General Provisions

Altimeter setting procedures

Altimetry

Aircraft maintain their level primarily with reference to a calibrated barometer, known as an altimeter, that is set to a specified pressure setting. As atmospheric pressure decreases with altitude, measuring the pressure outside the hull of an aircraft can provide a means to measure its altitude.

Altimeters are calibrated to the ISA standard atmosphere and will indicate an increase in altitude of approximately 30 ft for every 1 hPa reduction in atmospheric pressure near sea level. Barometric altimeters only measure the altitude above the reference pressure setting and have no means of indicating an aircraft’s true altitude, so some adjustment is required for different atmospheric conditions to ensure that the indicated level is accurate.

Air traffic controllers must pass the required pressure setting information to an aircraft, based on its location and level above ground. This is important as aircraft with different or inappropriate altimeter settings will be flying at different true altitudes and may result in a loss of separation with other aircraft or with terrain.

Altitude

When aircraft are being flown with reference to a local pressure setting, or QNH, the level is expressed as an altitude in thousands of feet above mean sea level. QNH corrects for local pressure deviations and provides aircraft with an indication of their height above mean sea level.

For example, the level of an aircraft that is at an indicated altitude of 8000 ft with reference to QNH, would be expressed as an altitude of 8000 ft.

Altitudes are typically flown at lower levels, usually within the aerodrome terminal area where terrain separation becomes a factor. Altitudes can be quickly measured against known elevation of the surrounding terrain, which is important during the approach and landing phase.

Flight level

When aircraft are being flown with reference to the standard barometric pressure setting, the level is expressed as a Flight Level (FL), in multiples of 100 ft.

For example, the level of an aircraft at an indicated altitude of 36000 ft with reference to standard barometric pressure, it would be said to be cruising at Flight Level 360 (FL 360).

Typically, aircraft are flown at flight levels during cruise. This is done to avoid several altimeter setting changes as aircraft travel long distances where atmospheric conditions are different. During cruise, terrain separation is rarely a factor, and separation between aircraft is more important.

Ensuring all enroute aircraft are following the same altimeter setting simplifies the controller's task of separating as aircraft as two aircraft at the same place will always have the same altimeter error.

Transition altitude and transition level

Due to the nature of aircraft altimeters, when transitioning from QNH to standard pressure, there will be an error in the reading, especially when atmospheric conditions are different from standard. This error may mean that aircraft following QNH may not be separated from aircraft following standard pressure at the adjacent higher level.

In order to avoid this problem, a transition altitude and transition level are established by each local ATS authority that ensure that minimum vertical separation will exist between aircraft referencing QNH and standard pressure.

The transition altitude is the highest available altitude to an aircraft with reference to QNH, whereas the transition level is the lowest available flight level (with reference to standard pressure).

The area between the transition altitude and transition level is known as the transition layer. Sustained flight within this layer must be avoided as adequate vertical separation may not be assured between aircraft.

Horizontal speed control

Airspeed

The airspeed of an aircraft is expressed in knots and, like barometric altitude, is subject to errors. Indicated airspeed is the uncorrected airspeed displayed to the flight crew and is an indication of "how much air" the aircraft is hitting at a given moment.

When a speed restriction is assigned to an aircraft for the purposes of separation, it will be with reference to indicated airspeed (IAS). Speed assignments must be applied in multiples of 10 knots.

True airspeed (TAS) is the true rate of movement of the aircraft through the airmass at a given time, corrected for instrument, pressure, compressibility and density error.

TAS rises by approximately two per cent for every 1000 ft an aircraft climbs when compared to IAS. For the purposes of ATC, however, to estimate an aircraft's true airspeed, approximately 6 knots may be added to the aircraft's reported indicated airspeed per every 1000 ft of altitude. Below 8000 ft, the difference between indicated and true airspeed is not significant and may be neglected.

In addition, controllers must also have an awareness of the current wind conditions, as a tailwind will result in an increased ground speed and a headwind will have the opposite effect.

Mach number

At higher altitudes, the effects of compressibility become the overriding factor in jet turbine aircraft aerodynamics. Because of this, Mach number is primary reference used to measure airspeed and any adjustments are applied in increments of 0.01 Mach.

For ATC speed control, Mach numbers are used above FL250.

Application of speed control

In order to facilitate orderly flow of traffic, ATC must provide aircraft with adequate notice of any speed control to be provided.

Speed instructions should be limited to those necessary to maintain adequate separation. Frequent alternating increases and decreases in speed should be avoided.

In order to maintain desired spacing, however, speed instructions should be issued to all aircraft concerned.

For aircraft entering or established in a holding pattern, speed control instructions must not be issued.

Descending and arriving aircraft

Arriving aircraft should, wherever possible, be permitted to absorb a period of terminal delay by cruising at a reduced speed before entry into a terminal hold. Instructions for aircraft to maintain “minimum clean speed” (the minimum speed of an aircraft with flaps and gear retracted) may be used for this purpose.

Other instructions to maintain “maximum speed” or “minimum speed” nay also be used to apply separation.

Speed reductions to less than 250 knots during the initial descent from cruising level of jet turbine aircraft should be avoided unless coordinated with pilots.

In addition, aircraft should not be instructed to maintain high rates of descent as well as to reduce speed simultaneously, as most aircraft will be unable to achieve this. Aircraft that are instructed to slow down during descent can be expected to maintain a short period of level or near-level flight to reduce speed.

Unless otherwise required by the terminal procedure or for traffic separation purposes, aircraft shall be permitted to operate in clean configuration for as long as possible below FL 150. The minimum clean speed for most jet turbine aircraft is approximately 220 knots. Speed reductions below this would require the use of flaps or slats.

Approach phase

During the intermediate and final approach phase, speed changes exceeding 20 knots must not be applied.

Controllers must be aware that aircraft must achieve a stabilized approach by 1000 ft above aerodrome level (AAL). As such speed control inside 4 nautical miles from touchdown should be avoided.

In addition, instructions to maintain speeds greater than 160 knots within an 8 nautical mile final should be avoided.

Vertical speed control

In order to maintain a safe and organized flow of traffic, aircraft can be instructed to adjust their climb and descent rates. This may be applied to two climbing aircraft or two descending aircraft to ensure adequate vertical separation exists.

Aircraft in a climb shall be issued a vertical speed greater than or equal to a specific value, or less than or equal to a specified value. The same method applies for aircraft in a descent.

In addition, aircraft can be instructed to expedite their rate of climb or descent through a specific level, or to reduce their rate of climb or descent.

Vertical speed control should only be assigned as necessary to ensure separation and frequent changes to climb/descent rates should be avoided.

When no longer needed, aircraft should be informed that vertical speed control has been cancelled.

Vertical speed control is expressed in “feet per minute” and in multiples of 100.

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