

## Appendix II

### GLOSSARY

Acceleration lag -- in the turbine engine, delay between the time instant power is requested and when power is available. The time it takes the engine to accelerate and give the required power increase.

Aerodynamic drag -- force which thrust must overcome to move an aircraft forward. Design can lessen aerodynamic drag through streamlining. Drag increases with increased speed.

Airbleed actuator -- device that operates the interstage bleed system, to improve compressor acceleration characteristics by unloading small amounts of compressed air.

Air density -- total mass of air per given volume, the weight of a given volume of air. Air is denser at lower altitude, at lower temperature, and lower humidity.

Air-fuel ratio -- 15 parts of air to 1 part of fuel by weight, the mixture to be burned in the combustion chamber.

Air inlet -- large, smooth aluminum duct to conduct the air into the compressor.

Ambient air -- surrounding air.

Angle of attack -- the acute angle formed by the direction of the relative wind and some longitudinal reference axis of the aircraft.

Annular combustion chamber -- two-part combustion chamber made up of an annular liner and a housing assembly. The compressed air goes into a ring-shaped space formed by the annular liner around the turbine shaft rather than into individual combustion chambers. The space between the outer liner wall and the housing assembly allows the flow of cooling air. Used with axial-flow and dual compressors.

Annular reverse-flow -- type of gas turbine engine most commonly used in Army aircraft. Air flow direction is reversed in the combustion area.

Anodizing -- putting a protective oxide film on a light metal by an electrolytic process.

Anti-icing system -- device that supplies hot air under pressure to prevent icing of the inlet housing areas and inlet guide vanes. Hot scavenged oil is also circulated through internal passages in the walls and struts.

Army Spectrometric Oil Analysis Program (ASOAP) -- periodic oil analysis for microscopic metal particles. This takes place at an oil analysis laboratory.

Atmospheric pressure -- barometric pressure exerted by the atmosphere as a result of gravitational attraction above the point in question.

Atomizer -- nozzle that creates a highly atomized and accurately shaped spray of fuel suitable for rapid mixing and combustion.

Axial-flow compressor -- one in which the air is compressed parallel to the axis of the engine. It is made up of a series of alternating rotor and stator vane stages.

Bleed system -- device that unloads small amounts of air to relieve pressure.

Boss -- raised rim around a hole; e.g., axle hole in a wheel. Circular projection on a casting, usually serving as the seat for a bolt head or nut.

Brayton cycle -- constant pressure cycle, with four basic operations which it accomplishes simultaneously and continuously for an uninterrupted flow of power. The turbine engine operates on this cycle.

Can-annular combustion chamber -- one with characteristics of both the can and annular types. It has an outer shell and a number of individual cylindrical liners.

Can combustion chamber -- one made up of individual combustion chambers in which the air from the compressor enters each individual chamber through the adapter.

Caustics -- substances that can burn, corrode, or destroy animal or other organic tissue by chemical action.

Centrifugal-axial flow compressor -- combination of the centrifugal-flow and the axial-flow compressors. It usually consists of a five- or seven-stage axial-flow compressor and one centrifugal-flow compressor. Also called the dual compressor.

Centrifugal-flow compressor -- one with an impeller (rotor), stator, and compressor manifold. The rotor revolves at high speed, drawing air into the blades. Centrifugal force accelerates the air, and it moves through the stator and through the manifold.

Combustion -- process of burning the fuel-air mixture in a gas turbine engine.

Combustion chamber -- part of a turbine engine in which the propulsive power is developed by combustion of the injected fuel and the expansive force of the resulting gases.

Combustion chamber liner -- engine part usually constructed of welded high-nickel steel, subjected to flame of extremely high temperature. It is behind the compressor and receives the compressed air which is mixed with fuel and ignited. The combustor is where the combustion takes place.

Combustor -- the combustion chamber of a gas turbine engine with its associated burners, igniters, and injection devices.

Compressor -- that section of an engine that produces an increase in air pressure. It is made up of rotating and stationary vane assemblies. It is the gas producer, or it may be thought of as an air pump.

Compressor rotor -- impeller, may be thought of as an air pump. It accelerates the air rearward into the first stage vane assemblies.

Compressor stall -- separation of the airflow from the suction surface of the fixed or rotating blades of a compressor. Any degree of stall reduces airflow.

Concave -- pressure side of an airfoil.

Conduction -- transfer of heat through material by communication of kinetic energy from particle to particle rather than by a flow of heated material.

Convergent area -- place where the cross-sectional area of a duct becomes smaller.

Convergent exhaust duct -- used on fixed-wing aircraft, formed by tapering toward the rear of the duct.

Convex -- suction side of an airfoil.

Crossover tube -- duct carrying flame to the individual cylindrical liners of the can-annular combustion chamber.

Diffuser -- aft structural member of an engine. It receives high velocity air from the centrifugal impeller and decreases velocity and increases air pressure. In the combustor, a diffuser forms a divergent flow path for the exhaust gases.

Diffusion -- process by which gases intermingle as the result of their spontaneous movement caused by thermal agitation.

Directional references -- specific definitions of terms referring to gas turbine engines to identify front and rear, right and left, bottom and top.

Divergent area -- place where air flows from a smaller into a larger area.

Divergent exhaust duct -- used on helicopters, device to diffuse the exhaust gases rearward and to eliminate thrust.

Dry-cleaning solvent -- cleaning compound that may be used for all metal parts.

Dry-sump engine -- one in which the oil is stored separate from the engine.

Dual compressor -- see centrifugal-flow, axial-flow compressor.

Duplex nozzle -- dual-orifice channel through which highly atomized and accurately shaped sprays of fuel go into the combustion chamber.

Engine airflow path -- route of the airflow through the engine. See paragraph 4. 4a for a detailed description of airflow through a T53-L-13.

Engine oil pressure indicating system -- device that gives continuous readings of engine oil pump pressure in psi.

Engine oil temperature indicating system -- device electrically connected to the 28v dc system which transmits temperature readings to the indicator in degrees centigrade.

Engine speed notation -- capital letter N represents the rotational speed of the engine. When a number is placed after the N, as in N<sub>1</sub>, it indicates a specific system on the engine.

Engine stations -- specific locations on the engine designating temperature- or pressure-measuring locations. For example, T3 means the third temperature pickup on the engine.

Engine surge -- result of compressor stall. The complete engine in stall.

Exhaust -- hot gases discharged from the engine through the exhaust diffuser section.

Exhaust diffuser -- section composed of an inner and outer housing, separated by hollow struts across the exhaust passage. It forms a divergent flow path for the exhaust gases.

Exhaust gas temperature indicator -- sensitive millivoltmeter calibrated in degree centigrade, activated by an electrical force generated by its thermocouple.

Fir tree mount -- manner of attaching the blades to the disk in the turbine rotor assembly. The root of the blade where it is attached to the disk is shaped like a fir tree. See figures 1.27 and 1.28 on page 42.

Foreign object damage -- commonly called FOD, harm or destruction to the turbine engine caused by foreign objects sucked into the inlet area of the engine with the required air.

Forged -- shaped by hammering. Only the malleable metals are worked successfully. The application of heat increases plasticity.

Free-power turbine engine -- the turbine engine used by the Army. Sixty percent of the energy produced by combustion is extracted by the gas producer turbine to drive the gas producer rotor. The rest of the energy is converted to shaft horsepower to drive the out-put shaft of the engine.

Frictional loss -- resistance to the relative motion of air flowing along a duct.

Frontal area -- front part of a gas turbine engine, smaller than that of a reciprocating engine, therefore producing less drag.

Front of engine -- end from which power is extracted. An exception is the T73 engine on the CH-54, in which the power is extracted at the end where the exhaust gas is expelled.

Fuel-air ratio -- see air-fuel ratio.

Fuel atomizer -- See atomizer.

Fuel controls -- devices to control fuel flow. They are usually hydromechanical and include speed governors, servo systems, valves, metering systems, and sensing pickups.

Fuel divider -- device that meters fuel to the engine nozzles according to a predetermined schedule of secondary flow versus primary flow.

Fuel nozzle -- device to inject fuel into the combustion chamber in a highly atomized and accurately shaped spray.

Fuel pressure indicating system -- device that gives continuous readings in psi of fuel pressure in the main fuel supply line.

Gas producer ( $N_1$ ) -- compressor in a free-power turbine engine.

Gas turbine engine -- aircraft powerplant that is adaptable for both airplanes and helicopters.

Gerotor pump -- modified gear-type pump with two moving parts, an inner toothed element and an outer toothed element. The inner one has one less tooth than the outer.

Glow plug -- device that consists of a heating element in a short conventional-looking spark plug.

Heat exchanger -- fuel-oil cooler, to help cool the oil. The exchanger is a cylindrical oil chamber surrounded by a jacket through which the fuel passes. Heat from the oil is transferred to the fuel by conduction.

Humidity -- amount or degree of moisture in the air. If humidity increases, air density is decreased. Humidity has little effect on density, however, in comparison with temperature and pressure changes.

Igniter plugs -- spark plugs which function only during starting and cut out of the circuit as soon as combustion is self-supporting.

Imbalance -- uneven distribution of weight resulting in rotating parts being out of balance. Measured in inch-grams or inch-ounces.

Impeller rotor -- rotor in a compressor that revolves at high speed, drawing air into the blades.

Inlet guide vanes -- devices positioned by the inlet guide vane actuator pilot valve. They are located in front of the first compressor rotor, and they control the angle of incidence of the inlet air, thus ensuring a compressor surge margin.

Inlet housing assembly -- forward structural support of the engine.

Jetcal analyzer -- device used to check the exhaust gas temperature during periodic maintenance inspections or when abnormally high or low temperatures are noted.

Jet propulsion -- propulsion of a body by means of a jet or stream of gas, obtaining all or most of its thrust by reaction to the ejection of the combustion products (gas).

Joule -- unit of energy or work used in rating gas turbine ignition systems. A joule is equal to the amount of energy expended in one second by an electric current of one ampere through a resistance of one ohm.

Kinetic energy -- work energy associated with motion.

Labyrinth seal -- device for preventing leakage of gas on the gas generator shaft in a turbine. A labyrinth consists of a series of projections on the rotating element running in close contact with grooves on the stationary element.

Maintenance allocation chart -- chart in a -20 TM that assigns maintenance tasks to the lowest level capable of doing them, based on experience, skills, tools, and time available.

Manifold -- component in which air or gases are collected for intake or expulsion.

Micron --one millionth of a meter.

Mil -- unit of length equal to 1/1000 inch. Unit of angular measurement equal to 1/6400 of the circumference of a circle.

N<sub>1</sub> system -- gas producer.

N<sub>2</sub> system -- power turbine and shaft.

Nacelle -- enclosed housing for an aircraft engine, outside the fuselage.

Nozzle -- channel through which gas is conveyed to the rotor vanes of a turbine. Its purpose is to convert pressure into velocity.

Orifice -- opening having a closed perimeter through which a fluid may discharge. It may be open to the atmosphere, or it may be partially or completely submerged in the discharged fluid.

Oscillograph -- instrument that produces a record of variations in an electrical quantity.

Oscilloscope -- instrument that shows the presence and form of an electric current.

Outside air temperature -- commonly abbreviated as O. A. T, the temperature of the air outside the engine.

Otto cycle -- a constant volume cycle, with four distinct operations performed intermittently. Reciprocating engines operate on this cycle.

Overspeed governor, N<sub>2</sub> -- gearbox mounted on engine inlet housing and driven from the power shaft.

Overspeed governor, fuel control -- part of the torquemeter system, an individual pumping unit which, with the tachometer drive assembly, sets the torquemeter oil pressure.

PD 680 -- cleaning solvent for exterior of engine and its attached components.

Pneumatic -- something moved or worked by air pressure.

Power-to-weight ratio -- relationship between power and weight. Turbine engines produce more power for weight than reciprocating engines.

Power turbine (N<sub>2</sub>) -- turbine that is free and independent of the gas producer system. It develops rotational shaft power.

Pressure oil system -- method of supplying oil under pressure to engine parts.

Pressure pumps -- devices to put oil into the system.

Pressurizing and drain dump valve -- device to prevent flow of fuel to the nozzle until enough pressure is built up in the fuel control. One also drains the fuel manifold at engine shutdown and traps fuel in the upper portion of the system to keep the fuel control primed for faster starts.

Primary air -- air that mixes with fuel in the combustion chamber, to form a combustible mixture. The ratio is 15 parts of air to 1 part of fuel.

Radial inflow turbine -- type of turbine made by some manufacturers, not used in any Army aircraft today, even though it is rugged and simple, relatively inexpensive, and easy to manufacture. Similar in design and construction to the centrifugal-flow compressor.

Ram air pressure -- free stream air pressure, provided by the forward motion of the engine.

Rear of engine -- end of engine from which exhaust gas is expelled.

Reciprocating engine -- device which produces motion in which the power originates in pistons and cylinders.

Reverse flow -- change in direction of airflow in the combustion chamber of a gas turbine engine.

Rotational direction -- direction of movement of the rotating part, determined by viewing the engine from the rear.

Rotor -- in a gas turbine engine, the turbine wheel.

Scavenge oil system -- method of returning oil from the engine to the oil tank, for cooling and reuse.

Scavenger pumps -- those that drain oil from the sumps at various parts of the engine, return it through the oil cooler, and back to the oil tank.

Secondary air -- large surplus of air that cools the hot sections of a gas turbine engine to lower temperatures.

Shaft horsepower (SHP) -- energy used to drive the compressor and accessories in a turbine engine.

Shroud -- device used with turbine rotor to prevent blade tip losses and excessive vibrations. The shrouded blades can be thinner than unprotected ones.

Simplex nozzles -- single-orifice channels through which highly atomized and accurately shaped sprays of fuel go into the combustion chamber.

Solvent immersion -- cleaning method in which parts are immersed in solvent to remove carbon, gum, grease, and other surface contaminants.

Splines -- teeth in a gear.

Speed governor -- device to relieve the pilot from resetting the power lever when outside air temperature and pressure change. Consists of flyweights balanced by a spring.

Standard day conditions -- 59°F, sea level barometric pressure (29.92 inches of mercury).

Stator -- part of assembly that remains stationary with respect to a rotating part. Stator vanes are a stationary set of airfoils in a compressor.

Tachometer -- device that gives the pilot a continuous indication of engine rpm.

Tachometer generator -- device that supplies power at a frequency proportional to the driven speed which drives the synchronous motors in the indicator.

TBO -- time between overhauls. This is established by the Army and the engine manufacturer.

Test cell -- building, usually concrete, that contains both a control room and an engine room, used for testing engines. The test cell is at the manufacturer's; a mobile engine-test unit is used in the field.

Thermocouple -- device composed of two pieces of metal or wire joined where heat is to be applied and the free end connected to an electrical measuring instrument.

Thermodynamic cycle -- succession of processes which involve changes in temperature, pressure, and density in which the substance acts as a means of transformation of energy. See Otto and Brayton cycles.

Thrust -- pushing or pulling force developed by an aircraft engine.

Torquemeter -- hydromechanical torque-measuring device located in the reduction-gear section of the inlet housing. The measurement is read as torque oil pressure in psi.

Torquemeter indicating system -- pressure indicator for continuous readings of engine output-shaft torque.

Transducer -- device actuated by power from one system and supplying power to a second system.

Turbine -- rotary engine actuated by the reaction of a current of fluid (gas in this case) subject to pressure. The turbine is usually made with a series of curved vanes on a central spindle arranged to rotate.

Turbine nozzle -- stationary nozzle which discharges a jet of gas against the blades on the periphery of a turbine wheel.

Turbine rotor -- rotating portion of a turbine engine. It is made of specially alloyed steel because of severe centrifugal loads, the result of high rotational speeds.

Turbine section -- part of the turbine engine that extracts the kinetic energy of the expanding gases and transforms it into shaft horsepower.

Turbofan -- compressor section of a turbine engine.

Turbojet -- engine most commonly used in high-speed, high-altitude aircraft.

Turboprop engine -- one in which a turbine rotor converts the energy of the expanding gases to rotational shaft power, to provide power for a propeller.

Turboshaft -- engine in which a turbine rotor converts the energy of the expanding gases to rotational shaft power, to provide power for a helicopter transmission.

Vapor blasting -- abrasive method used to clean combustor parts. Not to be used on ceramic, magnesium, painted, or aluminum surfaces.

Vapor degreasing -- cleaning method used on unpainted metal parts or aluminum-painted steel parts.

Vaporizing tubes -- devices used instead of fuel nozzles in a T53-L-11 engine.

Variable inlet guide vanes -- devices located in front of the first compressor rotor to guide the angle of incidence of the inlet air to the first compressor rotor.

Velocity -- speed or rate of motion in a given direction, and in a given frame of reference.

Venturi -- short tube with flaring ends connected by a constricted middle section forming a throat. It depends for operation upon the fact that as the velocity of a fluid increases in the throat, the pressure decreases. It is used for measuring the quantity of a fluid flowing in connection with other devices for measuring airspeed and for producing suction, especially for driving aircraft instruments by means of a branch tube joined at the throat.

Vermatherm element -- device which senses outlet fuel temperature and closes the core valve and opens the bypass valve.

Vibration -- periodic motion of a body or medium in alternately opposite directions from the position of equilibrium. Vibration meter--device for measuring vibrations.

Weldment -- unit formed by welding together an assembly of pieces, as in gear housing.