

SEPARATION METHODS AND MINIMA

Vertical or horizontal separation shall be provided according to the *airspace* we are using at the moment. A mix of the two is called composite separation.

No clearance shall be given to execute any manoeuvre that would reduce the spacing between two aircraft to less than the separation minimum applicable in the circumstances.

DEGRADED AIRCRAFT PERFORMANCE

Whenever, as a result of failure or degradation of navigation, communications, altimetry, flight control or other systems, aircraft performance is degraded below the level required for the airspace in which it is operating, the flight crew shall advise the ATC unit concerned without delay. Where the failure or degradation affects the separation minimum currently being employed, the controller shall take action to establish another appropriate type of separation or separation minimum.

MAINTAINING OWN SEPARATION

An ATC unit may clear a controlled flight, including departing and arriving flights, operating in airspace Classes D and E in visual meteorological conditions during the hours of daylight to fly subject to maintaining own separation to one other aircraft and remaining in visual meteorological conditions.

The responsibility of maintaining sufficient separation now lies with the pilot-in-command.

VERTICAL SEPARATION MINIMA (VSM)

Vertical separation is obtained by requiring aircraft using prescribed altimeter setting procedures to operate at different levels expressed in terms of flight levels or altitudes.

The vertical separation minimum shall be:

- a) a nominal 300 m (1000 ft) below FL290; and
- b) a nominal 600 m (2000 ft) at or above this level; except for
- c) within designated airspace, subject to a regional air navigation agreement (RVSM - reduced vertical separation minima):
a nominal 300 m (1000 ft) below FL 410 or a higher level where so prescribed for use under specified conditions, and a nominal 600 m (2000 ft) at or above this level.

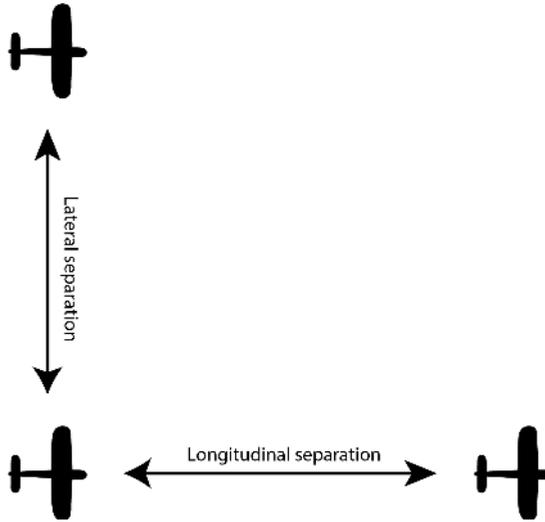
Explained: RVSM cruising levels are defined as those between FL290 and F410 inclusive.

As far as practicable, cruising levels of aircraft flying to the same destination shall be assigned in a manner that will be correct for an approach sequence at destination.

Pilots in direct communication with each other may, with their concurrence, be cleared to maintain a specified vertical separation between their aircraft during ascent or descent.

HORIZONTAL SEPARATION

The two main methods for horizontal separation are lateral and longitudinal.



Lateral vs longitudinal separation

LATERAL SEPARATION

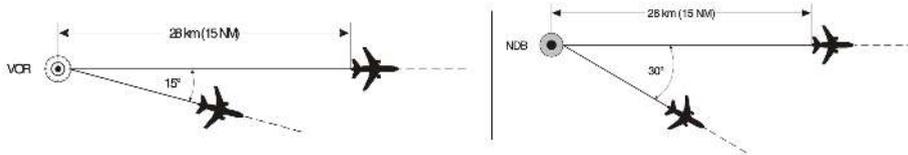
Lateral separation of aircraft is obtained by requiring operation on different routes or in different geographical locations as determined by visual observation, by the use of navigation aids or by the use of area navigation (RNAV) equipment.

Geographical separation

Geographical separation based position reports which positively indicate the aircraft are over different geographic locations as determined visually or by reference to a navigation aid.

Track separation

This can be achieved between aircraft using the same type of navigation aid or method by requiring aircraft to fly on specified tracks which are separated by a minimum amount appropriate to the navigation aid employed.



Track separation with the use of VOR (left side) and NDB (right side)

The distance required for track separation is 15 NM with a track divergence of:

- 15° with the use of VOR
- 30° with the use of NDB
- 45° when Dead Reckoning (DR)

LONGITUDINAL SEPARATION

Longitudinal separation is applied so that the spacing between aircraft is never less than a specified amount.

For aircraft following the same or diverging tracks, longitudinal separation may be achieved by requiring aircraft to make position reports and comparing the time of their reports.

DME, NDB and GNSS may be used to confirm positions

Reduced separation may apply if the leading aircraft is maintaining a higher speed than the following aircraft.

RADAR SEPARATION

When radar surveillance is used, the minimum horizontal separation is 5 nm.

COMPOSITE SEPARATION

Composite separation is a combination of vertical separation and one of the other forms of horizontal separation (lateral or longitudinal).

It should be noted that composite separation is *not* meant to be used in a surveillance environment (radar). In practice, this means oceanic flights.

It allows using minima for each which may be lower than, but not less than half of, those used for each of the combined elements when applied individually.

SEPARATION IN THE VICINITY OF AERODROMES

VISUAL APPROACH

An IFR flight may be cleared to execute a visual approach provided the pilot can maintain visual reference to the terrain and:

- a) the reported ceiling is at or above the level of the beginning of the initial approach segment for the aircraft so cleared; or
- b) the pilot reports at the level of the beginning of the initial approach segment or at any time during the instrument approach procedure that the meteorological conditions are such that with reasonable assurance a visual approach and landing can be completed.

Separation shall be provided between an aircraft cleared to execute a visual approach and other arriving and departing aircraft.

CLEARANCES TO MAINTAINING OWN SEPARATION WHILE IN VMC

It is obvious that a VFR flight must remain in VMC at all times. Accordingly, the issuance of a clearance to a VFR flight to fly subject to maintaining own separation and remaining in visual meteorological conditions has no other object than to signify that, for the duration of the clearance, separation from other aircraft by air traffic control is not provided.

INSTRUMENT APPROACH

The approach control unit shall specify the instrument approach procedure to be used by arriving aircraft. A flight crew may request an alternative procedure and, if circumstances permit, should be cleared accordingly.

If a pilot reports or it is clearly apparent to the ATC unit that the pilot is not familiar with an instrument approach procedure being carried out, only the final approach track has to be given to them by ATC.

HOLDING

Levels at a holding fix or visual holding location shall as far as practicable be assigned in a manner that will facilitate clearing each aircraft to approach in its proper priority. Normally, the first aircraft to arrive over a holding fix or visual holding location should be at the lowest level, with following aircraft at successively higher levels.

APPROACH SEQUENCE

The approach sequence shall be established in a manner which will facilitate arrival of the maximum number of aircraft with the least average delay.

Priority shall be given to:

- a) an aircraft which anticipates being compelled to land because of factors affecting the safe operation of the aircraft (engine failure, shortage of fuel, etc.);
- b) hospital aircraft or aircraft carrying any sick or seriously injured person requiring urgent medical attention;
- c) aircraft engaged in search and rescue operations; and
- d) other aircraft as may be determined by the appropriate authority.

If the pilot of an aircraft in an approach sequence has indicated an intention to hold for weather improvement, or for other reasons, such action shall be approved. However, when other holding aircraft indicate intention to continue their approach to land, the pilot desiring to hold will be cleared to an adjacent fix for holding awaiting weather change or re-routing.

Alternatively, the aircraft should be given a clearance to place it at the top of the approach sequence so that other holding aircraft may be permitted to land.

EXPECTED APPROACH TIME

An expected approach time shall be determined for an arriving aircraft that will be subjected to a delay of 10 minutes or more. The expected approach time shall be transmitted to the aircraft as soon as practicable and preferably not later than at the commencement of its initial descent from cruising level. A revised expected approach time shall be transmitted to the aircraft without delay whenever it differs from that previously transmitted by 5 minutes or more.

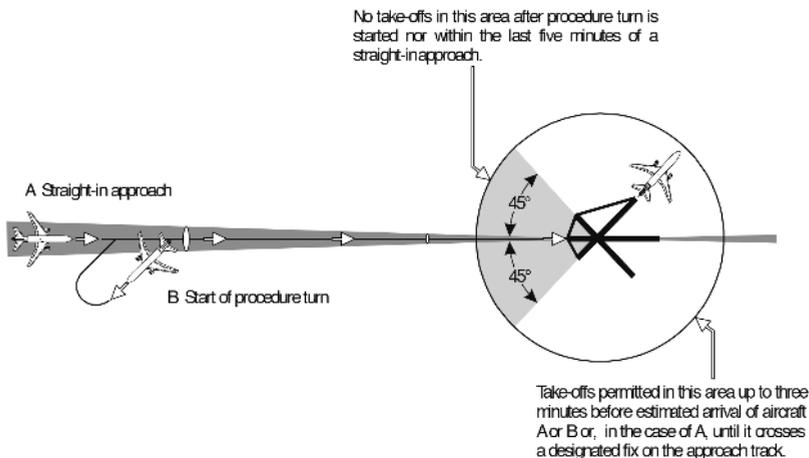
Concerning a flight plan, if the average true airspeed at cruising level between reporting points varies or is expected to vary by +/- 5 % of the true air speed, from that given in the flight plan, the appropriate air traffic services unit shall be so informed.

DEPARTING AIRCRAFT

The minimum separation between departing aircraft is two minutes if they follow the same track, or one minute if the tracks diverge by 45°.

DEPARTING FROM ARRIVING AIRCRAFT

If an arriving aircraft is making a complete instrument approach, a departing aircraft may take off in any direction until an arriving aircraft has started its procedure turn or base turn leading to final approach or in a direction which is different by at least 45 degrees from the reciprocal of the direction of approach after the arriving aircraft has started procedure turn or base turn leading to final approach, provided that the take-off will be made at least 3 minutes before the arriving aircraft is estimated to be over the beginning of the instrument runway.



Departing from arriving aircraft

ESSENTIAL TRAFFIC INFORMATION

Essential traffic is that controlled traffic to which the provision of separation by ATC is applicable, but which, in relation to a particular controlled flight is not, or will not be, separated from other controlled traffic by the appropriate separation minimum.

Essential traffic information shall be given to controlled flights concerned whenever they constitute essential traffic to each other.

REDUCTION IN SEPARATION MINIMA (RADAR)

When approved by the authorities and in specific circumstances, the radar separation may be reduced to 5 NM.

When radar capabilities permit, it may be reduced to 3 NM.

When two or more aircraft are on the same localizer course and within 10 NM of the runway threshold, the separation may be reduced to 2.5 NM.

If simultaneous parallel approaches are in use and the aircraft are on adjacent localizer courses the separation may be reduced to 2 NM.

WAKE TURBULENCE SEPARATION MINIMAS

CATEGORIES

Wake turbulence separation minima shall be based on a grouping of aircraft types into three categories according to the maximum certificated take-off mass as follows:

- a) HEAVY (H) — all aircraft types of 136000 kg or more;
- b) MEDIUM (M) — aircraft types less than 136000 kg but more than 7000 kg; and
- c) LIGHT (L) — aircraft types of 7000 kg or less.

Helicopters should be kept well clear of light aircraft when hovering or while air taxiing.

RADAR WAKE TURBULENCE SEPARATION MINIMA

Because the position of the aircraft is known to the controller, the required separation for wake turbulence in a radar environment is expressed in distance.

The criteria apply where the category of the following aircraft is lighter than the preceding aircraft (except for the heavy/heavy case).

Leading aircraft	Following aircraft	Separation
Heavy	Heavy	4 NM
Heavy	Medium	5 NM
Heavy	Light	6 NM
Medium	Light	5 NM

NON-RADAR WAKE-TURBULENCE SEPARATION MINIMA

Note that the following wake turbulence-separation minimas are procedural, e.g., non-radar. Your position can not be confirmed to the controller.

Although emphasized in the text, you should also note that they are only applicable when the following aircraft is LIGHTER than the preceding aircraft.

Arriving aircraft

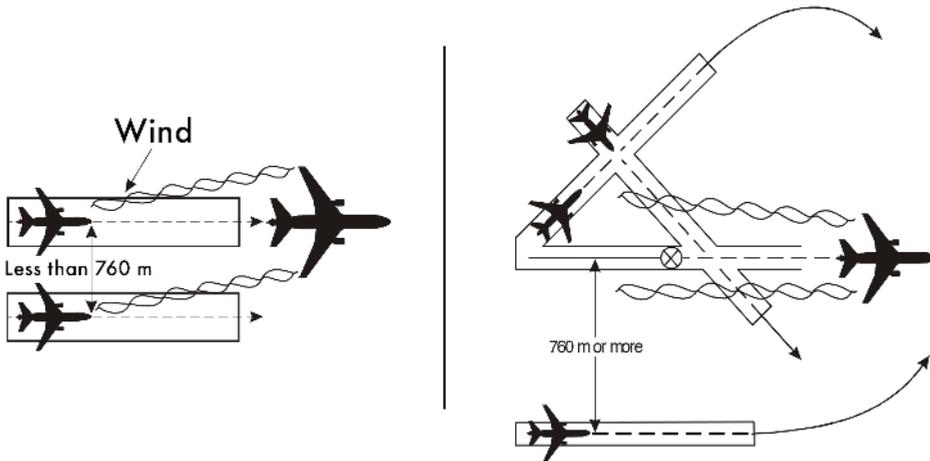
The following minima shall be applied to aircraft landing behind a HEAVY or a MEDIUM aircraft:

- a) MEDIUM aircraft behind HEAVY aircraft — 2 minutes;
- b) LIGHT aircraft behind a HEAVY or MEDIUM aircraft — 3 minutes.

Departing aircraft - using the whole runway

A minimum separation of 2 minutes shall be applied between a LIGHT or MEDIUM aircraft taking off behind a HEAVY aircraft or a LIGHT aircraft taking off behind a MEDIUM aircraft when the aircraft are using:

- a) the same runway;
- b) parallel runways separated by less than 760 m;
- c) crossing runways if the projected flight path of the second aircraft will cross the projected flight path of the first aircraft at the same altitude or less than 1000 ft below;
- d) parallel runways separated by 760 m or more, if the projected flight path of the second aircraft will cross the projected flight path of the first aircraft at the same altitude or less than 1000 ft below the heavier.

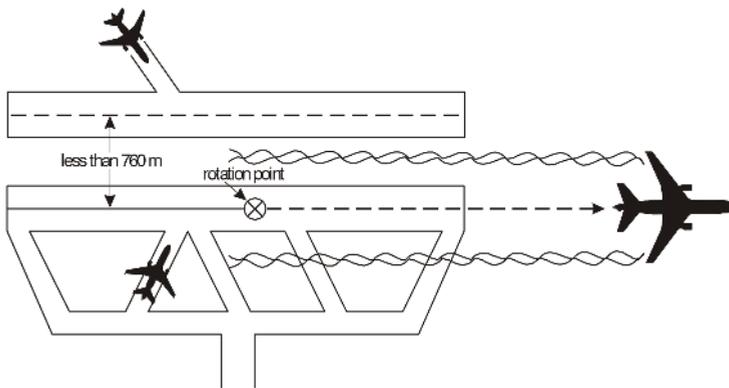


*Left: Two-minute separation for following aircraft
 Right: Two-minute wake turbulence separation for crossing aircraft*

Departing aircraft - using an intermediate part of the runway

A separation minimum of 3 minutes shall be applied between a LIGHT or MEDIUM aircraft when taking off behind a HEAVY aircraft or a LIGHT aircraft when taking off behind a MEDIUM aircraft from:

- a) an intermediate part of the same runway; or
- b) an intermediate part of a parallel runway separated by less than 760 m.



Three-minute wake turbulence separation for following aircraft

Displaced landing threshold

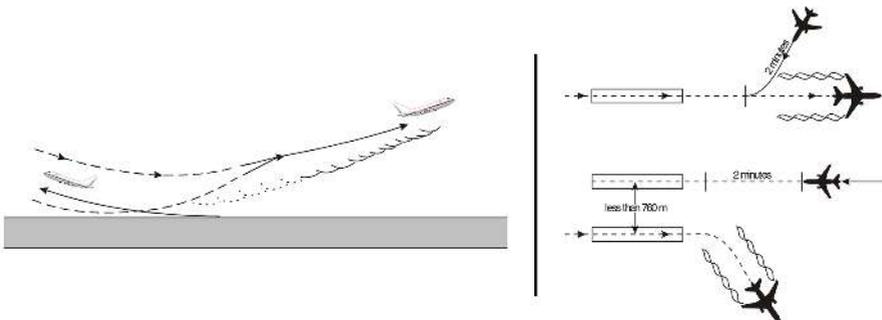
A separation minimum of 2 minutes shall be applied between a LIGHT or MEDIUM aircraft and a HEAVY aircraft and between a LIGHT aircraft and a MEDIUM aircraft when operating on a runway with a displaced landing threshold when:

- a) a departing LIGHT or MEDIUM aircraft follows a HEAVY aircraft arrival and a departing LIGHT aircraft follows a MEDIUM aircraft arrival; or
- b) an arriving LIGHT or MEDIUM aircraft follows a HEAVY aircraft departure and an arriving LIGHT aircraft follows a MEDIUM aircraft departure if the projected flight paths are expected to cross.

Opposite direction

A separation minimum of 2 minutes shall be applied between a LIGHT or MEDIUM aircraft and a HEAVY aircraft and between a LIGHT aircraft and a MEDIUM aircraft when the heavier aircraft is making a low or missed approach and the lighter aircraft is:

- a) utilizing an opposite-direction runway for take-off; or
- b) landing on the same runway in the opposite direction, or on a parallel opposite-direction runway separated by less than 760 m.



*Left: Two-minute wake turbulence separation for opposite-direction take-off
 Right: Two-minute wake turbulence separation for opposite-direction landing*