximum field current to flow. The field from an electro-magnet, whose strength varies directly with the generator voltage, opposes the spring to loosen the stack and increase its resistance when the generator voltage needs to be decreased. The increased resistance decreases the field current and reduces the output voltage.

Carbon track. A trail of carbon deposited by an arc across a high-voltage component such as a distributor block. Carbon tracks have a relatively low resistance to the high voltage and can cause misfiring and loss of engine power.

Cartridge starter. A self-contained starter used on some military aircraft. A cartridge similar in size to a shotgun shell is ignited in the starter breech. The expanding gases drive a piston attached to a helical spline that converts the linear movement of the piston into rotary motion to rotate the crankshaft.

Cascade effect. The cumulative effect that occurs when the output of one series of components serves as the input to the next series.

Catalyst. A substance used to change the speed, or rate, of a chemical action without being chemically changed itself.

Cavitating. The creation of low pressure in an oil pump when the inlet system is not able to supply all of the oil the pump requires. Prolonged cavitation can damage pump components.

Center of pressure. The point on the chordline of an airfoil where all aerodynamic forces are concentrated.

Center-line thrust airplane. A twin-engine airplane with both engines mounted in the fuselage. One is installed as a tractor in the front of the cabin. The empennage is mounted on booms.

Centrifugal compressor. A type of compressor that uses a vaned plate like impeller. Air is taken into the center, or eye, of the impeller and slung outward by centrifugal force into a diffuser where its velocity is decreased and its pressure increased.

Ceramic. Any of several hard, brittle, heat-resistant, noncorrosive materials made by shaping and then firing a mineral, such as clay, at a high temperature.

Channel-chromed cylinders. Reciprocating engine cylinders with hard chromium-plated walls. The surface of this chrome plating forms a spider web of tiny stress cracks. Deplating current enlarges the cracks and forms channels that hold lubricating oil on the cylinder wall.

Cheek (crankshaft). The offset portion of a crankshaft that connects the crankpin to the main bearing journals.

Chip detector. A component in a lubrication system that attracts and holds ferrous metal chips circulating with the engine oil. Some chip detectors are part of an electrical circuit. When metal particles short across the two contacts in the detector, the circuit is completed, and an annunciator light is turned on to inform the flight crew that metal particles are loose in the lubrication system.

Choke of a cylinder. The difference in the bore diameter of a reciprocating engine cylinder in the area of the head and in the center of the barrel.

Choke-ground cylinder. A cylinder of a reciprocating engine that is ground so that its diameter at the top of the barrel is slightly smaller than the diameter in the center of the stroke. The large mass of metal in the cylinder head absorbs enough heat to cause the top end of the barrel to expand more than the rest of the barrel. At normal operating temperature, the diameter of a choke-ground cylinder is uniform throughout.

Choke nozzle. A nozzle in a gas turbine engine that limits the speed of gases flowing through it. The gases accelerate until they reach the speed of sound, and a normal shock wave forms that prevents further acceleration.

Chordline. An imaginary line, passing through a propeller blade, joining the leading and trailing edges.

Cigarette. A commonly used name for a spark plug terminal connector used with a shielded spark plug.

Circular magnetism. A method of magnetizing a part for magnetic particle inspection. Current is passed through the part, and the lines of magnetic flux surround it. Circular magnetism makes it possible to detect faults that extend lengthwise through the part.

Circumferential coil spring (garter spring). A coil spring formed into a ring. This type of spring is used to hold segmented ring-type carbon seals tightly against a rotating shaft.

Claret red. A dark purplish pink to a dark gray purplish red color.

Class A fire. A fire with solid combustible materials such as

wood, paper, and cloth as its fuel.

Class B fire. A fire that has combustible liquids as its fuel.

Class C fire. A fire which involves energized electrical equipment.

Class D fire. A fire in which a metal such as magnesium burns.

Closed-loop control. A type of control in which part of the output is fed back to the input. This allows the input to continually compare the command signals with the output to determine the extent to which the commands have been complied with.

Coke. The solid carbon residue left when all volatile parts of a mineral oil have been evaporated by heat.

Cold-cranking simulation. A method used for specifying the characteristics of a lubricating oil at low temperature. Oils rated by this test have the letter W (standing for Winter) in their designation. For example, SAE 15W50.

Cold section. The portion of a gas turbine engine ahead of the combustion section. The cold section includes the inlet, compressor, and diffuser.

Cold-tank lubrication system. A turbine engine lubricating system in which the oil cooler is in the scavenge subsystem.

Collector ring. A ring made of thin corrosion-resistant steel tubing that encircles a radial engine and collects exhaust gases from each cylinder. The ring ends with a connection to the exhaust tail pipe.

Combustor (combustion chamber). The section of a gas turbine engine in which fuel is injected. This fuel mixes with air from the compressor and burns. The intense heat from the combustion expands the air flowing through the combustor and directs it our through the turbine. Combustors are also called burners.

Commutator. A mechanical rectifier mounted on the armature shaft of a DC generator or motor. It consists of a cylindrical arrangement of insulated copper bars connected to the armature coils. Carbon brushes ride on the copper bars to carry current into or out of the commutator, providing a unidirectional current from a generator or a reversal of current in the motor coils.

Compensating winding. A series winding in a compound-wound DC generator. The compensating windings are embedded in the faces of the field poles and their varying magnetic field works with the fields from the interpoles to effectively cancel the field distortion caused by armature current.

Composite propeller blade. A propeller blade made from several materials such as metal, graphite, glass or aramid fibers, and foam.

Compression ratio (reciprocating engine). The ratio of the volume of a cylinder of a reciprocating engine with the piston at the bottom of its stroke engine to the volume of the cylinder with the piston at the top of its stroke.

Compression ratio (turbine engine). The ratio of the pressure of the air at the discharge of a turbine engine compressor to the pressure of the air at its inlet.

Compressor (air conditioning system component). The component in a vapor-cycle cooling system in which the low-pressure refrigerant vapors, after they leave the evaporator, are compressed to increase both their temperature and pressure before they pass into the condenser. Some compressors are driven by electric motors, others by hydraulic motors and, in the case of most light airplanes, are belt driven from the engine.

Compressor bleed air. Air that is tapped off from a turbine engine compressor. Compressor bleed air is used for anti-icing the inlet ducts and for cooling the turbine inlet guide vanes and first stage turbine blades. Bleed air is also used for certain airframe functions. See customer bleed air.

Compressor pressure ratio. See compression ratio (turbine engine).

Compressor stall. A condition in a turbine engine axial-flow compressor in which the angle of attack of one or more blades is excessive and the smooth airflow through the compressor is disrupted.

Compressor surge. A stall that affects the entire compressor and seriously restricts the airflow through the engine.

Con-di ducts. The British name for a convergent-divergent duct. See convergent-divergent duct.

Condenser. See capacitor.

"Contact." The term used between a person hand-propping an aircraft engine and the person in the flightdeck. When the person is ready to spin the propeller, he calls "contact". The person in the flightdeck turns on the fuel, slightly opens the

throttle, applies the brakes, and replies “contact”, and then turns the ignition switch to BOTH. The propeller is then pulled through to start the engine.

Constant-displacement pump. A fluid pump that moves a specific volume of fluid each time it rotates.

Constant-pressure cycle of energy release. The cycle of energy transformation of a gas turbine engine. See Brayton cycle.

Constant-volume cycle of energy release. The cycle of energy transformation of a reciprocating engine. See Otto cycle.

Continuous magnetic particle inspection. A method of magnetic particle inspection in which the part is inspected by flowing a fluid containing particles of iron oxide over the part while the magnetizing current is flowing.

Contrarotating. Rotating in opposite directions. Turbine rotors are contrarotating when the different stages have a common center, but turn in opposite directions.

Convergent-divergent duct. A duct that has a decreasing cross section in the direction of flow (convergent) until a minimum area is reached. After this point, the cross section increases (divergent). Convergent-divergent ducts are called CD ducts or con-di ducts.

Convergent duct. A duct that has a decreasing cross section in the direction of flow.

Core engine. The gas generator portion of a turboshaft, turboprop, or turbofan engine. The core engine consists of the portion of the compressor used to supply air for the engine operation, diffuser, combustors, and turbine(s) used to drive the compressor. The core engine provides the high-velocity gas to drive the fan and/or any free turbines that provide power for propellers, rotors, pumps, or generators.

Cowling. The removable cover that encloses an aircraft engine.

Crankcase. The housing that encloses the crankshaft, camshaft, and many of the accessory drive gears of a reciprocating engine. The cylinders are mounted on the crankcase, and the engine attaches to the airframe by the crankcase.

Crankshaft. The central component of a reciprocating engine. This high-strength alloy steel shaft has hardened and polished bearing surfaces that ride in bearings in the crankcase. Offset throws, formed on the crankshaft, have ground and polished surfaces on which the connecting rods ride. The connecting rods change the in-and-out motion of the pistons into rotation of the crankshaft.

Creep. The deformation of a metal part that is continually exposed to high centrifugal loads and temperatures.

Critical altitude. The altitude above which a reciprocating engine will no longer produce its rated horsepower with its throttle wide open.

Critical engine. The engine of a twin-engine airplane whose loss would cause the greatest yawing effect.

Critical Match number. The flight match number at which there is the first indication of air flowing over any part of the structure at a speed of Mach one, the local speed of sound.

CRT. Cathode ray tube. An electronic display tube in which a stream of electrons is attracted to the charged inner surface of the tube face. Acceleration grids and inner surface of the tube face. Acceleration grids and focusing grids speed the movement of the electrons and shape the beam to a pin-point size. Electrostatic or electromagnetic forces caused by deflection plates or coils move the beam over the face of the tube. The inside of the tube face is treated with a phosphor material that emits light when the electrons strike it.

Cryogenic fluid. A liquid which boils at a temperature lower than about 110 ºK (-163 ºC) under normal atmospheric pressure.

CSD. Constant-speed drive. A component used with either aircraft gas turbine or reciprocating engines to drive AC generators. The speed of the output shaft of the CSD is held constant while the speed of its input shaft varies. The CSD holds the speed of the generator, and the frequency of the AC constant as the engine speed varies through its normal operating range.

CTF. Centrifugal twisting force. The force acting about the longitudinal axis of a propeller blade, and which tries to rotate the blade to a low-pitch angle. As the propeller rotates, centrifugal force tries to flatten the blade so all of its mass rotates in the same plane.

Curtiss Jenny (Curtiss JN4-D). A World War I training airplane powered by a Curtiss OX-5 engine. It was widely available after the war and helped introduce aviation to the general public.

Customer bleed air. Air that is tapped off a turbine engine

compressor and used for such airframe functions as the operation of air conditioning and pressurization systems.

Cylinder. The component of a reciprocating engine which houses the piston, valves, and spark plugs and forms the combustion chamber.

D

Data. The input for computer processing in the form of numerical information that represents characters or analog quantities.

Dataplate specifications. Specification of each gas turbine engine determined in the manufacturer's test cell when the engine was calibrated. This data includes the engine serial number with the EPR that produced a specific RPM. The technician refers to this information when trimming the engine.

Dataplate performance. The performance specifications of a turbine engine observed and recorded by the engine manufacturer or overhauler and recorded on the engine dataplate. This data includes the engine speed at which a specified EPR is attained. When trimming the engine, the technician uses this data as the goal.

DC. Direct current. Electrical current in which the electrons always flow in the same direction.

Deaerator. A component in a turbine engine lubrication system that removes air from the scavenged oil before it is returned to the tank.

Deceleration. The amount the velocity of an object, measured in feet per second, is decreased by a force during each second it is acted upon by that force. Deceleration is usually expressed in terms of feet per second, per second (fps^2).

DeHaviland DH-4. An English designed observation airplane built in large quantities in the united States during World War I. After the war, surplus DH-4s were used for carrying the U.S. Mail.

Deicing. The removal of ice that has formed on a surface.

Density altitude. The altitude in standard air at which the density is the same as that of the existing air.

Detergent oil. A type of mineral oil with metallic-ash-forming additives that protects the inside of an engine from sludge and varnish buildup. Used in automotive engines, it has proven unsuitable for use in aircraft engines.

Detonation. An uncontrolled explosion inside the cylinder of a reciprocating engine. Detonation occurs when the pressure and temperature of the fuel inside the cylinder exceeds the critical pressure and temperature of the fuel. Detonation may be caused by using fuel that has a lower octane rating or performance number than is specified for the engine.

Dewar bottle. A special container used to store liquid oxygen and liquid nitrogen. A Dewar bottle has an inner and an outer container, and the space between them forms a vacuum. The two surfaces within the vacuum are silvered to reflect heat away from the container walls.

Differential pressure. A single pressure that is the difference between two opposing pressures.

Diffuser. A component in a gas turbine engine that decreases the velocity of air flowing through it and increases its pressure.

Digitized image. A modified image picked up by the miniature TV camera in the end of a fiber-optic probe. This image is converted into a digital electronic signal that eliminates unwanted portions of the viewed area and allows the desired image to be enhanced for a clearer view of the inside of a turbine engine.

Dipstick. A gage, in the form of a thin metal rod, used to measure the level of liquid in a reservoir. The dipstick is pushed into the reservoir until it contacts a built-in stop; then it is removed and visually inspected. The level of liquid in the reservoir is indicated by the amount of the dipstick wet by the liquid.

Dirigible. A large, cigar shaped, lighter-than-air flying machine. Dirigibles differ from balloons in that they are powered and can be steered.

Distributed pole stator winding. Alternator stator windings wound in a series of slots in the stator frame. A distributed pole stator is distinguished from a salient pole stator whose coils are wound around separate pole shoes that project inward from the field frame toward the rotor.

Distributor. A high-voltage selector switch that is gear-driven from the shaft of the rotating magnet in a magneto. The distributor rotor picks up the high voltage from the secondary winding of the coil and directs it to high-voltage terminals. From here, it is carried by high-tension ignition leads to the spark plugs.

Divergent duct. A duct that has an increased cross-sectional area in the direction of flow.

Downdraft carburetor. A carburetor that mounts on the top of a reciprocating engine. Air entering the engine flows downward through the carburetor.

ΔP (delta P). Differential pressure.

Droop. A progressive decrease in RPOM with load in a gas turbine engine whose speed is governed with a fly-weight-type governor in the fuel control. As the load increases, the pilot valve drops down to meter more fuel. The lower position of the valve decreases the compression of the speeder spring and allows the flyweights to assume an on-speed position at a lower rpm.

Dry-sump engine. An engine that carries its lubricating oil supply in a tank external to the engine.

Dual ignition. An ignition system of an aircraft reciprocating engine that has two of every critical unit, including two spark plugs in each cylinder. Dual ignition provides safety in the event of one system malfunctioning, but more important, igniting the air/fuel mixture inside the cylinder at two locations provides more efficient combustion of the air/fuel mixture in the cylinder.

Dual-spool gas turbine engine. An axial-flow turbine engine that has two compressors, each driven by its own stage or stages of turbines.

Duct heater. A thrust augmentation system, similar to an afterburner, where fuel is added to the fan-discharge air and burned.

Duct losses. A decrease in pressure of the air flowing into a gas turbine engine caused by friction.

Durability. A measure of engine life. Durability is usually measured in TBO hours.

Duty cycle. A schedule that allows a device to operate for a given period of time, followed by a cooling down period before the device can be operated again.

Dwell chamber. A chamber in a turbine engine into which the scavenged oil is returned. Entrained air separates from the oil in the dwell chamber before it is picked up by the pressure pump.

Dynamometer. A device used to measure the amount of torque being produced by an engine. The drive shaft of the engine is loaded with either an electric generator or a fluid pump, and the output of the generator or pump is measured and converted into units of torque. Torque at a specific rpm can be converted into brake horsepower.

Dyne. The unit of force that imparts an acceleration of one centimeter per second, per second to a mass of one gram. One dyne is equal to 2.248 · 10-6 pounds.

E

Eddy current. Current induced into a conductor due to a mobbing or non-uniform magnetic field.

EEC. Electronic engine control. An electronic fuel control for a gas turbine engine. The EEC senses the power-lever angle (PLA), engine RPM, bleed valve, and variable stator vane position, and the various engine pressures and temperatures. It meters the correct amount of fuel to the nozzles for all flight conditions, to prevent turbine over-speed and over-temperature.

Effective pitch. The actual distance a propeller advances in one revolution through the air.

E-gap angle. The position of the rotating magnet in a magneto when the breaker points are timed to open. The E-gap (efficiency gap) angle is several degrees of magnet rotation beyond the magnet's neutral position. At this point, the magnetic field stress is the greatest, and the change in flux is the greatest, inducing the maximum voltage in the secondary winding.

EGT. Exhaust gas temperature. The temperature of the gases as they leave the cylinder of a reciprocating engine or the turbine of a gas turbine engine.

EICAS. Engine indicating and crew alerting system. An electronic instrumentation system that monitors airframe and engine parameters and displays the essential information on a video display on the instrument panel. Only vital information is continually displayed, but when any sensed parameters fall outside of their allowable range of operation, they are automatically displayed.

Elastic limit. The maximum amount of tensile load, in pounds per square inch, that a material is able to withstand without permanent deformation.

Electrical potential. The electrical force caused by a deficiency of electrons in one location and an excess of electrons in another. Electrical potential is measured in volts.

Electrical steel. A low-carbon iron alloy that contains some silicon It is used as the core for transformers, field frames

for generators and alternators, and the magnetic circuit of magnetos.

Electromagnet. A magnet produced by an electrical current flowing through a coil of wire. The coil is normally wound around a core of soft iron which has an extremely low retentivity, allowing it to lose its magnetism as soon as the current stops flowing.

Electromagnetic radiation. A method of transmitting energy from one location to another. Current caused by high voltage in the secondary winding of a magneto produces electric and magnetic fields which oscillate back and forth at a high frequency and extend out into space in the form of waves. These waves of electromagnetic radiation are received as interference by the radio receivers in the aircraft.

Electromotive force. A force that causes electrons to move from one atom to another within an electrical circuit. An electromotive force, or EMF, is the difference in the electrical pressure, or potential, that exists between two points. An EMF may be produced by converting mechanical movement, pressure, chemical, light, or heat energy into electrical energy. The basic unit of EMF is the volt.

Emulsion. A suspension of small globules of one material in another when the two materials will not mix. Oil and water will not mix, but they can be formed into an emulsion. An emulsion will separate into its components when it is allowed to sit.

Engine trimming. A maintenance procedure in which the fuel control on a gas turbine engine is adjusted to cause the engine to produce the required EGT or EPR at a specified rpm.

Entrained water. Water suspended in jet fuel. The amount of entrained water that can be held in the fuel is determined by the temperature of the fuel. When the fuel becomes cold, the water precipitates out and forms ice crystals on the fuel filter element.

Epicyclic reduction gears. A gear train in which a series of small planetary gears rotate around a central gear. More commonly called a planetary gear train.

EPR. Engine pressure ratio. The ratio of the turbine discharge total pressure to the compressor inlet total pressure. EPR is normally used as the parameter to determine the amount of thrust an axial-flow turbojet or turbofan engine is producing.

ESHP. Equivalent shaft horsepower. A measure of the power produced by a turboprop engine. ESHP takes into consideration both the shaft horsepower delivered to the propeller and the thrust developed at the engine exhaust. Under static conditions, one shaft horsepower is approximately equal to 2.5 pounds of thrust.

Ethanol. Alcohol made from cereal grains such as corn.

Ether. A volatile, highly flammable liquid that may be used to prime the cylinders of an aircraft engine when starting under extremely cold conditions.

Ethylene dibromide. A colorless, poisonous liquid $BrCH_2CH_2Br$ that is blended with leaded gasoline to help scavenge lead oxides.

Ethylene glycol. A form of alcohol used as a coolant for liquid-cooled aircraft engines. It is also used in automobile engines as a permanent antifreeze.

Eutectic. An alloy or solution that has the lowest possible constant melting point.

Evaporative cooling. See steam cooling.

Exceedance condition. A condition in which a parameter sensed by the EICAS exceeds the limits for which it is programmed.

Exhaust cone. The fixed conical fairing centered in the turbine wheel. The exhaust cone straightens the flow and prevents the hot gases from circulating over the rear face of the turbine wheel.

Exhaust nozzle. The opening at the rear of the exhaust pipe.

Expansion wave. The change in pressure and velocity of supersonic air as it passes over a surface that drops away from the flow. As the surface drops away, the air tries to follow it, and in changing its direction, the air speeds up to a higher supersonic speed, and its static pressure decreases. There is no change in the total amount of energy as air passes through an expansion wave.

External-combustion engine. A form of heat engine in which the fuel releases its energy outside of the engine. This released heat expands air which is used to perform useful work. Steam engines are a popular type of external combustion engine.

Extreme pressure (EP) lubricant. A lubricant that reacts with iron to form iron chlorides, sulfides, or phosphides on the surface of a steel part. These compounds reduce wear and damage to surfaces in heavy rubbing contact. EP lubricants are specially suited for lubricating gear trains.

F

FAA Form 337. The *Major Repair and Alteration* form that must be completed when an FAA-certificated aircraft or engine has been given a major repair or major alteration.

Face (propeller nomenclature). The flat surface of a propeller that strikes the air as the propeller rotates. The face of a propeller corresponds to the bottom of an airplane wing.

FADEC. Full-authority digital electronic control. A digital electronic fuel control for a gas turbine engine that is functioning during all engine operations, hence full authority. It includes the EEC (see EEC) and functions with the flight management computer. FADEC schedules the fuel to the nozzles in such a way that prevents overshooting power changes and over-temperature conditions. FADEC furnishes information to the EICAS (engine indication and crew alerting system).

Fan pressure ratio. The ratio of the fan-discharge pressure to the fan inlet pressure.

Feathering propeller. A controllable-pitch propeller whose blades can be moved into a high pitch angle of approximately 90º. Feathering the propeller of an inoperative engine prevents it from wind-milling and greatly decreases drag.

Feeler gages. A type of measuring tool consisting of strips of precision-ground steel of accurately measured thickness. Feeler gages are used to measure the distance between close-fitting parts, such as the clearances of a mechanical system or the distance by which moving contacts are separated.

FHP. Friction horsepower. The amount of horsepower used to turn the crankshaft, pistons, gears, and accessories in a reciprocating engine and to compress the air inside the cylinders.

Fiber optics. The technique of transmitting light or images through long, thin, flexible fibers of plastic or glass. Bundles of fibers are used to transmit complete images.

Fire sleeve. A covering of fire-resistant fabric used to protect flexible fluid lines that are routed through areas subject to high temperature.

Flame tubes. Small-diameter metal tubes that connect can-type combustors in a turbine engine to carry the ignition flame to all of the combustion chambers. The British call combustion liners flame tubes.

Flameout. A condition of turbine engine operation when the fire unintentionally goes out. Improper air/fuel mixture or interruption of the air flow through the engine can cause a flameout.

Flash point. The temperature to which a liquid must be raised for it to ignite, but not continue to burn when a flame is passed above it.

Flashing the field. A maintenance procedure for a DC generator that restores residual magnetism to the field frame, A pulse of current from a battery is sent through the field coils in the direction in which current normally flows. The magnetic field produced by this current magnetizes the steel frame of the generator.

Flashover. An ignition system malfunction in which the high voltage in the magneto distributor jumps to the wrong terminal. Flashover causes the wrong spark plug to fire. This reduces the engine power and produces vibration and excessive heat.

Flat-rated engine. A turboprop engine whose allowable output power is less than the engine is physically capable of producing.

Float carburetor. A fuel metering device that uses a float-actuated needle valve to maintain fuel level slightly below the edge of the discharge nozzle.

Flock. Pulverized wood or cotton fibers mixed with an adhesive. Flock, attached to a wire screen, acts as an effective induction air filter for small reciprocating engines.

Flow divider (reciprocating engine). The valve in an RSA fuel injection system that divides the fuel from the fuel control unit and distributes it to all of the cylinders. It compares with the manifold valve in a Teledyne-Continental fuel injection system.

Flow divider (turbine engine). A component in a turbine engine fuel system that routes all of the fuel to the primary nozzles or primary orifices when starting the engine or when the rpm is low. When the engine speed builds up, the flow divider shifts and opens a passage to send the majority of the fuel to the secondary nozzles or orifices.

FMC. Flight management computer. An electronic flight instrumentation system that enables the flight crew to initiate and implement a given flight plan and monitor its execution.

FOD. Foreign object damage. Damage to components in the gas path of a turbine engine, caused by ingested objects. Debris from the runway or ramp cause FOD on the ground.

Ice and birds cause most in-flight FOD.

Four-stroke cycle. A constant-volume cycle of energy transformation that has separate strokes for intake, compression, power, and exhaust.

Fractional distillation. Procedure used for separating various components from a physical mixture of liquids. Crude oil is a mixture of many different types of hydrocarbon fuels which can be separated by carefully raising its temperature. The first products to be released, those having the lowest boiling points, are some of the gaseous fuels; next are gasoline, kerosene, diesel fuel, heavy fuel oils, lubricating oils, and finally, tar and asphalt.

Frangible. Capable of being broken.

Free-turbine engine. A gas turbine engine with a turbine stage on a shaft independent of the shaft used to drive the compressor. Free turbines are used to drive the propeller reduction gear in a turboprop engine and the rotor transmission in a helicopter.

Freezing point. The temperature at which solids, such as wax crystals, separate from a hydrocarbon fuel as it is cooled.

Full-register position. The position of a magnet in a magneto when its poles are aligned with the pole shoes and the maximum amount of magnetic flux is flowing through the magnetic circuit.

G

Gauge pressure. Pressure referenced from existing atmospheric pressure.

Gas generator. The basic gas turbine engine. It consists of the compressor, diffuser, combustor, and turbine. The gas generator is also called the core engine.

Gas turbine engine. An internal combustion engine that burns its fuel in a constant-pressure cycle and uses the expansion of the air to drive a turbine which, in turn, rotates a compressor. Energy beyond that needed to rotate the compressor is used to produce torque or thrust.

General Aviation Airworthiness Alerts. While these documents are no longer published, they are still available at www.faa.gov. These are used to alert technicians of problems that have been found in specific models of aircraft, and reported on Malfunction and Defect Reports. Airworthiness Alerts suggest corrective action, but compliance with the suggestion is not mandatory.

General aviation. A term used to describe the total field of aviation operation except the military and airlines.

Geometric pitch. The distance a propeller would advance in one revolution if it were rotating in a solid.

Geopotential of the tropopause. The point in the standard atmosphere where the temperature stops dropping and becomes constant. This is the tropopause, or the dividing line between the troposphere and the stratosphere.

Gerotor pump. A form of constant-displacement pump that uses an external-tooth drive gear that meshes with and drives an internal-tooth gear that has one more space for a tooth than there are teeth on the drive gear. Both gears turn inside a close-tolerance housing. As the gears rotate, fluid flows between the teeth that are beginning to un-mesh, and is carried around the pump as the space continues to open up. On the discharge side of the pump, the teeth becomes smaller, fluid is forced out of the pump.

Glass flight deck. An aircraft instrument system that uses a few color cathode-ray-tube displays to replace a large number of mechanically actuated instruments.

Governor. A control used to automatically change the pitch of a constant speed propeller to maintain a constant engine rpm as air loads vary in flight.

GPU. Ground power unit. A service component used to supply electrical power and compressed air to an aircraft when it is operating on the ground.

Gross thrust. The thrust produced by a turbojet or turbofan engine when the engine is static or not moving. The air is considered to have no inlet velocity, and the velocity of the gas leaving the engine is considered to be the acceleration factor.

Ground-boosted engine. An aircraft reciprocating engine with a built-in supercharger that boosts the sea-level rated horsepower of the engine.

Gudgeon pin. The British name for a wrist pin, or piston pin. See wrist pin.

H

Half-wave rectifier. An electrical rectifier circuit that converts AC into pulsating DC. Only one alternation of each cycle is present in the output.

Halogenated hydrocarbon. A hydrocarbon compound in which one or more hydrogen atoms have been replaced with atoms of one of the halogen elements such as fluorine, chlorine, or bromine.

Head of pressure. Pressure exerted by a column of fluid and created by the height of the column.

Heat engine. A mechanical device that converts the chemical energy in a fuel into heat energy. The heat energy is then converted into mechanical energy and useful work.

Heli-Coil insert. The registered trade name of a special helical insert used to restore threads stripped from a bolt hole, or to reinforce the threads in an aluminum casting. The damaged threads are drilled out and new threads are cut with a special oversize tap. A coil of stainless steel wire, with a cross section in the shape of a diamond, is screwed into the hole and serves as the new threads. Heli-Coil inserts are also used to provide durable threads in soft metal castings. Some spark plug holes in aluminum alloy cylinder heads are fitted with Heli-Coil inserts to minimize the wear caused by repeated removal and installation of the spark plugs.

Helical spline. A spline that twists, or winds, around the periphery of a shaft. Helical splines are used to change linear motion into rotary motion of the shaft on which the splines are cut.

Helical spring. A spring wound in the form of a helix, or coil.

Helix. A spiral.

Heptanes. An organic compound, $CH_3(CH_2)_5CH_3$, that is used as the low reference fuel for rating the antidetonation characteristics of aviation gasoline.

Hermetically sealed. A complete seal, especially against the escape or entry of air.

Hertz. A unit of frequency equal to one cycle per second.

High-bypass ratio engine. A turbofan engine whose bypass ratio is 4:1 or greater.

High-pressure compressor. The second-stage compressor in a dual-spool gas turbine engine. The high pressure compressor is called the N2 compressor and is the one that is rotated by the starter for starting, and the one whose rpm is controlled by the fuel control.

High unmetered fuel pressure. Pressure in a Teledyne-Continental fuel injector pump that is adjusted by the variable orifice.

Home-built aircraft. See amateur-built aircraft.

Honing (cylinder wall treatment). Scratching the surface of the cylinder wall with an abrasive to produce a series of grooves of microscopic depth and uniform pattern. The honed pattern holds oil to lubricate the cylinder walls.

Horsepower. The most commonly used unit of mechanical power. One horsepower is equal to 33,000 foot-pounds of work done in one second.

Hot section. The portion of a gas turbine engine that operates at a high temperature. The hot section includes the combustion, turbine, and exhaust sections.

Hot-tank lubricating system. A turbine engine lubricating system in which the oil cooler is located in the pressure subsystem. The oil is returned to the tank without being cooled.

HRD fire extinguisher. A fire extinguisher that carries the extinguishing agent in a sealed sphere or cylinder. When the agent-discharged switch is closed, an ignited powder charge drives a cutter through a frangible disc which releases the agent. The entire contents of the container is emptied in much less than a second.

Hub (propeller component). The high-strength component inside a propeller that attaches the blades to the engine propeller shaft.

Hybrid compressor engine. A gas turbine engine that has both centrifugal and axial-flow compressors.

Hybrid spark plug. A fine-wire spark plug that has a platinum center electrode and iridium ground electrodes.

Hydraulic lock. A condition in which oil drains into the lower cylinders of a reciprocating engine and leaks past the piston rings to fill the combustion chamber. If the oil is not removed before the engine is started, it can cause serious damage.

Hydromechanical. Any device that combines fluid pressures with mechanical actions to achieve a desired result. In a hydromechanical fuel control used for a turbine engine, hydraulic servos are used in conjunction with the mechanical linkages.

Ice bridging. A spark plug failure that occurs when starting a reciprocating engine in extremely cold weather. When a cylinder fires, the air/fuel mixture is converted into carbon dioxide and water vapor. The water vapor condenses on the spark plug electrodes and forms ice that bridges the electrode gap and prevents the plug firing until the ice is melted. This normally requires removing the spark plugs from the engine.

IDG. Integrated drive generator. An AC generator installed on turbine engines. An IDG incorporates a brushless, three-phase AC generator and a constant-speed drive in a single component.

Igniter. The component in a turbine-engine ignition system that provides a high-energy spark for igniting the air/fuel mixture in the combustion chamber for starting.

IHP. Indicated horsepower. The theoretical horse-power a reciprocating engine develops.

IMEP. Indicated mean effective pressure. The average pressure existing inside the cylinder of a reciprocating engine during its power stroke.

Impulse coupling. A spring-loaded coupling between a magneto shaft and the drive gear inside the engine. When the engine is rotated for starting, the impulse coupling locks the magnet so it cannot turn. The spring in the coupling winds up as the crankshaft continues to turn, and when the piston is near top center, the coupling releases and spins the magnet, producing a hot and retarded spark.

Inline engine. A reciprocating engine with all of the cylinders arranged in a straight line.

Incandescent. Glowing because of intense heat.

Inconel. The registered trade name for an alloy of chromium, iron, and nickel. Inconel is similar to stainless steel, but cannot be hardened by heat treatment.

Inductive reactance. An opposition to the flow of AC or changing DC caused by inductance in the circuit. Inductive reactance, whose symbol is XL, causes a voltage drop, but it does not use power nor produce heat.

Inertia. The tendency of a body to resist acceleration. A body at rest will remain at rest or a body in motion will stay in motion in a straight line unless acted on by an outside force.

Inertia starter. A starter for a large reciprocating engine that uses energy stored in a rapidly spinning flywheel to turn the crankshaft.

Inlet guide vanes. A set of stator vanes in front of the first stage of compression in a gas turbine engine. The inlet guide vanes deflect the air entering the compressor in the correct direction for optimum operation. Inlet guide vanes may be fixed, or their angle may be controlled hydraulically by fuel from the fuel control.

Integral fuel tank. An aircraft fuel tank made by sealing off part of the structure so fuel can be carried in the structure itself.

Intercooler. An air-to-air heat exchanger installed between a turbosupercharger and the carburetor. Intercoolers decrease the temperature of compressed air to prevent detonation.

Interference angle (poppet valve dimension). The difference between the valve seat and the valve face angles. Normally, the valve seats are ground with between 0.5º and 1º greater angle than the valve face. This allows the face to touch the seat with a line contact that provides the best sealing.

Interference fit. A type of fit used when assembling certain mechanical devices. The hole is made smaller than the part that fits into it. The material containing the hole is heated to expand the hole, and the part that fits into the hole is chilled to shrink it. The parts are assembled, and when they reach the same temperature their fit is so tight they will not loosen in service.

Internal-combustion engine. A form of heat engine in which the fuel and air mixture is burned inside the engine to heat and expand the air so it can perform useful work.

Internal timing. The adjustment of the breaker points of a magneto so they will begin to open at the time the magnet is in its E-gap position.

Interpole. A field pole in a compound-wound DC generator used to minimize armature reaction. Interpoles are located between each of the regular field poles, and their coils are in series with the armature winding so all of the armature current flows through them. The magnetic field produced by the interpole coils cancels the distortion caused by the armature field and allows the brushed to remain in the neutral plane where there is no potential difference between the commutator segments. Keeping the brushes in the neutral plane minimizes sparking.

Inverted engine. An inline or V-engine in which the cylinders are mounted below the crankshaft.

Iridium. A very hard, brittle, highly corrosion-resistant, whitish-yellow, metallic chemical element. Iridium is used for the fine-wire electrodes in spark plugs that must operate in engines using fuel with an exceptionally high lead content.

Iso-octane. An organic compound used as the high reference fuel for rating the antidetonation characteristics of aviation gasoline $(CH_3)_2CHCH_2C(CH_3)_3$.

Isothermal change. A physical change that takes place within a material in which heat energy is added to or taken from the material as needed to keep its temperature constant.

J

Jet fuel. Fuel designed and produced to be used in aircraft gas turbine engines.

Jet propulsion. A method of propulsion by accelerating a relatively small mass of air through a large change in velocity.

Jeweler's file. A small, fine-cut, metalworking file used by jewelry manufacturers.

Joule. A measure of energy. In terms of electrical energy, one joule is equal to one watt-second.

Journal (bearing). A hardened and polished surface on a rotating shaft that rides in a plain bearing.

K

Kerosene. A light, almost colorless, hydrocarbon liquid obtained from crude oil through the fractional distillation process. Kerosene is the base for turbine engine fuel.

Kevlar. The registered trade name by DuPont for a patented aramid fiber.

Kinematic viscosity. The ratio of the absolute viscosity of a fluid to its density. Kinematic viscosity is measured in centistokes.

L

Labyrinth seal. A type of air and/or seal used around the main –shaft bearings in a gas turbine engine. The seal consists of a series of rotating blades that almost contact the seal land. A small amount of air flows between the seal and the land to prevent oil flowing past the seal.

Land (piston) The portion of a piston between the ring grooves.

Land (splined shaft). The portion of a splined shaft between the grooves.

Laser tachometer. A highly accurate tachometer that shines a laser beam on a rotating element that has reflective tape or a contrasting mark. The reflected laser beam is converted into electrical pulses which are counted and displayed on a monitoring instrument.

Last-chance oil filter. A small filter installed in the oil line to the bearing jet in a gas turbine engine. This filter traps any contaminants that have passed the main filter and holds them until the engine is disassembled for overhaul.

LCD. Liquid crystal display. A digital display that consists of two sheets of glass separated by a sealed-in, normally transparent liquid crystal material. The outer surface of each glass sheet has a transparent conductive coating with the viewing side etched into character-forming segments with leads going to the edges of the display. A voltage applied between the front and back coatings disrupts the orderly arrangement of molecules and causes the liquid to darken so that light cannot pass through it. The segment to which the voltage is applied appears as black against a reflected background.

Leading edge. The thick edge at the front of a propeller blade.

Lean die-out. A condition in which the fire in a gas turbine engine goes out because the air/fuel mixture ratio is too lean to sustain combustion.

Lean mixture. A air/fuel mixture that contains more than 15 parts of air to 1 part of fuel, by weight.

Line boring. A method of assuring concentricity of bored holes. A boring bar extends through all of the holes and cuts the inside diameters so they all have the same center.

Link rod. The rod in a radial engine that connects one of the piston wrist pins to a knuckle pin on the master rod. Also called articulating rods.

Liquid cooling. The removal of unwanted heat from an aircraft engine by transferring the heat into a liquid and then passing the heated liquid through a liquid-to-air heat exchanger (radiator) to transfer the heat into the ambient air.

Longitudinal magnetism. A method of magnetizing through a solenoid, or coil, that encircles the part so the lines of magnetic flux pass lengthwise through the part. Longitudinal magnetism makes it possible to detect faults that extend across the part.

Low bypass ratio engine. A turbofan engine whose bypass ratio is less than 2:1.

Low-pressure compressor. The first-stage compressor in a dual-spool gas turbine engine. The low-pressure compressor is called the N1 compressor and its speed is not governed. It seeks its own best speed as the atmospheric conditions change so it can furnish a relatively constant mass of air to the inlet of the second-stage compressor.

Low unmetered fuel pressure. Pressure in a Teledyne-Continental fuel injector pump that is adjusted by the relief valve.

LRU. Line replaceable unit. Aircraft components designed to be replaced as a unit while the aircraft is on the flight line.

M

M&D (Malfunction and Defect) report. A small postcard-like form (FAA Form 8330) used by repair stations, maintenance shops, and technicians to report an unacceptable condition to the FAA. Information on these forms provides the basis for the General Airworthiness Alerts and subsequent Airworthiness Directives.

Mach number. The ratio of the speed of an object through the air to the speed of sound under the same atmospheric conditions. An object traveling at the speed of sound is traveling at Mach one (M1.0).

Magnesyn system. The registered trade name of a remote indicating instrument system. A Magnesyn system uses a permanent magnet as its rotor and a toroidal coil excited by 400-hertz AC as its stator. A small magnet in the center of the indicator coil follows the movement of a larger magnet in the transmitter coil.

Magnetic field. The invisible, but measurable, force surrounding a permanent magnet or current-carrying conductor. This field is produced when the orbital axes of the electrons of the atoms in the material are all in alignment.

Magnetic flux. Lines of magnetic force that are assumed to leave a magnet at its north end and return to its south end. Lines of flux tend to be as short as possible and cannot cross each other.

Magnetic particle inspection. A method of non-destructive inspection for ferrous metal components. The part being inspected is magnetized and then flooded with a solution of iron oxide suspended in a light oil, much like kerosene. Any flaw, either on the surface or just below the surface, forms a north and south pole, and the iron oxide attracted to these poles helps locate the flaw. The iron oxide is normally treated with a fluorescent dye, and the inspection is conducted in a darkened booth. When an ultraviolet light (black light) is shone on the part, the treated iron oxide shows up as a brilliant line.

Major alteration. An alteration not listed in the aircraft, aircraft engine, or propeller specifications that might appreciably affect weight, balance, structural strength, powerplant operation, flight characteristics, or other qualities affecting airworthiness; an alteration not done according to accepted practices, or one that cannot be done by elementary operations.

Major overhaul. The disassembly, cleaning, and inspection of an engine and the repair and replacement of all parts that do not meet the manufacturer's specification.

Major repair. A repair to a component that if improperly done might appreciably affect weight, balance, structural strength, performance, powerplant operation, flight characteristics, or other qualities affecting airworthiness; a repair not done according to accepted practices, or one that cannot be done by elementary operations.

Mandrel. A precision steel bar on which a propeller is mounted for balancing. The mandrel is placed across two perfectly level knife-edge plates, and the propeller is allowed to rotate until it stops with its heavy point at the bottom.

Manifold pressure. The absolute pressure of the air inside the induction system of a reciprocating engine.

Manifold valve. See flow divider (reciprocating engine).

MAP. Manifold absolute pressure. The absolute pressure that exists within the induction system of a reciprocating engine. It is the MAP that forces air into the cylinders of the engine. MAP is commonly called manifold pressure.

Mass. A measure of the amount of matter in an object. For the purpose of measuring the mass of air flowing through a turbine engine, the weight of the air, in pounds per second, is divided by the acceleration due to gravity (32.3 feet per second).

Matrix (advanced composites). The material that bonds the fibers together in an advanced composite structure. The matrix carries the stresses into the fibers.

Matter. Something that has mass, takes up space, and exists as a solid, liquid, or gas.

Medium-bypass ratio engine. A turbofan engine whose bypass ratio is between 2:1 and 4:1.

MEK. Methul ethyl ketone. A volatile, water soluble, organic chemical compound that is used as a solvent to remove oily contaminants from ignition system components.

Methanol. Alcohol made from wood.

MFD. Multifunction display. A liquid crystal or CRT display that shows a number of parameters and replaces several analog-type indicators.

Microinches rms. A measure used for cylinder wall surface roughness. Twenty microinches rms means that the highest and lowest deviation from the average surface is 20 millionths of an inch.

Micron. A measurement used to identify the size of particles trapped by filters. One micron is a micro meter, or one millionth of a meter. It is 0.000039 inch.

Microprocessor. A single silicon chip that contains the arithmetic and logic functions of a computer.

Milliammeter. An instrument that measures electrical current in units of thousandths of an ampere.

Millibar. A unit of pressure in the metric system. One bar is a pressure of 14.5 psi, or 29.52 in. Hg. One millibar is one thousandth of a bar, or 0.01469 psi, or 0.02952 in. Hg.

Minor alteration. Any alteration that does not fit the definition of a major repair. See major repair.

Module (modular engine construction). The method of construction for mast modern gas turbine engine. The engine is made of several modules, or units, that can be removed and replaced or serviced independent of the rest of the engine.

Momentum. A force caused by the inertia of a moving body as it tries to keep the object moving in the same direction, at the same speed.

Motor. (verb) The act of rotating a turbine engine using the starter, with the ignition system deactivated. An engine is motored to force air through it to purge fuel fumes.

Multiple-can combustor. A combustor used in a gas turbine engine that consists of a series of individual burner cans, each made of an inner liner and an outer case. The individual cans are arranged around the periphery of a centrifugal compressor. Hot gases flow directly from the cans into the turbine.

N

N1. A symbol representing the rotational speed of the low-pressure compressor in a dual-spool gas turbine engine.

N2. A symbol representing the rotational speed of the high-pressure compressor in a dual-spool gas turbine engine.

NACA. National Advisory Committee for Aeronautics. This organization, dedicated to the technical development of aviation, has been superseded by NASA.

NACA cowling. A long-chord cowling used over a radial engine. The forward portion of this cowling has an aerodynamic shape that produces a forward pull, and the rear portion extends back to fair in with the fuselage. There is a narrow peripheral gap between the rear of the cowling and the fuselage for the cooling air to escape. Some NACA cowlings have controllable flaps over this opening to control the amount of cooling air that flows through the engine.

Nacelle. An enclosed compartment, normally in the leading edge of the wing, in which an aircraft engine is mounted.

Naphtha. A volatile, flammable liquid distilled from petroleum. It is used as a cleaning agent and solvent, and is present in some blended turbine-engine fuels.

NASA. National Aeronautics and Space Administration.

Naturally aspirated engine. A reciprocating engine that depends upon atmospheric pressure to force the air/fuel mixture into the cylinders. Naturally aspirated engines are neither supercharged nor turbocharged.

Net thrust. The thrust produced by a turbojet or turbofan engine in which the acceleration factor is the difference between the velocity of the incoming air and the velocity of the exhaust gases leaving the engine.

Neutral position. The position of the magnet in a magneto when its poles are between the pole shoes and no lines of flux are flowing through the magnetic circuit.

Newton. The unit of force needed to accelerate a mass of one kilogram one meter per second per second. One newton is equal to 1000,000 dynes, or 2.248×10^{-1} pound.

Nichrome. The registered trade name for an alloy of nickel and chromium. Nichrome wire is used for making electrical heater elements and precision wire-wound resistors. Nichrome's

resistance is approximately 65 times that of copper.

Nitriding. A method of case hardening steel. Steel is placed in a retort (a sealed, high-temperature furnace), and heated to a specified temperature while surrounded by ammonia gas (NH_3). The ammonia breaks down into nitrogen and hydrogen, and the nitrogen unites with some of the alloying elements in the steel to form an extremely hard surface. Nitriding hardens crankshaft bearing surfaces and cylinder walls in reciprocating engines. It takes place at a lower temperature than other forms of case hardening, and does not cause warping.

Normal category airplane. An aircraft that is certificated under 14 CFR part 23 that is not certificated under the acrobatic, utility, or commuter category.

Normal shock wave. A type of pressure wave that forms at right angles to a surface when air moves at the speed of sound.

Notch sensitivity. A measure of the loss of strength of a material caused by the presence of a notch, or a V-shaped cut.

Nozzle guide vanes. See turbine inlet guide vanes.

O

Oblique shock wave. A pressure wave that forms on a sharp-pointed object when air flows past it at a supersonic speed.

Octane rating. A system used to rate the antidetonation characteristics of a reciprocating engine fuel. Fuel with an octane rating of 80 performs in a laboratory test engine the same as the fuel made of a mixture of 80% iso-octane and 20% heptanes.

Odometer. The portion of an automobile speedometer that indicates the distance traveled.

Offset throw (crankshaft design). Crank arms on a reciprocating engine crankshaft. The arms, or throws, to which the connecting rods and pistons are attached are offset from the center of the crankshaft to move the pistons in and out of the cylinder. The amount of the offset determines the stroke of the engine.

Oil analysis. A method of measuring the contents in parts per million of various chemical elements in oil. A sample of the oil is burned in an electric arc, and the resulting light is analyzed with a spectroscope which identifies the chemical elements in the oil and gives an indication of the amount of each element. This type of oil analysis is called a spectrometric oil analysis program, or SOAP.

Oil dilution. A method of temporarily decreasing the viscosity of the lubricating oil to make it possible to start a reciprocating engine when the temperature is very low. Before shutting the engine down, enough gasoline from the fuel system is mixed with the lubricating oil in the engine to dilute it so the starter can turn the engine over when the oil is cold and viscous. When the engine starts and the oil warms up, the gasoline evaporates.

Oil-damped bearing. A type of roller bearing installation in a gas turbine engine in which the outer race is installed in an oil damper compartment whose inside diameter is a few thousandths of an inch larger than the outside diameter of the outer race. Oil under pressure fills the oil damper compartment and allows the bearing to compensate for sight misalignment and to absorb vibrations of the shaft.

On-condition maintenance. A maintenance program that closely monitors the operating condition of an engine and allows major repairs or replacements to be made when engine performance deteriorates to a specific level.

On-speed condition. The speed condition in which the engine is turning at the rpm for which the propeller governor is set.

One-hundred-hour inspection. An inspection required by 14 CFR part 91, section 91.409 for FAA-certificated aircraft operated for hire or used for flight instruction for hire. A 100-hour inspection is identical in content to an annual inspection, but can be conducted by an aviation maintenance technician who holds an Airframe and Powerplant rating, but does not have an Inspection Authorization. See 14 CFR part 43, Appendix D for list of the items that must be included in an annual or 100-hour inspection.

Operating cycle. One complete series of events in the operation of a turbine engine that consists of starting the engine, taking off, landing, and shutting the engine down.

Optoelectronic device. An electronic device that produces, modulates, or senses electromagnetic radiation in the ultraviolet, visible light, or infrared portions of the energy spectrum.

Otto cycle. The constant-volume cycle of energy transformation used by reciprocating engines. A mixture of fuel and air is drawn into the cylinder as the piston moves to the bottom of its stroke. The mixture is compressed as the piston moves upward in the cylinder, and when the piston is near the top of its stroke, the mixture is electrically ignited and burns. The burning mixture heats and expands the air inside the cylinder and forces the piston down, performing useful work. The piston then moves back up, forcing the

burned gases out of the cylinder.

Overboost. A condition of excessive manifold pressure in a reciprocating engine. Overboosting occurs when the supercharger is operated at too high a speed.

Overrunning clutch. A type of clutch that couples an input shaft with an output shaft. When the input shaft is driven, the output shaft rotates with it. When the output shaft is driven, the output shaft rotates with it. But when the output shaft is driven, the input shaft does not turn.

Overspeed condition. A speed condition in which the engine is turning at an rpm higher than that for which the propeller governor is set.

P

P-lead. Primary lead. The wire that connects the primary winding of a magneto to the ignition switch. The magneto is turned off by grounding its P-lead.

Pascal. The unit of pressure produced when one newton of force acts uniformly over an area of one square meter. One pascal is equal to 14.503 · 10-5 (0.00014503) psi. The kilopascal (kPa) is easier to manipulate. 1 kPa = 1,000 Pa = 0.14503 psi.

PCB. Plenum chamber burning. A method of thrust augmentation used on engines with vectored nozzles. Fuel injected into the fan-discharge air is burned to increase thrust.

Peak voltage. The voltage of AC electricity that is measured from zero voltage to the peak of either alternation.

Penetrant dwell time. The length of time a part is left in the penetrant when preparing it for inspection by the fluorescent or dye penetrant method. The hotter the part and the longer the penetrant dwell time, the smaller the fault that will be detected.

Performance number. The rating of antidetonation characteristics of a reciprocating engine fuel that is better than the high rating reference fuel, iso-octane. Performance numbers are greater than 100.

Permanent magnet. A piece of hardened steel that has been exposed to a strong magnetizing force which has aligned the spin axes of the electrons surrounding its atoms. The high retentivity of the material causes the electrons to retain their magnetic orientation.

Permanent-mold casting. A casting made in a reusable metal mold. The walls of permanent-mold castings can be made thinner than similar walls made by sand casting.

Permeability. A measure of the ease with which lines of magnetic flux can pass through a material.

Phase sequence, or phase rotation. The sequence with which the output phases of a three-phase generator are connected to the load. Reversing the phase sequence of a generator from A-B-C to A-C-B prevents the generator from being synchronized with the others on the bus.

Pi (π) filter. An electronic filter used to prevent radio frequency energy produced in the ignition exciter from feeding back into the aircraft electrical system. The filter is made of an inductor with a capacitor on its input and output. The name is derived from the resemblance of the three components on a schematic diagram to the Greek letter pi (π).

Pinion. A small gear that meshes with and drives a larger gear.

Piston (reciprocating engine component). The movable plug inside the cylinder of a reciprocating engine. The piston moves in and out to compress the air/fuel mixture and to transmit the force from the expanding gas in the cylinder to the crankshaft.

Piston pin. See wrist pin.

Pitch angle. The angle between the chordline of a propeller blade and the plane of rotation. See blade angle.

Pitch distribution. The gradual change in pitch angle of a propeller blade from the root to the tip.

Plane of rotation. The plane in which a propeller blade rotates. The plane of rotation is perpendicular to the propeller shaft.

Planetary gears. A type of large-ratio reduction gearing. A series of small planetary gears are mounted on a spider attached to the output shaft. The planetary gears rotate between a fixed sun gear and a driven ring gear.

Plenum chamber. An enclosed chamber in which air can be held at a pressure slightly higher than that of the surrounding air. Plenum chambers are used to stabilize the pressure of the air before it enters a double entry centrifugal compressor.

POH. Pilot's Operating Handbook. A document published by the airframe manufacturer and approved by the FAA that lists the operating conditions for a particular model of aircraft. Engine operating parameters are included in the POH.

Pole shoe. Inward extensions from the field frame of a generator around which the field coils are wound.

Poppet valve. A T-shaped valve with a circular head. Poppet valves are used to cover the intake and exhaust openings in the cylinder head of a reciprocating engine. The valves are held closed by one or more coil springs and are opened by a cam lobe or a rocker arm pushing on the end of the valve stem.

Porcelain. A hard, white, translucent ceramic material that was used as the insulator in some of the early aircraft spark plugs.

Positive-displacement pump. A fluid pump that moves a specific volume of fluid each time it rotates. Spur-gear pumps, gerotor pumps, and vane pumps are all positive-displacement pumps.

Power. The time rate of doing work. Power is found by dividing the amount of work done, measured in floor-pounds, by the time in seconds or minutes used to do the work. Power may be expressed in foot-pounds of work per minute or in horsepower. One horsepower is 33,000 foot-pounds of work done in one minute, or 550 foot pounds of work done in one second.

Power-assurance check. A test run made of a gas turbine engine to determine how its performance compares with its precious performance as new or freshly overhauled.

Powerplant. The complete installation of an aircraft engine, propeller, and all accessories needed for its proper function.

Pre-ignition. Ignition of the air/fuel mixture inside the cylinder of an engine before the time for normal ignition. Pre-ignition is often caused by incandescent objects inside the cylinder.

Prepreg. Preimpregnated fabric. A type of composite material in which the reinforcing fibers are encapsulated in an uncured resin. Prepreg materials are cut to size and shape and laid up with the correct ply orientation, and the entire component is cured with heat and pressure.

Pressure. A measure of force applied uniformly over a given unit of surface area.

Pressure altitude. The altitude in standard atmosphere at which the pressure is the same as the existing pressure.

Pressure carburetor. A carburetor installed on some aircraft reciprocating engines that uses the pressure difference between air inside the venture and ram air entering the carburetor to produce a fuel-metering force. Pressure carburetors have generally been replaced with continuous-flow fuel injection systems.

Pressure cooling. A method of air cooling a reciprocating engine in which the cylinders are enclosed in tight-fitting shrouds. The cowling is divided into two compartments by baffles and seals, with half of each cylinder in each compartment. Ram air is directed into one compartment, and the pressure in the other is decreased by air flowing over a flared exit or adjustable cowl flaps. The pressure difference across the cylinders causes cooling air to be drawn through the fins to remove the unwanted heat.

Pressure-injection carburetor. A multibarrel pressure carburetor used on large radial and V-engines. Fuel is metered on the basis of air mass flowing into the engine and is sprayed under pressure into the eye, or center, of the internal supercharger impeller.

Prevailing torque. The torque required to turn a threaded fastener before it contacts the surface it is intended to hold.

Primary winding. The winding in a magneto or ignition coil that is between the source of voltage and the breaker points. The primary winding is normally made of comparatively large diameter wire, and has a small number of turns, typically about 200.

Profile tip (compressor blade tip). The tip of an axial-flow compressor bladed whose thickness is reduced to give it a higher resonant frequency so it will not be subject to the vibrations that would affect a blade with a squared tip. The profile tip also provides a more aerodynamically efficient shape for the high velocity air that is moved by the blade. Profile tips often touch the housing and make a squealing noise as the engine is shut down. For this reason profile tips are often called squealer tips.

Profilometer. A precision measuring instrument used to measure the depth of the hone marks in the surface of a cylinder wall.

Prony brake. An instrument used to measure the amount of horsepower an engine is delivering to its output shaft. The engine is operated at a specific rpm, and a brake is applied to its output shaft. The amount of torque applied to the brake is measured, and this, with the rpm, is converted into brake horsepower.

Propeller. A device for propelling an aircraft that has blades on an engine-driven shaft and that, when rotated, produces by

its action on the air, a thrust approximately perpendicular to its plane of rotation. It includes control components normally supplied by its manufacturer, but does not include main and auxiliary rotors or rotating airfoils of engines.

Propeller end. The end of a reciprocating engine to which the propeller is attached.

PropFan engine. The registered trade name by Hamilton Standard of an ultra-high-bypass turbine engine. See UHB engine.

Propulsive efficiency. A measure of the effectiveness with which an aircraft engine converts the fuel it burns into useful thrust. It is the ratio of the thrust horsepower produced by a propeller to the torque horsepower of the shaft turning the propeller. The nearer the speed of the aircraft is to the speed of the exhaust jet or propeller wake, the less kinetic energy is lost in the jet or wake, and the higher the propulsive efficiency.

PRT. Power recovery turbine. A turbine driven by exhaust gases from several cylinders of a reciprocating engine. Energy extracted from exhaust gases by the turbine is coupled, through a fluid clutch, to the engine crankshaft.

Pulsating DC. Direct current whose voltage periodically changes, but whose electrons flow in the same direction all of the time.

Pulse-jet engine. A type of air-breathing reaction engine used during World War II to power jet-propelled missiles. Fuel is sprayed into the combustion chamber and ignited. As the heated air expands, it closes the one-way shutter valve in the front of the engine and exits the engine through the nozzle at the rear. As soon as the pressure inside the combustion chamber decreases, air enters through the shutter valve and more fuel is ignited. The thrust is produced in a series of pulses.

Push fit. A fit between pieces in a mechanical assembly that is close enough to require the parts to be pushed together. A push fit is looser than a press fit, but closer than a free fit.

Pusher engine. An engine installed with the propeller facing the rear of the aircraft. Thrust produced by the propeller mounted on a pusher engine pushes rather than pulls the aircraft.

Pusher propeller. A propeller installed on an aircraft engine so that it faces the rear of the aircraft. Thrust from the propeller pushes rather than pulls the aircraft.

PV diagram. A diagram showing the relationship between the volume of a cylinder and the pressure during a cycle of engine operation.

Q

Quill shaft. A type of shaft used to couple parts of an engine that are subject to torsional loads. A quill shaft is a long, hardened steel shaft with splines on each end. One end splines into the drive shaft and the other end splines into the device being driven. Torsional vibrations are absorbed by the quill shaft twisting.

R

Radial bearing load. The load on a bearing perpendicular to the shaft on which the bearing is mounted. Centrifugal loads are radial loads.

Radial engine (static radial). A form of reciprocating engine in which the cylinders radiate out from a small central crankcase. The pistons in the cylinders drive a central crankshaft which in turn drives the propeller.

Radial-inflow turbine. A turbine, similar in appearance to a centrifugal compressor rotor. Radial-inflow turbines are used to drive the compressor in reciprocating engine turbochargers and some of the smaller APU turbine engines. Hot gases flow into the turbine from its outside rim, then radially inward through the vanes and out of the turbine at its center.

Radiation. See electromagnetic radiation.

Ram air. Air whose pressure has been increased by the forward motion of the aircraft. Ram air pressure is the same as pitot pressure.

Ram drag. The loss of thrust produced by a turbojet or turbofan engine caused by the increase of velocity of air entering the engine. Ram drag is the difference between gross thrust and net thrust.

Ram pressure. Pressure produced when a moving fluid is stopped.

Ram-recovery speed. The speed of an aircraft at which the ram effect caused by the forward movement increases the air pressure at the compressor inlet so that it is the same as that of the ambient air.

Ramjet engine. The simplest type of air-breathing reaction engine. Air entering the front of the engine at a high velocity has fuel sprayed into it and ignited. A barrier formed by the incoming air forces the expanding gases to leave through the nozzle at the rear. The energy added by the burning fuel

accelerates the air and produces a forward thrust. Ramjet engines are used in some military unmanned aircraft that are initially boosted to a speed high enough for the engine to function.

Ratiometer indicator. An analog temperature measuring instrument in which the pointer deflection is proportional to the ratio between the current flowing in an internal reference circuit and that flowing through the temperature-sensing probe.

Reach (spark plug specification). The length of the threads on the shell of a spark plug.

Reaction engine. A form of heat engine that produces thrust by heating a mass of air inside the engine and discharging it at a high velocity through a specially shaped nozzle. The amount of thrust is determined by the mass of the air and the amount it is accelerated.

Reactive power. Wattless power in an AC circuit. It is the power consumed in the inductive and capacitive reactances. Reactive power is expressed in volt-amps reactive (var) or in kilovolt-amps reactive (kvar).

Reamed fir. The fit of a shaft in a hole in which the hole is drilled undersize and cut with a reamer to the correct diameter. Reamed holes have smooth walls and a consistent diameter.

Rebuilt engine. A used engine that has been completely disassembled, inspected, repaired as necessary, and reassembled, tested, and approved in the same manner and to the same tolerances and limits as a new engine, using either new or used parts. However, all parts used must conform to all production drawings, tolerances, and limits for new parts, or be of approved oversize or undersize dimensions for a new engine. According to 14 CFR part 91, section 91.421, a rebuilt engine is considered to have no precious operating history and may be issued a zero-time logbook. Only the engine manufacturer can rebuild an engine and issue a zero-time record.

Reciprocating engine. A type of heat engine that changes the reciprocating (back-and-forth) motion of pistons inside the cylinders into rotary motion of a crank-shaft.

Rectifier. A device that allows electrons to flow in one direction while preventing their flow in the opposite direction. Rectifiers are used to change AC into DC.

Reheat system. The British name for an afterburner. See afterburner.

Reid vapor pressure. The amount of pressure that must be exerted on a liquid to keep it from vaporizing. Reid vapor pressure is measured at 100 ºF.

Reliability. The ability of an aircraft engine to perform its designed functions under widely varying operating conditions.

Residual magnetic particle inspection. A form of magnetic particle inspection for small steel parts that have a high degree of retentivity. The part is magnetized, removed, and inspected away from the magnetizing machine.

Residual magnetism. The magnetism that remains in the field frame of a generator when no current is flowing in the field coils.

Residual voltage. The voltage produced in a generator armature when the armature is rotated in the residual magnetism.

Resistor spark plug. A shielded spark plug with a resistor between the ignition lead terminal and the center electrode. The resistor stops the flow of secondary current when its voltage drops to a specified value. The resistor prevents capacitive afterfiring.

Retarded sparks. The timing of the firing of the spark plugs used to start a reciprocating engine. The sparks for starting occur later in terms of crankshaft rotation than those used for normal operation. Retarding the sparks prevent the engine from kicking back when it is being started.

Retentivity. The ability of a magnetizable material to retain the alignment of the magnetic domains after the magnetizing force has been removed. Hard steel normally has a high retentivity, while soft iron and electrical steel both have very low retentivity.

Reverse-flow combustor. A type of combustor in which the air from the compressor enters the combustor outer case and reverses its direction as it flows into the inner liner. It again reverses its direction as it flows into the inner liner. It again reverses its direction before it flows through the turbine. Reverse-flow combustors are used where engine length is critical.

RF energy. Electromagnetic energy with a frequency high enough to radiate from any conductor through which it is flowing.

Rich blowout. A condition in which the fire in a gas turbine engine goes out because the air/fuel mixture ratio is too rich

to sustain combustion.

Rich mixture. A air/fuel mixture that contains less than 15 parts of air to 1 part of fuel, by weight.

Riffle file. A hand file with its teeth formed on a curved surface that resembles a spoon.

Rms. Root mean square. A dimension that is the square root of the average of an infinite number of varying values. An rms dimension is used to indicate the allowable surface roughness of a reciprocating engine cylinder wall.

Rocker arm. A pivoted arm on the cylinder head of a reciprocating engine. The pushrod forces one end of the rocker arm up, and as the other end moves down, it forces the poppet valve off of its seat.

Rocker box. The enclosed part of a reciprocating engine cylinder that houses the rocker arm and valve mechanism.

Rocket engine. A form of reaction engine whose fuel and oxidizer contain all of the oxygen needed for the release of heat energy. The released heat expands the gases which are ejected at a high velocity from a nozzle at the rear of the rocket. Because rocket engines carry their own oxygen, they can operate in outer space where there is no atmosphere.

Rotary radial engine. A form of reciprocating engine used in some early aircraft. The crankshaft is rigidly attached to the airframe, and the propeller, crankcase, and cylinders all revolve as a unit.

Rotating combustion (RC) engine. A form of internal combustion engine in which a rounded, triangular-shaped rotor with sliding seals at the apexes forms the combustion space inside an hourglass-shaped chamber. Expanding gases from the burning air/fuel mixture push the rotor around and turn a geared drive shaft in its center. The RC engine was conceived in Germany by Felix Wankel in 1955.

RPM. Revolutions per minute. A measure of rotational speed. One rpm is one revolution made in one minute.

Run in. A time of controlled operation of a new or freshly overhauled engine that allows the moving parts to wear together.

Run up. A procedure in which an aircraft engine is operated on the ground to determine its condition and performance.

Runout. A measure of the amount a shaft, flange, or disc is bent or fails to run true. Runout is normally measured with a dial indicator.

S

SAE. Society of Automotive Engineers. A professional organization that has formulated standards for the automotive and aviation industries.

Safety gap. A location in a magneto that allows a spark to jump to ground from the secondary circuit before the voltage rises high enough to damage the secondary insulation.

Sand casting. A method of molding metal parts in a mold made of sand. A pattern that duplicates the part to be molded is made of wood and is covered with a special casting sand that contains a resin to bind it. The mold is separated along a special parting line, and the pattern is removed. The mold is put back together, and molten metal is poured into the cavity. When the metal cools, the sand is broken away from the molded part. Sand casting is less expensive than permanent-mold casting.

Saybolt Seconds Universal (SSU) viscosity. A measurement of viscosity (resistance to flow)of a lubricating oil. The number of seconds needed for 60 milliliters of oil at a specified temperature to flow through a calibrated orifice. The viscosity number used for commercial aviation engine lubricating oil relates closely to the SSU viscosity of the oil at 210 ºF.

Scavenge subsystem. The subsystem in the lubrication system of a gas turbine engine that collects oil after it has lubricated the bearings and gears and returns it to the oil tank.

Scimitar shape. The shape of the blades of the propellers mounted on UHB engines. The name is derived from the shape of a curved Asian sword that has its edge on the convex side. See UHB engine.

Scramjet. Supersonic combustion ramjet. A special type of ramjet engine whose fuel can be ignited while the vehicle is mobbing at a supersonic speed.

Scuffing. Severe damage to moving parts caused when one metal part moves across another without sufficient lubricant between them. Enough heat is generated by friction to cause the high points of the surfaces to weld together; continued movement tears, or scuffs, the metal.

Sea-level boosted engine. A reciprocating engine that has had its sea-level rated horsepower increased by supercharging. This is the same as a ground-boosted engine.

Secondary winding. The winding in a magneto or ignition coil that connects to the distributor rotor. The secondary winding is normally made of very small diameter wire and has a large number of turns, typically about 20,000.

Self-accelerating speed. The speed attained by a gas turbine engine during start-up that allows it to accelerate to its normal idling speed without assistance from the starter.

Semiconductor transducer. A piezoelectric crystal that converts input energy of one form, such as pressure, into output energy of another, such as an electrical signal.

Series-wound motor. An electric motor with field coils connected in series with the armature.

Serviceable limits. Limits included in a reciprocating engine overhaul manual. If a part measures outside of the new-parts limits, but within the serviceable limits, it will not likely wear to the point of causing engine failure within the next TBO interval.

Servo system. A type of automatic control system in which part of the output is fed back into the input.

Shaft horsepower. The horsepower actually available at a rotating shaft.

Shielding. The electrically conductive covering placed around an electrical component to intercept and conduct to ground any electromagnetic energy radiated from the device.

Short circuit. A low-resistance connection between two points in an electric circuit.

Shower of Sparks ignition system. A patented ignition system for reciprocating engines. An induction vibrator sends pulsating DC into a set of retard breaker points on one of the magnetos. This provides a hot and retarded spark for starting the engine.

Single-shaft turbine engine. A turboprop engine in which the propeller reduction gears are driven by the same shaft that drives the compressor for the gas generator.

Single-spool gas-turbine engine. A type of axial-flow-compressor gas turbine engine that has only one rotating element.

Skin radiator. A type of radiator used on some early liquid-cooled racing airplanes. The radiator was made of two thin sheets of brass, slightly separated so the heated coolant could flow between them. Skin radiators were mounted on the surface of the wing, on the sides of the fuselage, or on the floats of seaplanes. Air flowing over the smooth surface of the radiator removed heat from the coolant.

Slip (propeller specification). The difference between the geometric and effective pitch of a propeller.

Slip ring. A smooth, continuous ring of brass or copper mounted on the rotor shaft of an electrical generator or alternator. Brushes riding on the smooth surface of the slip ring carry current into and out of the rotor coil.

Slow-blow fuse. A special type of electrical circuit protection device that allows a momentary flow of excess current, but opens the circuit if the excessive flow is sustained.

Sludge. A heavy contaminant that forms in an aircraft engine lubricating oil because of oxidation and chemical decomposition of the oil.

Sludge plugs. Spool-shaped sheet metal plugs installed in the hollow throws of some engine crankshafts.

Slug. The unit of mass equal to that which experiences an acceleration of one foot per second, per second when a force of one pound acts on it. It is equal to 32.174 pounds, or 14.5939 kilograms, of mass. Also called a G-pound.

SOAP. Spectrometric oil analysis program. An oil analysis program in which a sample of oil is burned in an electric arc and an analysis is made of the wavelength composition of the resulting light. Each chemical element in the oil, when burned, produces light containing a unique band of frequencies. A computer analyzes the amount of each band of frequencies and prints out the number of parts of the element per million parts of the entire sample. SOAP can predict engine problems by warning the engine operator of an uncharacteristic increase of any elements in the oil.

Sound suppressor. The airframe component that replaces the turbine engine tail pipe. It reduces the distance the sounds made by the exhaust gases propagate by converting low-frequency vibrations.

Specific gravity. The ratio of the density of a material to the density of pure water.

Specific weight. The ratio of the weight of an aircraft engine to the brake horsepower it develops.

Spline. Parallel slots cut in the periphery of a shaft, parallel to its length. Matching slots, cut into the hub or wheel that fits on the shaft, lock the shaft into the device to transmit torque.

Sprag clutch. A freewheeling, nonreversible clutch that allows torque to be applied to a driven unit in one direction only.

Springback. A condition in the rigging of an aircraft engine control in which the stop at the engine is reached before the stop in the flight deck. The flight deck control moves slightly after the stop in the engine is reached, and when it is released, it springs back slightly.

Spur-gear pump. A form of constant-displacement fluid pump that uses two meshing spur-gears mounted in a close fitting housing. Fluid is taken into the housing where it fills the space between the teeth of the gears and is carried around the housing as the gears rotate. On the discharge side of the pump, the teeth of the two gears mesh, and the fluid is forced out of the pump.

Squat switch. An electrical switch actuated by the landing gear scissors on the oleo strut. When no weight is on the landing gear, the oleo piston is extended and the switch is in one position; but when weight is on the gear, the oleo strut compresses and the switch changes its position.

Squealer tip (compressor blade tip). See profile tip.

Squeeze film bearings. Another name for oil-damped bearings. See oil-damped bearings.

Stage length. The distance between landing points in airline operation.

Stage of a compressor. One disc of rotor blades and the following set of stator vanes in an axial-flow compressor.

Staggered timing. Ignition timing that causes the spark plug nearest the exhaust valve to fire a few degrees of crankshaft rotation before the spark plug nearest the intake valve.

Standard day conditions. Conditions that have been decided upon by the ICAO for comparing all aircraft and engine performance. The most basic standard day conditions are: temperature, 15 ºC or 59 ºF; altitude, mean sea level; pressure, 29.92 inches of mercury.

Standard J-1. A World War I training airplane powered by a Curtiss OX-5 engine.

Standpipe. A pipe which protrudes upward from the base of an oil tank and through which oil used for normal engine lubrication is drawn. In the event of a catastrophic leak when all oil available to the engine-driven pump is lost overboard, enough oil is available from an outlet below the standpipe to feather the propeller.

Starter-generator. A single-component starter and generator used on many smaller gas-turbine engines. It is used to start the engine, and when the engine is running, its circuitry is shifted so that it acts as a generator.

Static pressure. The pressure of an unmoving fluid.

Static rpm. The number of revolutions per minute an aircraft engine can produce when the aircraft is not moving.

Steam cooling. A method of liquid cooling in which the coolant, normally water, is allowed to absorb enough heat that it boils. The steam gives up its heat when it condenses back into a liquid.

Stellite. A nonferrous alloy of cobalt, chromium, and tungsten. Stellite is hard, water resistant, and corrosion resistant, and it does not soften until its temperature is extremely high. Stellite is welded to the faces of many reciprocating engine exhaust valves that operate at very high temperatures.

Stepping motor. A precision electric motor whose output shaft position is changed in steps by pulses from the control device. Stepping motors can make high-torque changes in small angular increments to their output shaft.

Stoichiometric mixture. The air/fuel mixture ratio that, when burned, leaves no uncombined oxygen nor any free carbon. It releases the maximum amount of heat, and therefore produces the highest exhaust gas temperature. A stoichiometric mixture of gasoline and air contains 15 pounds of air for 1 pound of gasoline.

Straight-through combustor. A combustor in a gas turbine engine through which the air from the compressor to the turbine flows in an essentially straight line.

Stratosphere. The upper part of the Earth's atmosphere. The stratosphere extends upward from the tropopause, which is approximately 36,000 feet above the surface of the Earth, to approximately 85,000 feet. The temperature of the air in the stratosphere remains constant at -56.5 ºC (-69.7 ºF).

Stress. A force within an object that tries to prevent an outside force from changing its shape.

Stroboscopic tachometer. A tachometer used to measure the speed of any rotating device without physical contact. A highly accurate variable-frequency oscillator triggers a high-intensity strobe light. When the lamp is flashing at the same frequency the device is rotating, the device appears to

stand still.

Stroke. The distance the piston moves inside the cylinder.

Sump (aircraft engine component). A low point in an aircraft engine in which lubricating oil collects and is stored or transferred to an external oil tank. A removable sump attached to the bottom of the crankcase of a reciprocating engine is often called an oil pan.

Sump (fuel tank component). A low point in an aircraft fuel tank in which water and other contaminants collect and are held until they can be drained out.

Supercharged engine. A reciprocating engine that uses a mechanically driven compressor to increase the air pressure before it enters the engine cylinders.

Supercharger. An air compressor used to increase the pressure of the air being taken into the cylinders of a reciprocating engine.

Surface roughness. The condition of the surface of a reciprocating engine cylinder wall that has been honed to make it hold lubricating oil. Surface roughness is measured in micro-inches rms.

Surge. A condition of unstable airflow, through the compressor of a gas turbine engine, in which the compressor blades have an excessive angle of attack. Surge usually affects an entire stage of compression.

Synthetic oil. Oil made by chemical synthesis of a mineral, animal, or vegetable base. Synthetic oils have appropriate additives that give them such characteristics as low volatility, low pour point, high viscosity index, good lubricating qualities, low coke and lacquer formation, and low foaming.

T

Tachometer. An instrument that measures the rotational speed of an object.

TAI. Thermal anti-ice. A system used to prevent the formation of ice on an aircraft by flowing heated air inside the structure.

Tail pipe. The portion of the exhaust system of a gas turbine engine through which the gases leave. The tail pipe is often called the exhaust duct, or exhaust pipe.

TBO. Time between overhauls. A time period specified by the manufacturer of an aircraft engine as the maximum length of time an engine should be operated between overhauls without normal wear causing parts of the engine to be worn beyond safe limits. TBO depends upon proper operation and maintenance in accordance with the engine manufacturer's recommendations. The overhaul of an engine when it reaches its TBO hours is not mandatory, except for certain commercial operators that have the requirement written into their operations manual.

TDC. Top dead center. The position of a piston in a reciprocating engine when the piston is at the top of its stroke and the wrist pin, crankpin, and center of the crankshaft are all in line.

TEL. Tetraethyl lead.

Test club. A wide-blade, short-diameter propeller used on a reciprocating engine when it is run in a test cell. A test club applies a specific load to the engine and forces the maximum amount of air through the engine cooling fins.

Thermal efficiency. The ratio of the amount of useful work produced by a heat engine, to the amount of work that could be done by all of the heat energy available in the fuel burned.

Thermal expansion coefficient. A number that relates to the change in the physical dimensions of a material as the temperature of the material changes. The thermal expansion coefficient of aluminum is approximately twice that of steel.

Thermal shock. The sudden change in engine operating temperature that occurs when engine power is suddenly reduced at the same time the airspeed, thus the cooling, is increased. Thermal shock occurs when an aircraft is required to rapidly descend to a lower altitude.

Thermistor. A semiconductor material whose electrical resistance varies with its temperature.

Thermocouple. A device used to generate an electrical current. A thermocouple is made of two dissimilar metal wires whose ends are welded together to form a loop. A voltage exists in the loop proportional to the difference in temperature of the junctions at which the wires are joined. The amount of current flowing in the loop is determined by the types of metals used for the wires, the temperature difference between the junctions, and the resistance of the wires.

Thermosetting resin. A plastic resin that, once it has been hardened by heat, cannot be softened by heating again.

Thermostatic valve. A temperature-sensitive valve that controls the temperature of oil in an aircraft engine. When

the oil is cold, the valve shifts and directs the oil through the oil cooler.

Thermoswitch. An electrical switch that closes a circuit when it is exposed to a specified high temperature.

Three-dimensional cam. A drum-shaped cam in a hydro-mechanical fuel control whose outer surface is ground so that followers riding on the surface, as the cam is moved up and down and rotated, can move mechanical linkages to control the fuel according to a preprogrammed schedule.

Throttle. The control in an aircraft that regulates the power or thrust the pilot wants the engine to produce.

Throw (crankshaft design). See offset throw.

Thrust horsepower. The horsepower equivalent of the thrust produced by a turbojet engine. Thrust horsepower is found by multiplying the net thrust of the engine, measured in pounds, by the speed of the aircraft, measured in miles per hour, and then dividing this by 375.

Thrust. The aerodynamic force produced by a propeller or turbojet engine as it forces a mass of air to the rear, behind the aircraft. A propeller produces its thrust by accelerating a large mass of air by a relatively small amount. A turbojet engine produces its thrust by accelerating a smaller mass of air by a much larger amount.

Time-Rite indicator. A patented piston-position indicator used to find the position of the piston in the cylinder of a reciprocating engine. The body of the Time-Rite indicator screws into a spark plug hole, and as the piston moves outward in the cylinder, it contacts the arm of the indicator. A pointer contacted by the arm moves across a calibrated scale to show the location of the piston in degrees of crankshaft rotation before top center.

Timing light. An indicator light used when timing magnetos to an engine to indicate when the breaker points open. Some timing lights incorporate an oscillator or buzzer that changes its pitch when the points open.

TIT. Turbine inlet temperature. The temperature of the gases from the combustion section of a gas turbine engine as they enter the turbine inlet guide vanes or the first stage of the turbine.

Toggle. A T-shaped handle fitted onto the end of a cable used to engage a simple starter with an overrunning clutch.

Top overhaul. An overhaul of the cylinders of an aircraft engine. The valves, pistons, and cylinders are overhauled, but the crankcase is not opened.

Torque. A force that produces or tries to produce rotation.

Total pressure. The pressure a column of moving fluid would have if it were stopped from its motion. Total pressure is the sum of dynamic pressure and static pressure.

Total temperature. The temperature of moving fluid that has been stopped from its motion. Total temperature is the sum of static temperature and the temperature rise caused by the ram effect as the fluid was stopped.

Townend ring. A type of ring cowling used over a single-row radial engine. The cross section of the ring is in the form of an airfoil that produces enough forward thrust to compensate for the cooling drag of the engine. In the United States, townend rings are often called speed rings.

Track. The path followed by a blade segment of a propeller or helicopter rotor in one rotation.

Tractor engine. An engine installed with the propeller facing the front of the aircraft. Thrust produced by the propeller mounted on a tractor engine pulls the aircraft through the air. tractor propeller. A propeller mounted on an airplane in such a way that its thrust pulls the aircraft.

Trailing edge. The thin edge at the rear of a propeller blade.

Transducer. A device that changes energy from one form to another. Commonly used transducers change mechanical movement or pressures into electrical signals.

Transformer. An electrical component used to change the voltage and current in an AC circuit.

Transonic range. Flight at Mach numbers between 0.8 and 1.2. In this range, some air passing over the aircraft is subsonic, and some is supersonic.

Trend monitoring. A system for comparing engine performance parameters with a baseline of these same parameters established when the engine was new or newly overhauled. Parameters such as EGT, rpm, fuel flow, and oil consumption are monitored on every flight, and the baseline is plotted. Any deviation from a normal increase or decrease warns the technician of an impending problem.

Tricresyl phosphate (TCP). A colorless, combustible compound, $(CH_3C_6H_4O)_3PO$, that is used as a plasticizer in aircraft dope and an additive in gasoline and lubricating oil.

TCP aids in scavenging lead deposits left in the cylinders when leaded fuel is burned.

TSFC. Thrust specific fuel consumption. A measure of efficiency of a turbojet or turbofan engine. It is a measure of the number of pounds of fuel burned per hour for each pound of thrust produced.

Turbine. A wheel fitted with vanes, or buckets, radiating outward from its circumference. The reactive or aerodynamic force caused by the fluid flowing through the vanes is converted into mechanical power that spins the shaft on which the wheel is mounted.

Turbine engine. See gas turbine engine.

Turbine inlet guide vanes. A series of stator vanes immediately ahead of the first-stage turbine. The function of the inlet guide vanes is to divert the hot gases in the proper direction to enter the turbine, and to provide a series of convergent ducts which increase the velocity of the gases.

Turbine nozzle. Another name for turbine inlet guide vanes.

Turbocharger. An exhaust-driven air compressor used to increase the power of a reciprocating engine. A turbocharger uses a small radial inflow turbine in the exhaust system to drive a centrifugal-type air compressor on the turbine shaft. The compressed air is directed into the engine cylinders to increase power.

Turbo-compound engine. A reciprocating engine that has power recovery turbines in its exhaust system. The power extracted from the exhaust by these turbines is directed into the engine crankshaft through a fluid coupling.

Turbofan engine. A type of gas turbine engine that has a set of lengthened blades on the low-pressure compressor or low-pressure turbine. Air moved by these special blades bypasses the core engine and produces between 30% and 75% of the total thrust.

Turbojet engine. A gas turbine engine that produces thrust by accelerating the air flowing through it. A minimum of energy is extracted by the turbine, with the majority used to produce an exhaust velocity much greater than the inlet velocity. The amount of thrust produced by the engine is determined by the amount the air is accelerated as it flows through the engine.

Turboprop engine. A turbine engine in which several stages of turbines are used to extract as much energy as possible. The turbines drive reduction gears which in turn drive a propeller.

Turboshaft engine. A turbine engine in which several stages of turbines are used to extract as much energy as possible. The turbines drive shafts which are used to drive helicopter rotors, generators, or pumps.

Turbosupercharger. A centrifugal air compressor driven by exhaust gases flowing through a turbine. The compressed air is used to increase the power produced by a reciprocating engine at altitude.

Two-spool engine. See dual-spool gas turbine engine.

Two-stroke cycle. A constant-volume cycle of energy transformation that completes its operating cycle in two strikes of the piston, one up and one down. When the piston moves up, fuel is pulled into the crankcase, and at the same time the air/fuel mixture inside the cylinder is compressed. When the piston is near the top of its stroke, a spark plug ignites the compressed air/fuel mixture, and the burning and expanding gases force the piston down. Near the bottom of the stroke, the piston uncovers an exhaust port and the burned gases leave the cylinder. When the piston moves further down, it uncovers the intake port, and a fresh charge of fuel and air are forced from the crankcase into the cylinder.

U

UDF engine. Un-ducted Fan™. The trade name registered by General Electric for a type of ultra-high-bypass turbofan engine that drives one or more wide-blade propellers that have between eight and twelve blades. These blades, which are not enclosed in a duct or shroud, are very thin, have wide chords, and are highly swept back in a scimitar shape that enables them to power airplanes flying in the speed range near Mach 0.8.

UHB (ultra-high-bypass) engine. A turbine that drives a pair of ducted or un-ducted contrarotating propellers which have eight to 12 variable-pitch blades. These blades are very thin, have wide chords, and are swept back with a scimitar shape that allows them to power airplanes flying in the speed range of Mach 0.8. The blades are made of advanced composites for high strength and light weight. USH engines may be of either the tractor or pusher type, and have a bypass ratio in excess of 30:1.

Underspeed condition. A speed condition in which the engine is turning at an RPM lower than that for which the propeller governor is set.

Unidirectional fibers. Fibers in a piece of composite material arranged so that they sustain loads in only one direction.

Updraft carburetor. A carburetor that mounts on the bottom

of a reciprocating engine. Air entering the engine flows upward through the carburetor.

Upper-deck pressure. The absolute pressure of air at the inlet to the fuel metering system of a turbocharged engine. Upper-deck pressure is the same as the turbocharger discharge pressure.

V

V-blocks. A fixture that allows a shaft to be centered and rotated to measure any out-of-round condition.

V-engine. A form of reciprocating engine in which the cylinders are arranged in two banks. The banks are separated by an angle of between 45º and 90º. Pistons in two cylinders, one in each bank, are connected to each throw of the crankshaft.

Valence electrons. Electrons in the outer shell, or ring, around the nucleus of an atom. It is the valence electrons that give an atom its electrical characteristics and are the electrons that may be pulled loose from an atom to cause electrical current.

Valve overlap. The portion of the operating cycle of a four-stroke-cycle reciprocating engine during which both the intake and exhaust valves are off of their seats at the same time.

Vapor lock. A condition of fuel starvation that can occur in a reciprocating engine fuel system. If the fuel in the line between the tank and carburetor is heated enough for the fuel to vaporize, a bubble will form in the line. If the vapor pressure of the bubble is high enough, it will block the fuel and keep it from flowing to the engine.

Vapor pressure. The amount of pressure needed above a liquid to prevent it from evaporating.

Vaporize. The changing of a liquid into a vapor.

Vectored-thrust engine. A turbojet or turbofan engine with the fan and/or exhaust nozzles mounted in such a way that they may be rotated in flight to produce forward, vertically upward, or rearward thrust.

Velocity. A vector quantity that expresses both the speed an object is moving and the direction in which it is moving.

Velocity turbine. A turbine driven by forces produced by the velocity, rather than the pressure, of gases flowing through the vanes.

Venture. A specially shaped restrictor in a tube designed to speed up the flow of fluid passing through it. According to Bernoulli's principal, any time the flow of fluid speeds up without losing or gaining any energy from the outside, the pressure of the fluid decreases.

Vernier coupling. A timing coupling used with base-mounted magnetos. The vernier coupling allows the timing to be adjusted in increments of considerably less than one degree.

Vertical tape instrument. A tall rectangular instrument that displays the quantity of the parameter being measured by a movable strip of colored tape. The presentation resembles a vertical bar graph.

Vibration loop. A loop in a rigid fluid line used to prevent vibration from concentrating stresses that could cause the line to break.

VIFF. Vectoring in forward flight. A method of enhancing the maneuverability of an airplane by vectoring the exhaust gases and/or fan-discharge air to produce thrust components not parallel to the longitudinal axis of the aircraft.

Viscosimeter. An instrument used to measure the viscosity of a liquid. The time required for a given volume of liquid at a specified temperature to flow through a calibrated orifice is used to indicate the viscosity of the liquid.

Viscosity. The resistance of a fluid to flow. Viscosity is the stiffness of the fluid, or its internal friction.

Viscosity index (VI). A measure of change in viscosity of an oil as it changes temperature. The higher the viscosity index, the less the viscosity changes.

Viscosity index improver. An additive used to produce a multi-viscosity lubricating oil. The polymer additive expands as temperature increases and contracts as temperature decreases. VI improvers cause viscosity to increase as oil heats and decrease as it cools.

Volatile memory. Computer memory that is lost when the power to the computer is turned off.

Volatility. The characteristic of a liquid that relates to its ability to vaporize or change into a gas.

Volumetric efficiency. The ratio of the volume of the charge of the fuel and air inside the cylinder of a reciprocating engine to the total physical volume of the cylinder.

Von Ohain, Dr. Hans Pabst. The designer and developer of the first turbojet engine to power an airplane. His HeS3b engine was built in Germany by the Heinkel Company and it flew in a Heinkel He178 airplane on August 27, 1939.

Vortex. A whirling mass of air that sucks everything near it toward its center.

Vortex dissipator. A high-velocity stream of compressor bleed air blown from a nozzle into an area where vortices are likely to form. Vortex dissipaters destroy the vortices that would otherwise suck debris from the ground into engines mounted in pods that are low to the ground.

W

Wake. The high-velocity stream of turbulent air behind an operating aircraft engine.

Wankel engine. See rotating combustion (RC) engine.

Waste gate. A controllable butterfly valve in the exhaust pipe of a reciprocating engine equipped with an exhaust-driven turbocharger. When the waste gate is open, exhaust gases leave the engine through the exhaust pipe, and when it is closed, they leave through the turbine.

Watt. The basic unit of power in the metric system. One watt is the amount of power needed to do one joule (0.7376 foot-pound of work) in one second. One watt is $\frac{1}{746}$ horsepower.

Wet-sump engine. An engine that carries its lubricating oil supply in a reservoir that is part of the engine itself.

Wet-sump lubrication system. A lubrication system in which the oil supply is carried within the engine itself. Return oil drains into the oil reservoir by gravity.

Whittle, Sir Frank. The British Royal Air Force flying officer who in 1929 filed a patent application for a turbojet engine. Whittle's engine first flew in a Gloster E.28 on May 15, 1941. The first jet flight in America was made on October 2, 1942, in a Bell XP-59A that was powered by two Whittle-type General Electric I-A engines.

Windmilling propeller. A propeller that is rotated by air flowing over the blades rather than powered by the engine.

Work. The product of a force times the distance the force is moved.

Worm gear. A helical gear mounted on a shaft. The worm meshes with a spur gear whose teeth are cut at an angle to its face. A worm gear is an irreversible mechanism. The rotation of the shaft, on which the worm gear locks the spur gear so its shaft cannot be rotated.

Wrist pin. The hardened steel pin that attaches a piston to the small end of a connecting rod.

Y

Yaw. Rotation of an aircraft about its vertical axis.

Z

Zero-lash valve lifter. A hydraulic valve lifter that maintains zero clearance in the valve actuating mechanism.