DOCUMENT
GSM-G-CPL.022

DOCUMENT TITLE

GENERAL OPERATIONS, FLIGHT PLANNING AND PERFORMANCE

CHAPTER 2 – TERMS AND DEFINITIONS

Version 1.1
October 2013

CONTENTS ..... PAGE

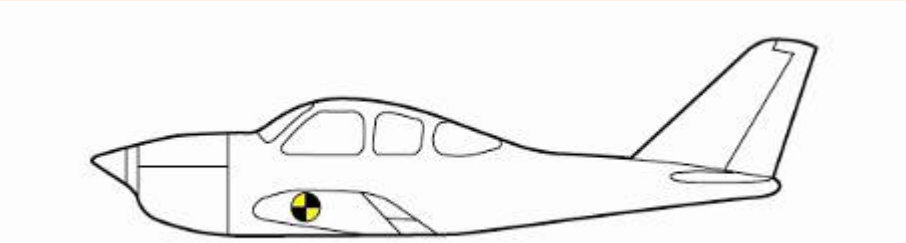
TERMS AND DEFINITIONS

WEIGHT AND BALANCE TERMINOLOGY

A pilot should be familiar with terms used in working the problems related to weight and balance. The following list of terms and their definitions is well standardised and knowledge of these terms will aid you to better understand weight and balance calculations of any aircraft.

Centre of gravity

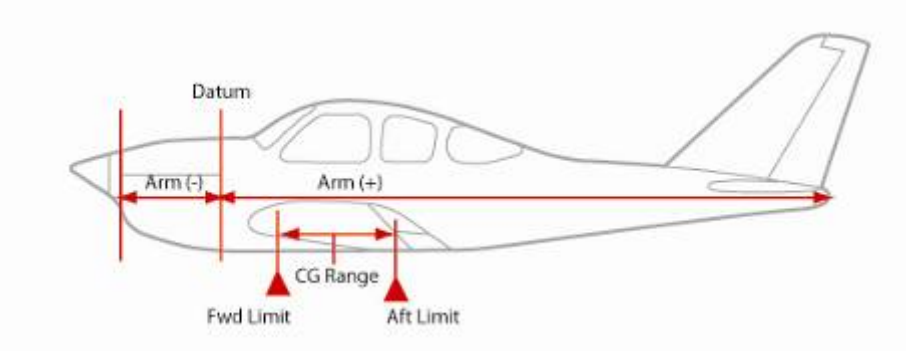
Centre of gravity (CG) is the point about which an aircraft would balance if it were possible to suspend it at that point. It is the mass centre of the aircraft, or the theoretical point at which the entire weight of the aircraft is assumed to be concentrated. It may be expressed in inches or millimetres from the reference datum, or in percentage of mean aerodynamic chord (MAC).



CG

Centre of gravity limits

Centre of gravity limits are the specified forward and aft points within which the CG must be located during flight. These limits are indicated on pertinent aircraft specifications (weight and balance section of flight manual).

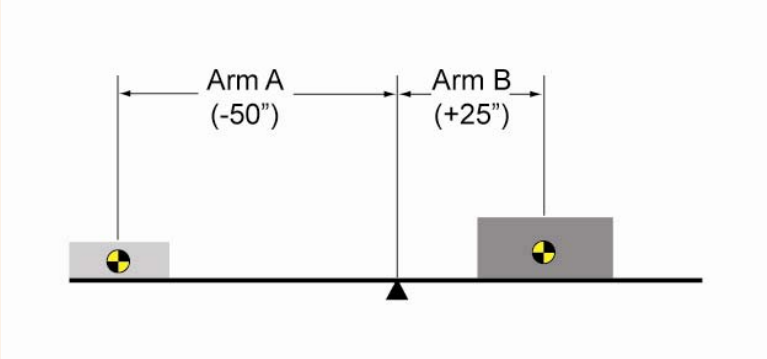


Centre of gravity range

Centre of gravity range is the distance between the forward and aft CG limits indicated on pertinent aircraft specifications.

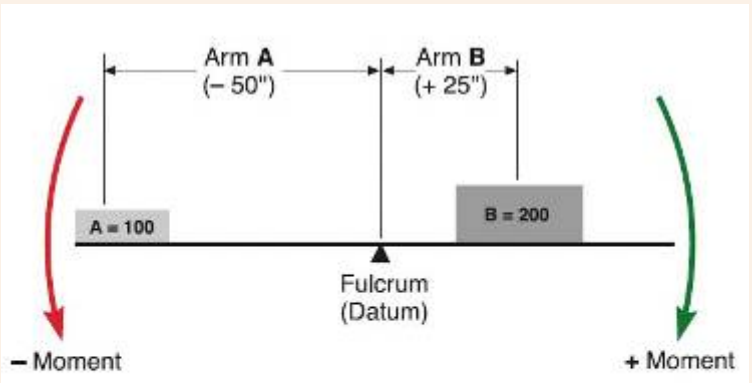
Arm (moment arm)

Arm is defined as the horizontal distance in inches or millimetres from the reference datum line to the center of gravity of an item. The algebraic sign is plus (+) if measured aft of the datum, and minus (–) if measured forward of the datum.



Moment

Moment is the product of the weight of an item multiplied by its arm. Moments are expressed in pound-inches (lb-in) or kilogram-millimetres (kg-mm). Total moment is the weight of the aircraft multiplied by the distance between the datum and the CG.



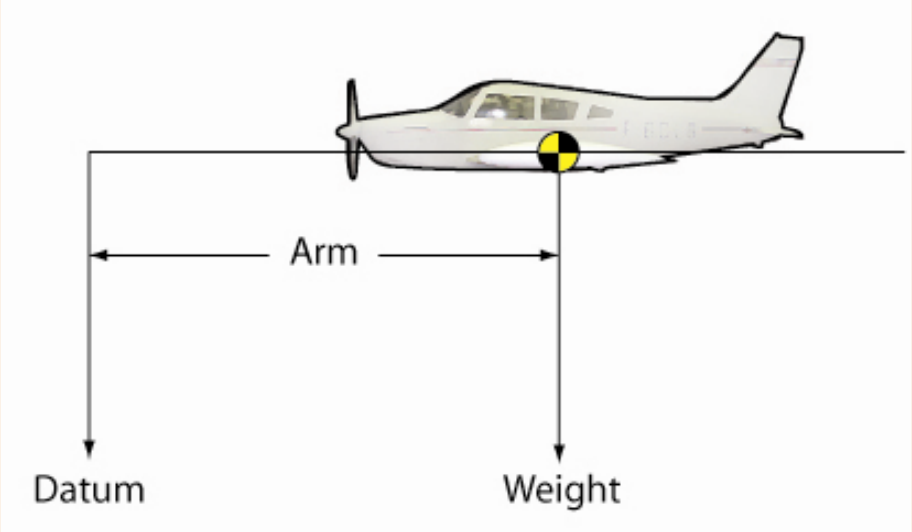
Item	Weight (KG)	Arm (in)	Moment (lb-in)
Weight A	100	–50	–5,000
Weight B	200	+25	+5,000
	300		0

Index Unit

Index-unit is a moment divided by a specified number such as 100, 1,000, or 10,000. The purpose of using a moment index is to simplify weight and balance computations of aircraft where heavy items and long arms result in large, unmanageable numbers.

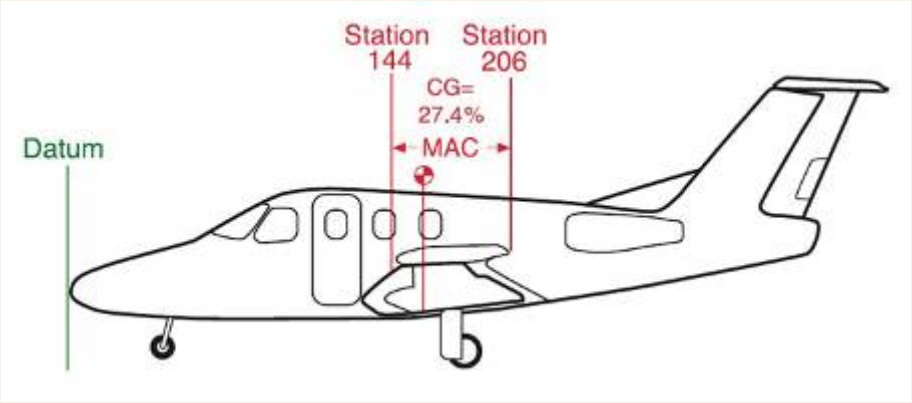
Datum (reference datum)

Datum is an imaginary vertical plane or line from which all measurements of arm are taken. The datum is established by the manufacturer. Once the datum has been selected, all moment arms and the location of CG range are measured from this point.



Station

Station is a location in the aircraft that is identified by a number designating its distance in inches or millimetres from the datum. The **datum** is, therefore, identified as station zero. An item located at station +144 would have an arm of 144 inches.



Floor load limit

Floor load limit is the maximum weight the floor can sustain per square inch/foot or km/m² as provided by the manufacturer.

Fuel load

Fuel load is the expendable part of the load of the aircraft. It includes only usable fuel, not fuel required to fill the lines or that which remains trapped in the tank sumps.

Maximum Landing Weight (MLW)

Maximum Landing Weight is the maximum weight, according to the Certificate of Airworthiness or approved Flight Manual, at which the aircraft may usually be landed. It is a structural limitation.

It is the maximum allowable weight that should not be exceeded (except in an emergency) at landing.

The vertical component of velocity at the point of "impact" on touchdown can cause a considerable force to be exerted on the undercarriage and aeroplane structure.

The Maximum Landing Weight limit is specified so as to:-

- Avoid excessive stresses on the undercarriage and airframe at the instant of landing; and
- To ensure that performance requirements specified in the certification can be met.

Ramp **Weight**

Ramp weight is the total weight of a loaded aircraft, and includes all fuel. It is greater than the take-off weight due to the fuel that will be burned during the taxi and run-up operations. Ramp weight may also be referred to as taxi weight.

Maximum take-off weight

Maximum take-off weight is the maximum allowable weight for takeoff.

Basic empty weight

BOLD NOTE: This definition is for examination purposes

Basic empty weight includes unusable fuel and full oil.

Empty Weight

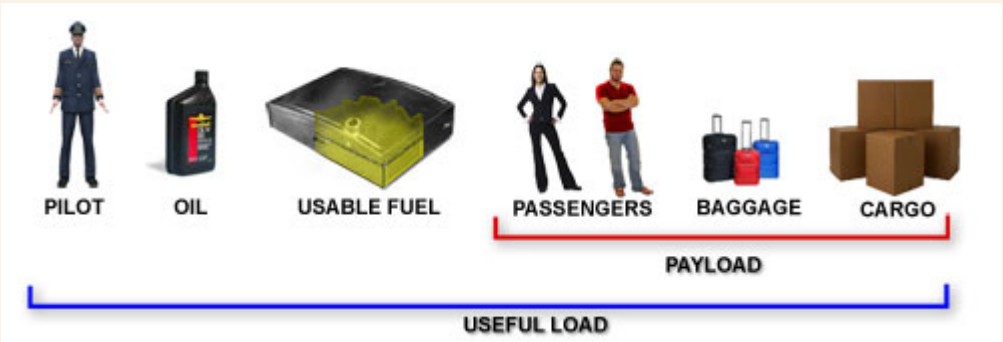
is the measured or calculated weight of an aircraft including all items of fixed equipment and other equipment that is mandatory for all operations, fixed ballast, unusable fuel and undrainable oil, total quantity of hydraulic fluids, but excluding all other items of disposable load.

Payload

Payload is the weight of occupants, cargo, and baggage.

Useful load

Useful load is the weight of the pilot, co-pilot, passengers, baggage, usable fuel. It is the basic empty weight subtracted from the maximum allowable gross weight. This term applies to general aviation aircraft only.



Note: (For Examination Purposes Only)
However, oil may need to be part of the useful load if empty weight is given.

Zero Fuel Weight (ZFW)

ZFW is the weight of the aeroplane not including fuel load. Fuel in the wing tanks exerts a downward force on the wings which relieves stress loads in the wing roots caused by the upwards lift forces. As fuel is burned off in flight, the stress-relieving downwards force is reduced and wing root stress increases.

Maximum Zero Fuel Weight (MZFW)

Is a structural limitation imposed by aircraft manufacturers to prevent over stressing of the wings in certain flight conditions. Any weight above the MZFW must be useable fuel carried in the wing tanks, as this will provide a downward force, helping to alleviate any upward stress to the wings that may be caused in flight.

METEOROLOGICAL TERMS AND DEFINITIONS

A pilot should be familiar with the meteorological aspects which may affect aircraft performance. The following list of terms and their definitions is well standardised and knowledge of these terms will aid you to better understand performance calculations of any aircraft.

Indicated Outside Air Temperature

Indicated outside air temperature (IOAT) is the temperature value read from an indicator. It will normally have to be corrected for use.

Outside Air Temperature

Outside air temperature (OAT) is the free air temperature obtained either from an indicator (IOAT) and adjusted for compressibility effects or from ground meteorological sources. This is also known as Static air temperature (SAT).

International Standard Atmosphere

The (ISA) is an average of world wide conditions and is used as a common reference standard for various flight instruments and performance charts and graphs.

In the ISA :

- Mean sea level pressure is 1013 hPa.
- Mean sea level temperature is 15°C.
- The rate of pressure decrease with height is 1 hPa/ 30 ft.
- The temperature lapse rate is 2°C/ 1000 ft.
- Humidity is nil.

Density Altitude

Density altitude is that altitude in the International Standard Atmosphere (ISA) at which the prevailing density occurs. This is pressure altitude corrected for temperature.

Pressure Altitude

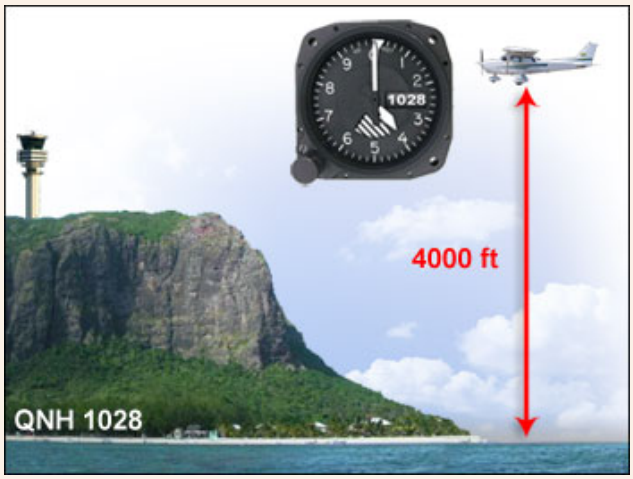
Pressure altitude is the altitude measured with reference to the 1013.25 hPa datum. Pressure altitudes are normally referred to as flight levels and are measured in hundreds of feet. This setting is also referred to as QNE. This setting is often the base for calculations on aircraft performance.

QFE

QFE is the barometric pressure at an airfield. When this value is set on the subscale of an altimeter, the instrument should read zero on touchdown at that particular airfield (strictly speaking, the height of the altimeter above ground.) It is also used when checking the serviceability of the instrument.

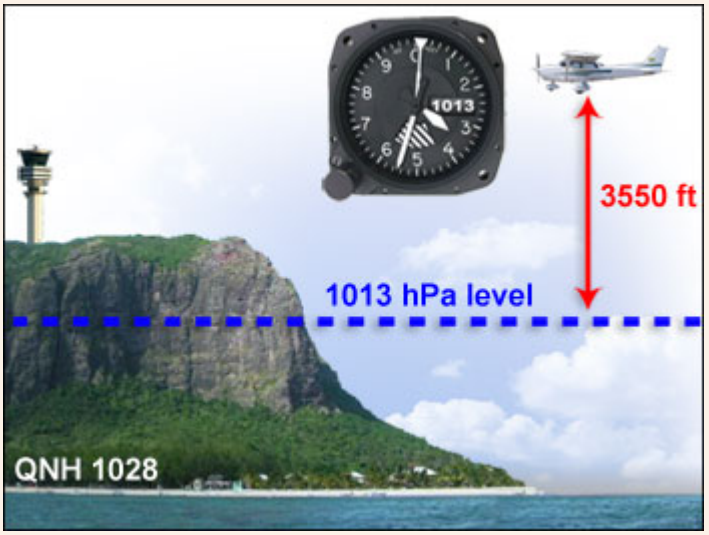
QNH

QNH is the pressure correction factor which causes the altimeter to read the altitude above mean sea level. It is sometimes defined as the barometric pressure at an airfield, reduced to mean sea level using the ICAO formula.



QNE

QNE is the altitude an altimeter will display with the standard setting of 1013.2 hPa on the sub-scale. This indicated altitude is called Pressure altitude or flight level (FL). Frequently it differs from the actual altitude by hundreds of feet.

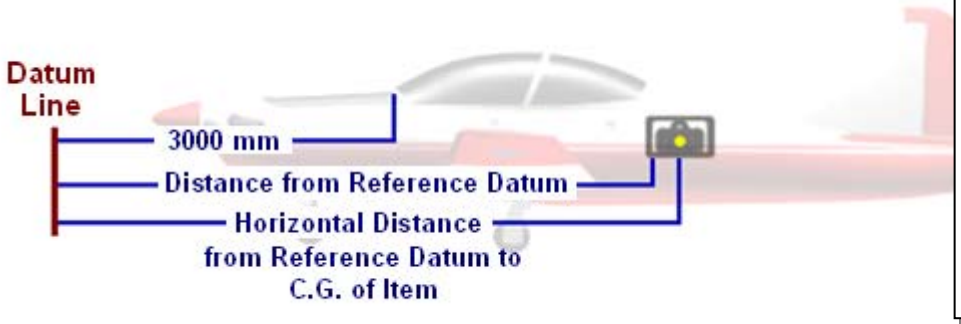


WEIGHT AND BALANCE TERMINOLOGY

TERMINOLOGY

In order to understand the concept of weight and balance, it is important to be familiar with certain terms.

The Datum: This is an imaginary vertical plane from which all horizontal distances are measured for balance purposes. In the case of the example aircraft the reference datum is located 3000 mm forward of the front face of the **firewall**.



Firewall: This is the panel that separates the front cockpit area from the engine bay. It is a fireproof wall that is designed to prevent the spread of a fire in the event of a fire in the engine compartment.

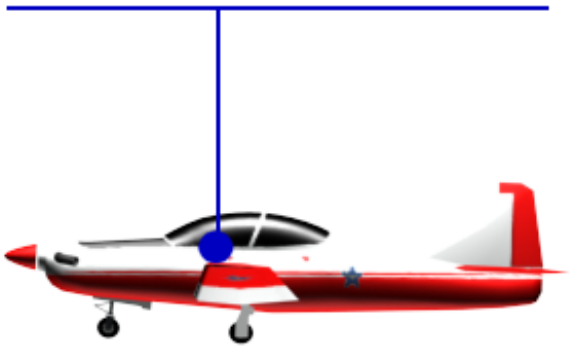
Station: Station: is a location in the aircraft which is Identified by a number designating its distance from a datum. The datum therefore is station zero. Station and arm are usually identical

Arm: is the horizontal distance measure in a given unit, usually millimetres or inches from the Datum to the centre og gravity of the item. The algebraic sign (+) plus is used if measured aft of the datum and (-) minus if measured forward of the datum

Moment: This is the product of the weight of an item (i.e. the bag in the baggage compartment), multiplied by its arm (distance from reference datum to C.G. of item).

Moment = **W** (**Item**) x **arm**

Centre of Gravity (C.G.): The point about which an aircraft would balance if suspended from it. Its distance from the reference datum is found by dividing the total of all the moments in the aircraft by the total weight of the aircraft.



C. G. Arm: This is the arm obtained by adding the individual moments of the aircraft and dividing the sum by the total weight of the aircraft.

C.G. Limits: This is the extreme centre of gravity locations within which the aircraft must be operated at a given weight.

Usable Fuel: Fuel available for flight planning.

Unusable Fuel: Fuel remaining after a runout test has been completed in accordance with government regulations.

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

Basic Empty Weight: Empty weight but with full oil.

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

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 Landing Weight: Maximum weight approved for the landing touchdown.

Maximum Zero Fuel Weight: Maximum weight exclusive of usable fuel.

Mean aerodynamic chord (MAC)

Mean aerodynamic chord is the chord of an imaginary rectangular wing having the same aerodynamic characteristics as that of the actual wing.