Glossary

Adverse Loaded CG Check. A weight and balance check to determine that no condition of legal loading of an aircraft can move the CG outside of its allowable limits.

Aircraft Specifications. Documentation containing the pertinent specifications for aircraft certificated under the CARs.

Aircraft Flight Manual (AFM). An approved document, prepared by the holder of a Type Certificate for an aircraft, that specifies the operating limitations and contains the required markings and placards and other information applicable to the regulations under which the aircraft was certificated.

Approved Type Certificate. A certificate of approval issued by an aviation regulatory authority for the design of an aircraft, engine, or propeller.

Arm. The horizontal distance from the reference datum to the centre of gravity (CG) of an item. The algebraic sign is plus (+) if measured aft of the datum or to the right side of the centre line when considering a lateral calculation. The algebraic sign is minus (-) if measured forward of the datum or the left side of the centre line when considering a lateral calculation.

Balanced Laterally. Balanced in such a way that the wings tend to remain level.

Ballast. A weight installed or carried in an aircraft to move the centre of gravity to a location within its allowable limits.

Permanent Ballast (fixed ballast). A weight permanently installed in an aircraft to bring its centre of gravity into allowable limits. Permanent ballast is part of the aircraft empty weight.

Temporary Ballast. Weights that can be carried in a cargo compartment of an aircraft to move the location of CG for a specific flight condition. Temporary ballast must be removed when the aircraft is weighed.

Basic Empty Weight. Standard empty weight plus optional equipment.

Basic Operating Index. The moment of the airplane at its basic operating weight divided by the appropriate reduction factor.

Basic Operating Weight (BOW). The empty weight of the aircraft plus the weight of the required crew, their baggage and other standard item such as meals and potable water.

Bilge Area. The lowest part of an aircraft structure in which water and contaminants collect.

Butt (or buttock) Line Zero. A line through the symmetrical centre of an aircraft from nose to tail. It serves as the datum for measuring the arms used to determine the lateral CG. Lateral moments that cause the aircraft to rotate clockwise are positive (+), and those that cause it to rotate counter clockwise are negative (-).

Calendar Month. A time period used for certification and currency purposes. A calendar month extends from a given day until midnight of the last day of that month.

Centre of Gravity (CG). The point at which an airplane would balance if suspended. Its distance from the reference datum is determined by dividing the total moment by the total weight of the airplane. It is the mass centre of the aircraft, or the theoretical point at which

the entire weight of the aircraft is assumed to be concentrated. It may be expressed in percent of MAC (mean aerodynamic cord) or in inches from the reference datum.

Centre of Lift. The location along the chord line of an aerofoil at which all the lift forces produced by the aerofoil are considered to be concentrated.

Centroid. The distance in inches aft of the datum of the centre of a compartment or a fuel tank for weight and balance purposes.

CG Arm. The arm obtained by adding the airplane's individual moments and dividing the sum by the total weight.

CG Limits. The extreme centre of gravity locations within which the aircraft must be operated at a given weight. These limits are indicated on pertinent FAA aircraft type certificate data sheets, specifications, or weight and balance records.

CG Limits Envelope. An enclosed area on a graph of the airplane loaded weight and the CG location. If lines drawn from the weight and CG cross within this envelope, the airplane is properly loaded.

CG Moment Envelope. An enclosed area on a graph of the airplane loaded weight and loaded moment. If lines drawn from the weight and loaded moment cross within this envelope, the airplane is properly loaded.

Chord. A straight-line distance across a wing from leading edge to trailing edge.

Curtailment. An operator created and CAR 35-approved operational loading envelope that is more restrictive than the manufacturer's CG envelope. It ensures that the aircraft will be operated within limits during all phases of flight.

Curtailment typically accounts for, but is not limited to, in-flight movement of passengers and crew, service equipment, cargo variation, seating variation, etc.

Delta *Δ*. This symbol, ***Δ***, means a change in something.

ΔCG means a change in the centre of gravity location.

Dynamic Load. The actual weight of the aircraft multiplied by the load factor, or the increase in weight caused by acceleration.

Empty Weight. The weight of the airframe, engines, all permanently installed equipment, and unusable fuel. Depending upon the part of the federal regulations under which the aircraft was certificated, either the undrainable oil or full reservoir of oil is included.

Empty-weight Centre of Gravity (EWCG). This is the centre of gravity of the aircraft in the empty condition, containing only the items specified in the aircraft empty weight. This CG is an essential part of the weight and balance record of the aircraft.

Empty-weight Centre of Gravity Range. The distance between the allowable forward and aft empty-weight CG limits.

Equipment List. A list of items approved for installation in a particular aircraft. The list includes the name, part number, weight, and arm of the component. Installation or removal of an item in the equipment list is considered to be a minor alteration.

Fleet Weight. An average weight accepted by the regulator for aircraft of identical make and model that have the same equipment installed. When a fleet weight control program is in effect, the fleet weight of the aircraft can be used rather than every individual aircraft having to be weighed.

Fuel Jettison System. A fuel subsystem that allows the flight crew to dump fuel in an emergency to lower the weight of an aircraft to the maximum landing weight if a return to landing is required before sufficient fuel is burned off. This system must allow enough fuel to be jettisoned that the aircraft can still meet the engine out climb requirements.

Fulcrum. The point about which a lever balances.

Index Point. A location specified by the aircraft manufacturer from which arms used in weight and balance computations are measured. Arms measured from the index point are called index arms.

Interpolate. To determine a value in a series between two known values.

Landing Weight. The take-off weight of an aircraft less the fuel burned and/or dumped enroute.

Large Aircraft. An aircraft of more than 5,700 kg, maximum certificated take-off weight.

Lateral Balance. Balance around the roll, or longitudinal, axis.

Lateral Offset Moment. The moment, in lb-in, of a force that tends to rotate a helicopter about its longitudinal axis. The lateral offset moment is the product of the weight of the object and its distance from butt line zero. Lateral offset moments that tend to rotate the aircraft clockwise are positive, and those that tend to rotate it counter clockwise are negative.

LEMAC. Leading Edge of the Mean Aerodynamic Chord.

Load Cell. A component in an electronic weighing system that is placed between the jack and the jack pad on the aircraft. The load cell contains strain gauges whose resistance changes with the weight on the cell.

Load Factor. The ration of the maximum load an aircraft can sustain to the total weight of the aircraft. Normal category aircraft must have a load factor of a least 3.8, Utility category aircraft 4.4, and acrobatic category aircraft, 6.0.

Loading Graph. A graph of load weight and load moment indexes. Diagonal lines for each item relate the weight to the moment index without having to use mathematics.

Loading Schedule. A method for calculating and documenting aircraft weight and balance prior to taxiing, to ensure the aircraft will remain within all required weight and balance limitations throughout the flight.

Longitudinal Axis. An imaginary line through an aircraft from nose to tail, passing through its centre of gravity.

Longitudinal Balance. Balance around the pitch, or lateral, axis.

MAC. Mean Aerodynamic Chord.

Major Alteration. An alteration not listed in the aircraft, aircraft engine, or propeller specifications, That:

(1) might appreciably affect weight, balance, structural strength, performance, power plant operation, flight characteristics, or other qualities affecting airworthiness; or
(2) is not done according to accepted practices or cannot be done by elementary operations.

Maximum Landing Weight. Maximum weight approved for the landing touchdown.

Maximum Permissible Hoist Load. The maximum external load that is permitted for a helicopter to carry. This load is specified in the POH.

Maximum Ramp Weight. Maximum weight approved for ground manoeuvre. It includes weight of start, taxi, and run-up fuel.

Maximum Take-off Weight. Maximum weight approved for the start of the take-off run.

Maximum Taxi Weight. Maximum weight approved for ground manoeuvres. This is the same as maximum ramp weight.

Maximum Weight. The maximum authorized weight of the aircraft and all of its equipment as specified in the Type Certificate Data Sheets (TCDS) for the aircraft.

Maximum Zero Fuel Weight. The maximum authorized weight of an aircraft without fuel. This is the total weight for a particular flight less the fuel. It includes the aircraft and everything that will be carried on the flight except the weight of the fuel.

METO Horsepower (maximum except take-off). The maximum power allowed to be continuously produced by an engine. Take-off power is usually limited to a given amount of time, such as 1 minute or 5 minutes.

Minimum Fuel. The amount of fuel necessary for one half hour of operation at the rated maximum-continuous power setting of the engine, which, for weight and balance purposes, is 1/12 gallon per maximum-except-take-off (METO) horse-power. It is the maximum amount of fuel that could be used in weight and balance computations when low fuel might adversely affect the most critical balance conditions. To determine the weight of the minimum fuel in pounds, divide the METO horsepower by two.

Minor Alteration. An alteration other than a major alteration. This includes alterations that are listed in the aircraft, aircraft engine, or propeller specifications.

Moment. A force that causes or tries to cause an object to rotate. It is indicated by the product of the weight of an item multiplied by its arm.

Moment. The product of the weight of an item multiplied by its arm. (Moment divided by a constant is used to simplify balance calculations by reducing the number of digits; see reduction factor.)

Moment Index. The moment (weight times arm) divided by a reduction factor such as 1,000, 10,000 or 100,000 to make the number smaller and reduce the chance of mathematical errors in computing the centre of gravity.

Moment Limits vs. Weight Envelope. An enclosed area on a graph of three parameters. The diagonal line representing the moment /100 crosses the horizontal line representing the weight at the vertical line representing the CG location in inches aft of the datum. When the lines cross inside the envelope, the aircraft is loaded within its weight and CG limits.

Net Weight. The weight of the aircraft less the weight of any chocks or other devices used to hold the aircraft on the scales.

Normal Category. A category of aircraft that allows the maximum weight and CG range while restricting the manoeuvres that are permitted.

PAX. Passengers.

Payload. Weight of occupants, cargo, and baggage.

Pilot's Operating Handbook (POH). An approved document published by the airframe manufacturer that lists the operating conditions for a particular model of aircraft and its engine(s).

Potable Water. Water carried in an aircraft for the purpose of drinking.

Ramp Weight. The zero fuel weight plus all of the usable fuel on board.

Reference Datum. An imaginary vertical plane from which all horizontal distances are measured for balance purpose.

Index factor. A constant, usually 1,000, 10,000 or 100,000 by which a moment is divided to produce a smaller number that is less likely to cause mathematical errors when computing the centre of gravity.

Residual Fuel. Fuel that remains trapped in the system after draining the fuel from the aircraft with the aircraft in level flight attitude. The weight of this residual fuel is counted as part of the empty weight of the aircraft.

Service Ceiling. The highest altitude at which an aircraft can still maintain a steady rate of climb of 100 feet per minute.

Small Aircraft. An aircraft weighing 5700 kg or less, maximum certificated take-off weight.

Standard Empty Weight. Weight of a standard airplane including unusable fuel, full operating fluids, and full oil.

Static Load. The load imposed on an aircraft structure due to the weight of the aircraft and its contents.

Station. A location along the airplane fuselage usually given in terms of distance from the reference datum.

Strain Sensor. A device that converts a physical phenomenon into an electrical signal. Strain sensors in a wheel axle sense the amount the axle deflects and create an electrical signal that is proportional to the force that caused the deflection.

Structural Station. This is a location in the aircraft, such as a bulkhead, which is identified by a number designating its distance in inches or percent MAC from the datum. The datum is, therefore, identified as station zero. The stations and arms are identical. An item located at station +1000 would have an arm of 1000 mm.

Take-off Weight. The weight of an aircraft just before beginning the take-off roll. It is the ramp weight less the weight of the fuel burned during start and taxi.

Tare Weight. The weight of any chocks or devices that are used to hold an aircraft on the scales when it is weighed. The tare weight must be subtracted from the scale reading to get the net weight of the aircraft.

TEMAC. Trailing Edge of the Mean Aerodynamic Chord.

Type Certificate Data Sheets (TCDS). The official specifications issued by an aviation regulatory authority for an aircraft, engine, or propeller.

Undrainable Oil. Oil that does not drain from an engine lubricating system when the aircraft is in the normal ground attitude and the drain valve is left open. The weight of the undrainable oil is part of the empty weight of the aircraft.

Unusable Fuel. Fuel remaining after a run out test has been completed in accordance with governmental regulations.

Usable Fuel. Fuel available for flight planning.

Useful Load. Difference between take-off weight, or ramp weight if applicable, and basic empty weight.

Utility Category. A category of aircraft that permits limited acrobatic manoeuvres but restricts the weight and the CG range.

Wing Chord. A straight-line distance across a wing from leading edge to trailing edge.

Zero Fuel Weight. The weight of an aircraft without fuel.

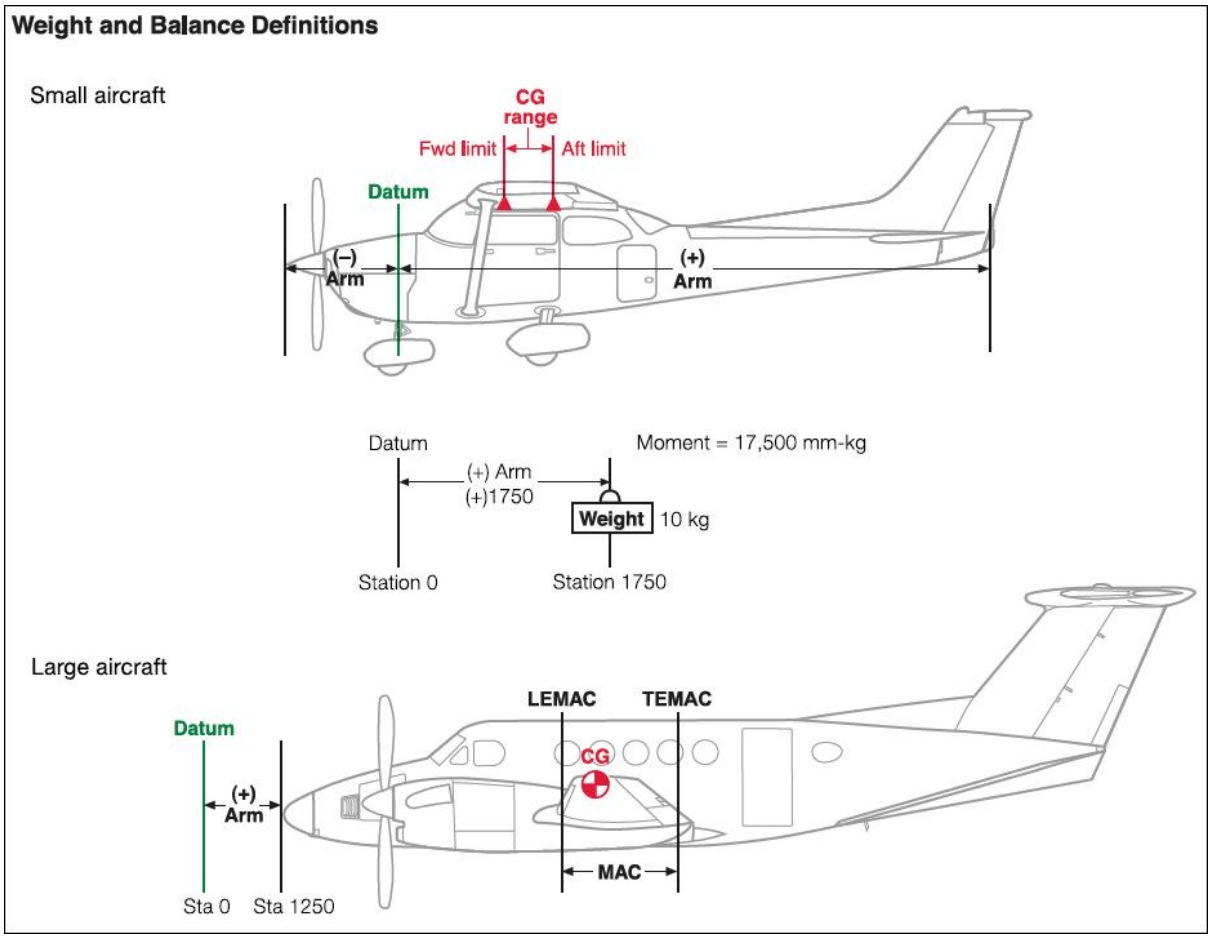

FIGURE 1- WEIGHT AND BALANCE DEFINITIONS