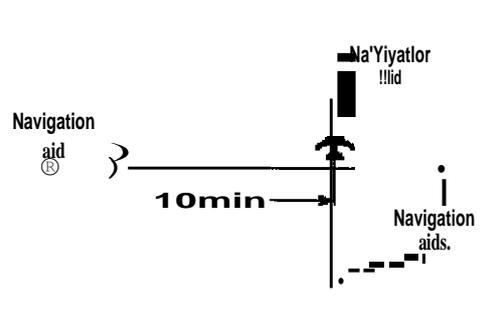
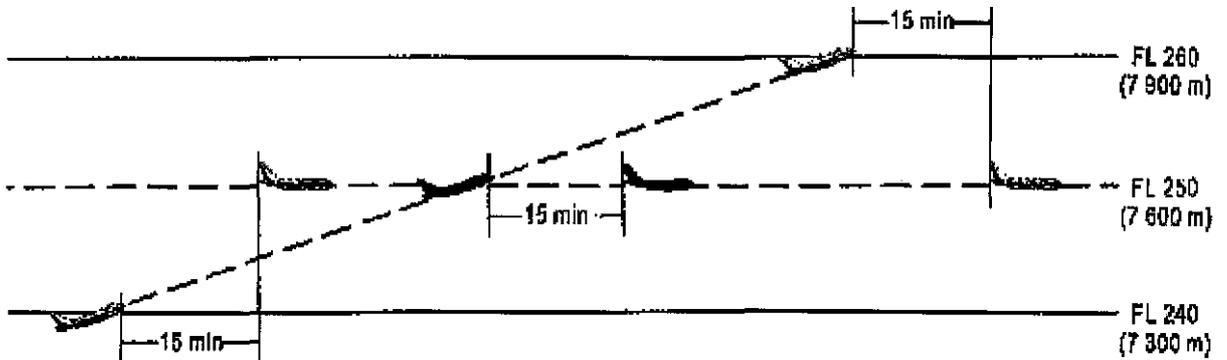


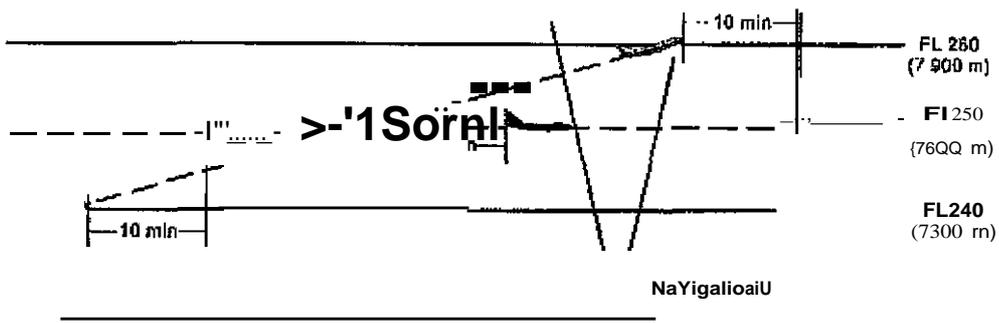
15 min separation between aircraft on crossing tracks and same level



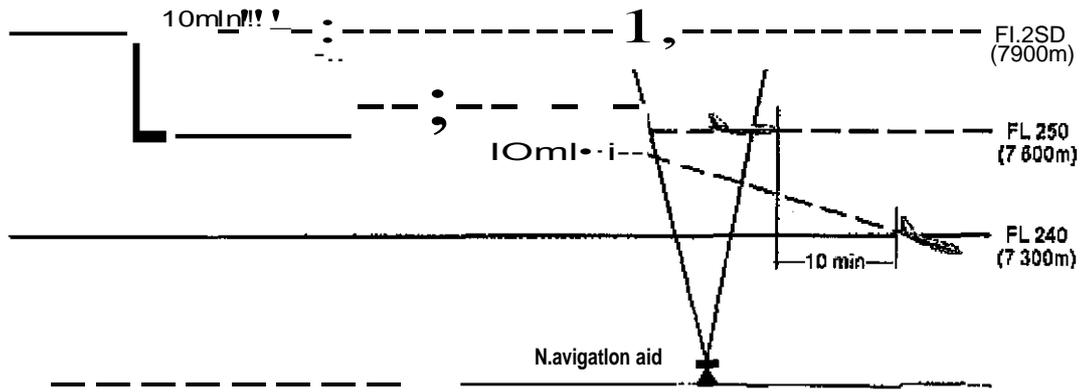
10 min separation between aircraft on crossing tracks and same level



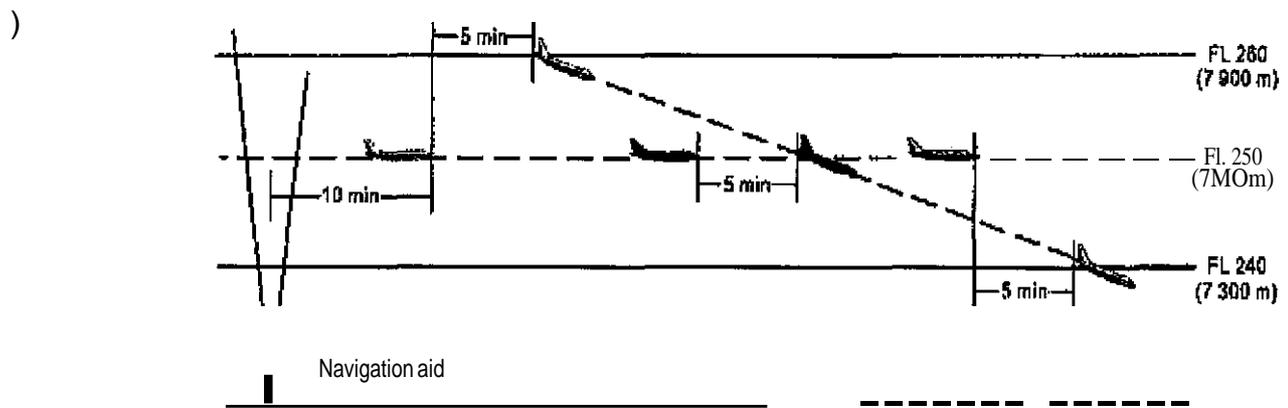
15 min separation between aircraft climbing and on same track



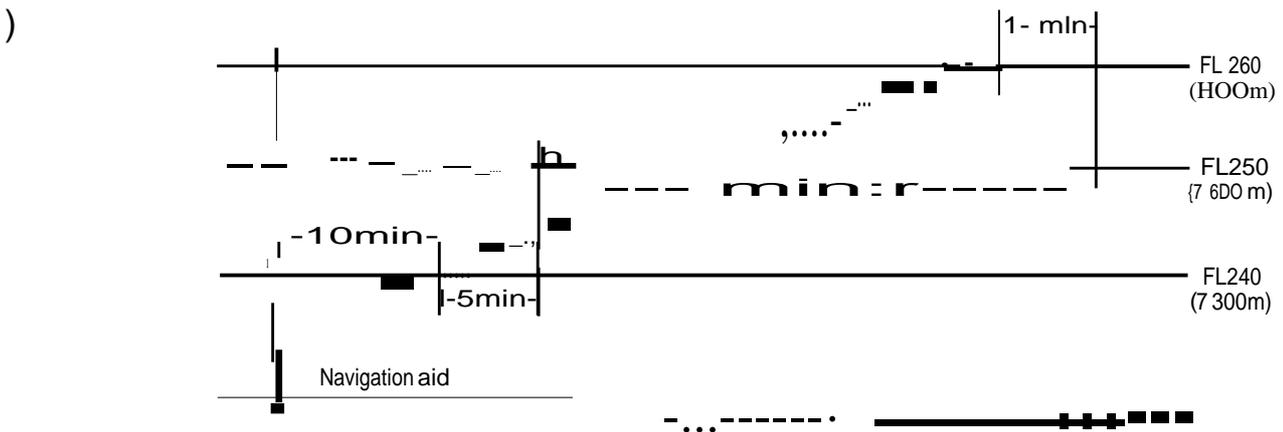
10 min separation between aircraft climbing and on same track



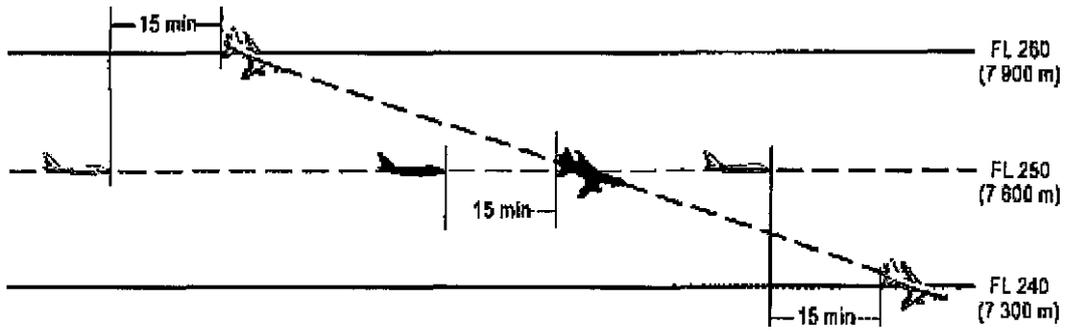
10 min separation between aircraft descending and on same track



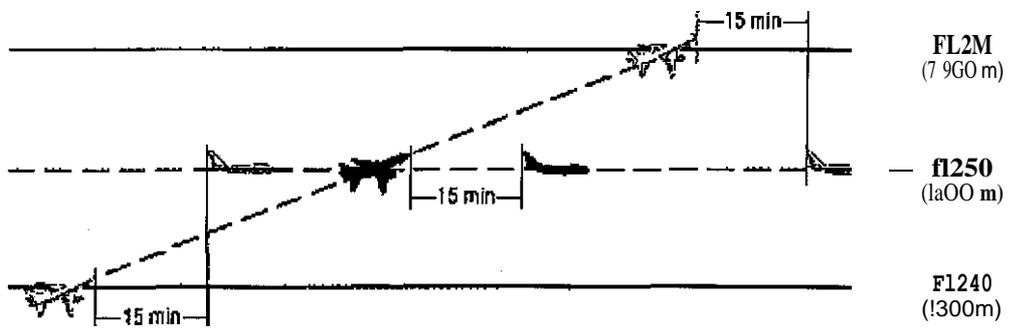
5 min separation between aircraft descending and on same track



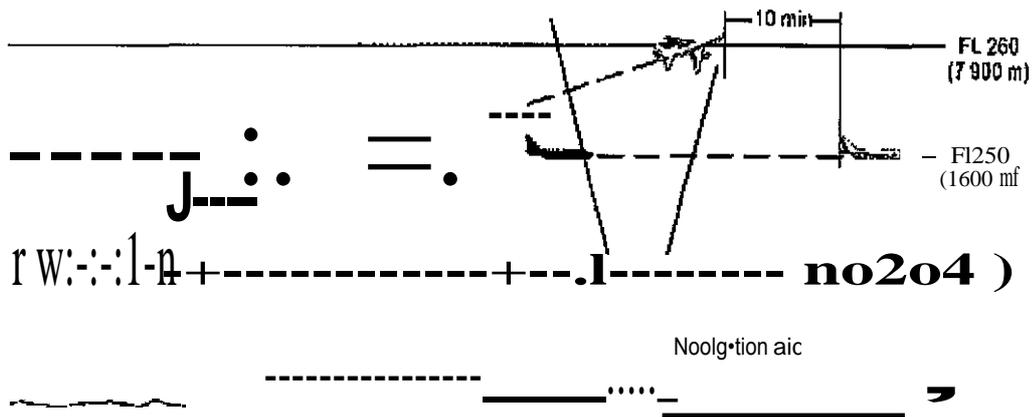
5 min separation between aircraft climbing and on same track



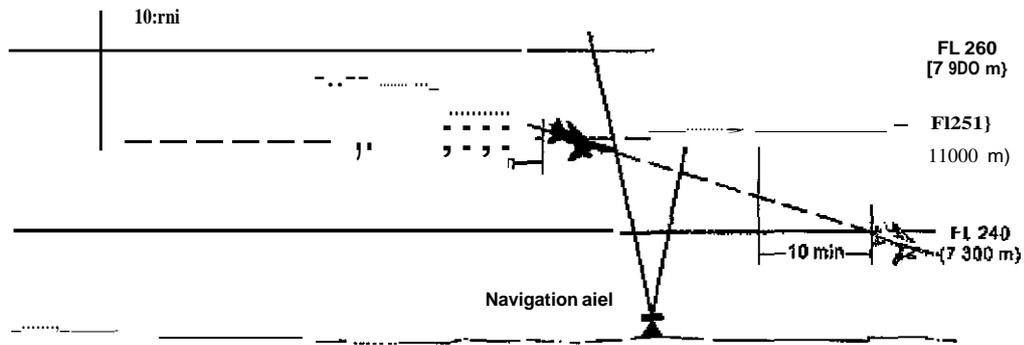
15min separation between aircraft descending and on crossing tracks



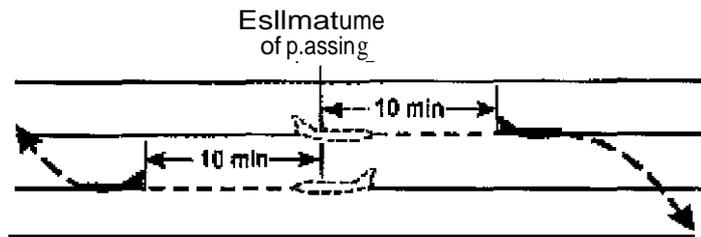
15min separation between aircraft climbing and on crossing tracks



10 min separation between aircraft climbing and on crossing tracks



10 min separation between aircraft descending and on crossing tracks



10 min separation between aircraft reciprocal tracks

**4.1.2 LONGITUDINAL SEPARATION MINIMA
BASED ON DISTANCE USING DME**

NOTE. The term "on track" means that the aircraft is flying either directly inbound to or directly out bound from the DME station.

- a) Separation shall be established by maintaining not less than specified distance(s) between A/C positions as reported by reference to DME in conjunction with VOR.
- b) Direct controller-pilot communication shall be maintained while such separation is used.

4.1.2.1 Longitudinal separation based on distance using DME shall be as follows:

MINIMUM SEPARATION	PROVISIONS
4.1.2. 1 AIRCRAFT SAME CRUISING LEVEL SAME TRACK	
20NM	<ul style="list-style-type: none"> • shall apply provided: <ol style="list-style-type: none"> 1) Each aircraft utilizes the same "on-track" DME stations; and 2) Separation is checked by obtaining simultaneous DME readings from the aircraft at frequent intervals to ensure that the minimum will not be infringed.
10NM	<ul style="list-style-type: none"> • shall apply provided: <ol style="list-style-type: none"> 1) The leading aircraft maintains a true airspeed of 20 kt or more faster than the succeeding aircraft; 2) Each aircraft utilizes the same "on-track" DME stations; and 3) Separation is checked by obtaining simultaneous DME readings from the aircraft at frequent intervals to ensure that the minimum will not be infringed.

4.1.2. 2 AIRCRAFT SAME CRUISING LEVEL ON CROSSING TRACKS

20NM	<ul style="list-style-type: none"> • shall apply provided: 1) Each aircraft reports distance from the DME station located at the crossing point of the tracks; and 2) That the relative angle between the tracks is less than 90°.
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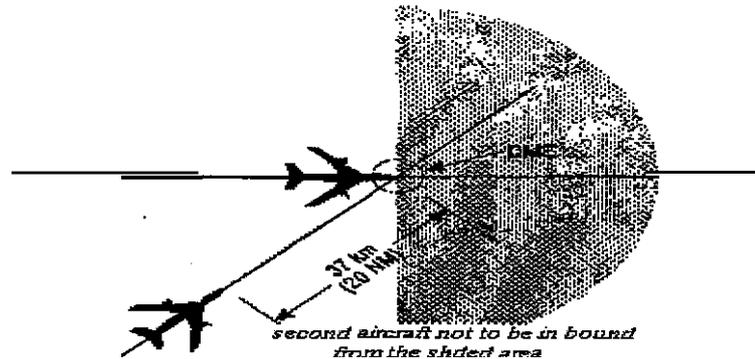
4.1.2.3 AIRCRAFT CLIMBING OR DESCENDING SAME TRACK

ISNM	<ul style="list-style-type: none"> • while vertical separation does not exist, provided: 1) Each aircraft utilizes "on-track" DME stations; 2) One aircraft maintains a level while vertical separation does not exist; and 3) Separation is established by obtaining simultaneous DME readings from the aircraft
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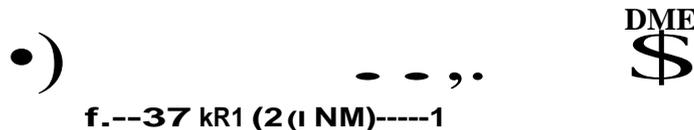
NOTE. Where a considerable change of level is involved, a descending aircraft may be cleared to some convenient level above the lower aircraft, or a climbing aircraft to some convenient level below the higher aircraft, to permit a further check on the separation that will obtain while vertical separation does not exist.

4.1.2.4 AIRCRAFT ON RECIPROCAL TRACKS

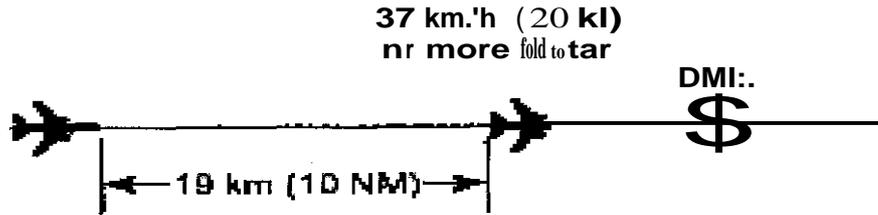
ISNM after aircraft have passed each other	<ul style="list-style-type: none"> • Aircraft utilizing on-track DME; may be cleared to climb or descend to (through the levels occupied by other aircraft utilizing on-track DME, provided that it has been positively established that the aircraft have passed each other and are at least 15 NM apart.,
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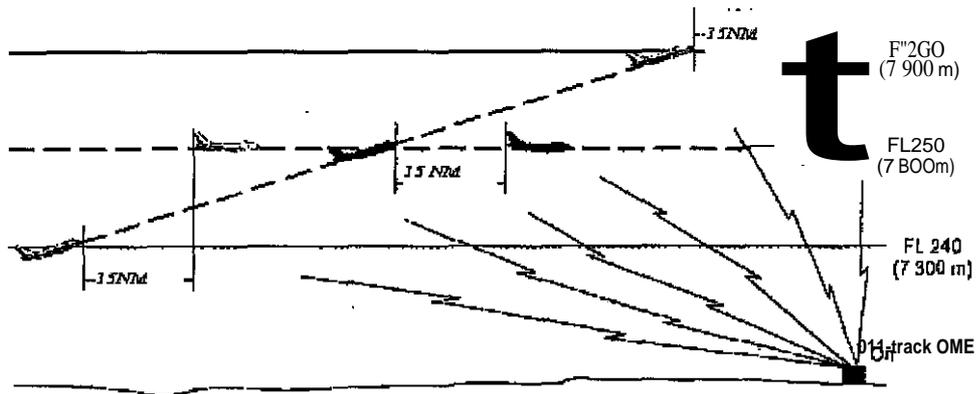
20 NM DME-based between aircraft on crossing tracks at same levels



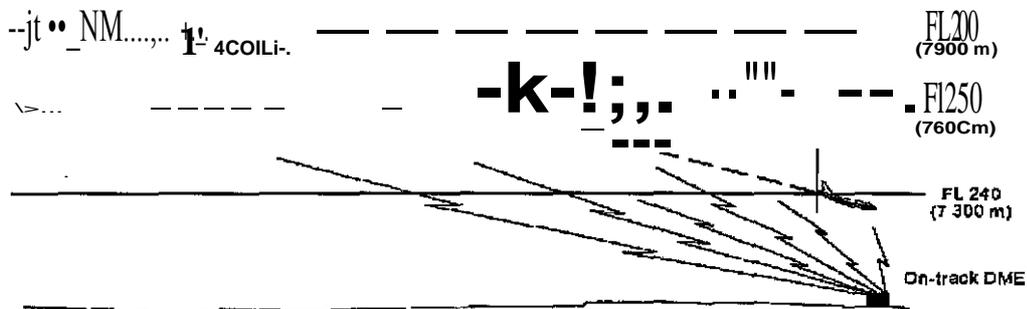
20NM DME-based separation between aircraft on same track and same level



10 NM DME-based separation between aircraft on same track and same level



15 NM DME-based separation between aircraft climbing and on same track



15 NM DME-based separation between aircraft descending and on same track

4.1.3 LONGITUDINAL SEPARATION MINIMA WITH MACH NUMBER TECHNIQUE BASED ON TIME

- a) Longitudinal separation may be maintained by application of speed control, including the Mach number technique based on True Mach number;
- b) Turbojet aircraft shall adhere to the Mach number approved by ATC and shall request ATC approval before making any changes thereto;
- c) If a temporary change in the Mach number is essential, due to turbulence, pilot shall notify ATC as soon as possible that such a change has been made;
- d) If, due to performance, unable to maintain last assigned Mach number during climb or descents, , pilots shall advise ATC at the time of the climb/descent request.
- e) When the Mach number technique is applied and provided that:

- 1) the aircraft concerned have reported over the same reporting point and follow the same track or continuously diverging tracks until some other form of separation is provided; or
- 2) if the aircraft have not reported over the same reporting point and it is possible to ensure, by radar or other means, that the appropriate time interval will exist at the common point from which they either follow the same track or continuously diverging tracks;

Minimum longitudinal separation between turbojet aircraft on the same track, whether in level, climbing or descending flight shall be as follows:

<i>TURBOJET A/C EN-ROUTE</i>	<i>SEPARATION MINIMUM</i>	<i>PROVISIONS; PROVIDED THAT:</i>
<i>SAME LEVEL; CLIMBING OR DESCENDING ON THE SAME TRACK</i>	10 min.....>	<ul style="list-style-type: none"> • Mach number is equal to or greater than that maintained by the following aircraft.
	9 min.....>	<ul style="list-style-type: none"> • Preceding aircraft is Mach 0.02 faster than the following aircraft;
	8 min.....>	<ul style="list-style-type: none"> • Preceding aircraft is Mach 0.03 faster than the following aircraft;
	7 min.....>	<ul style="list-style-type: none"> • Preceding aircraft is Mach 0.04 faster than the following aircraft;
	6 min.....>	<ul style="list-style-type: none"> • Preceding aircraft is Mach 0.05 faster than the following aircraft;
5 min.....>	<ul style="list-style-type: none"> • Preceding aircraft is Mach 0.06 faster than the following aircraft. 	

4.1.4 LONGITUDINAL SEPARATION MINIMA WITH MACH NUMBER TECHNIQUE (MMT) BASED ON DISTANCE USING RNAV

4.1.4.1 General

- a) Separation shall be established by maintaining not less than the specified distance between aircraft positions as reported by reference to RNAV equipment.
- b) Turbojet aircraft shall adhere to the Mach number approved by ATC and shall request ATC approval before making any changes thereto.
- c) If a temporary change in the Mach number is essential, due to turbulence, ATC shall be notified as soon as possible that such a change has been made.
- d) If it is not feasible, due to aircraft performance, to maintain the last assigned Mach number during en-route climbs and descents, pilots of aircraft concerned shall advise ATC at the time of the climb/descent request.
- e) **RNAV Distance-Based Separation Minima:**
 - 1) **Shall not be applied** after ATC has received pilot advice indicating navigation equipment deterioration or failure.
 - 2) **May be applied** between RNAV-equipped aircraft when operating on designated RNAV routes or on ATS routes defined by VOR.

4.1.4.2 Application & minima

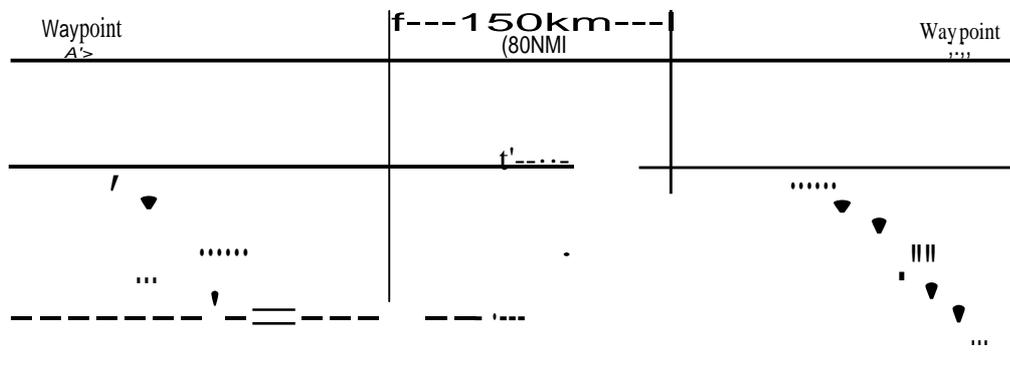
- a) Direct controller-pilot communications should be maintained, while such separation is used.

- b) To assist pilots to readily provide the required RNAV distance information, such position reports should be referenced to a common waypoint ahead of both aircraft.
- c) A minimum of SONM RNAV distance-based separation with MMT may be used on same-direction tracks instead of a 10 min minimum with MMT, provided that:
 - 1) Each aircraft reports its distance to or from the same "on-track" waypoint.
 - 2) Separation between aircraft at the same level is checked by obtaining simultaneous RNAV distance readings, from the aircraft at frequent intervals, to ensure that the minimum will not be infringed.
 - 3) Separation between aircraft climbing or descending is established by obtaining simultaneous RNAV distance readings from the aircraft; and
 - 4) In the case of aircraft climbing or descending, one aircraft maintains a level while vertical separation does not exist.
- d) When the 80 Nm longitudinal separation minimum with MMT is applied, the preceding aircraft maintains a Mach number equal to or greater than that maintained by the following aircraft.

NOTE. Where a considerable change of level is involved, a descending aircraft may be cleared to some convenient level above the lower aircraft, or a climbing aircraft to some convenient level below the higher aircraft, to permit a further check on the separation that will obtain while vertical separation does not exist.

4.1.4.3 AIRCRAFT ON RECIPROCAL TRACKS

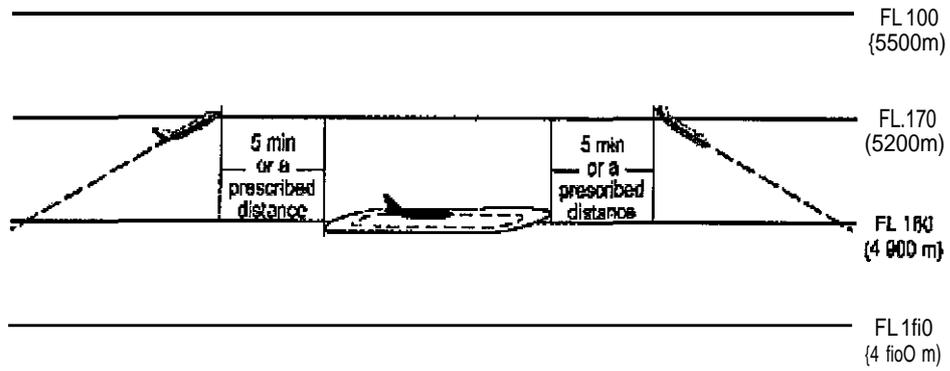
Aircraft utilizing RNAV may be cleared to climb/descend to or through the levels occupied by other aircraft utilizing RNAV, provided it has been positively established by simultaneous RNAV distance readings to or from the same "on-track" waypoint that the aircraft have passed each other and are at least SONM apart.



80 NM RNAV- based separation between aircraft on reciprocal tracks

4.1.5 SEPARATION OF AIRCRAFT HOLDING IN FLIGHT

- a) Aircraft established in adjacent holding patterns shall be separated by applicable vertical separation minimum., EXCEPT when holding areas are laterally separated;
- b) The vertical separation shall be applied between aircraft holding in non-laterally separated holding patterns
- c) Except when lateral separation exists, vertical separation shall be applied between aircraft holding in flight and other aircraft, whether arriving, departing or en-route, whenever the other aircraft concerned are within five minutes flying time of the holding area.



Separation between holding aircraft and en-route aircraft

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Section 5. MINIMUM SEPARATION FOR DEPARTURE AIRCRAFT

5.1 MINIMUM SEPARATION BETWEEN DEPARTING AIRCRAFT

NOTE. The following provisions are complementary to the previously specified longitudinal separation minima in this chapter.

MINIMUM SEPARATION	PROVISIONS
1 NM .•...•>	• Aircraft are to fly on tracks diverging by at least 45° immediately after take-off so that lateral separation is provided
2 NM .•...•>	• Between take-offs when the preceding aircraft is 40 kt or more faster than the following aircraft and both will follow the same track
5 NM	• Separation is required while vertical separation does not exist if a departing aircraft will be flown through the level of a preceding departing aircraft and both aircraft propose to follow the same track the five-minute separation will be maintained or increased while vertical separation does not exist.
<p><i>NOTE 1. This minimum may be reduced when aircraft are using parallel runways.</i></p> <p><i>NOTE 2. Wake vortices and their effect on aircraft, as well as Wake turbulence categories of aircraft should be considered</i></p>	

5.2 SEPARATION OF DEPARTING AIRCRAFT FROM ARRIVING AIRCRAFT

• *The following separation shall be applied when take-off clearance is based on the position of an arriving aircraft:*

- a) **If an arriving aircraft is making a complete instrument approach,** a departing aircraft may take-off:
 - 1) In any direction until an arriving aircraft has started its procedure turn or base turn leading to final approach;
 - 2) in a direction which is different by at least 45° from the reciprocal of approach direction after the arriving aircraft has started procedure turn or base turn leading to final approach, provided that the takeoff will be made at least 3 min before arriving aircraft is estimated to be over the beginning of the instrument runway.
- b) **If an arriving aircraft is making a straight-in approach,** a departing A/C may take-off:
 - 1) in any direction until 5 min before the arriving aircraft is estimated to be over the instrument runway;
 - 2) in a direction which is different by at least 45° from the reciprocal of approach direction of the arriving aircraft:
 - (i) until 3 min before the arriving aircraft is estimated to be over the beginning of the instrument runway, or
 - (ii) before the arriving aircraft crosses a designated fix on the approach track, when so determined in the ATC unit instructions.

5.3 Non-Radar Wake Turbulence Longitudinal Separation Minima

5.3.1 Applicability

- a) Wake turbulence separation shall not be required to apply:
 - 1) For arriving VFR flights landing on the same runway as a preceding landing HEAVY or MEDIUM aircraft; and
 - 2) Between arriving IFR flights executing visual approach when the aircraft has reported the preceding aircraft in sight and has been instructed to follow and maintain own separation from that aircraft.
- b) ATC unit shall issue a caution of possible wake turbulence in respect of a) above, as well as when otherwise deemed necessary.
- c) The pilot-in-command shall be responsible for ensuring that the spacing from a preceding aircraft of a heavier wake turbulence category is acceptable; and
- d) If it is determined that additional spacing is required, the flight crew shall inform the ATC unit accordingly, stating their requirements.

5.3.2 ARRIVING AIRCRAFT

- a) Except as provided for in 3.5.3.1, the following non-radar separation minima shall be applied to aircraft landing behind a HEAVY or a MEDIUM aircraft:
 - 1) MEDIUM aircraft behind HEAVY aircraft — **2 min;**
 - 2) LIGHT aircraft behind a HEAVY or MEDIUM aircraft-**3 min.**

5.3.3 DEPARTING AIRCRAFT

- a) **2 min separation minimum shall be applied between:**
 - 1) LIGHT or MEDIUM aircraft taking off behind a HEAVY aircraft; or
 - 2) LIGHT aircraft taking off behind a MEDIUM aircraft **when aircraft are using:**
 - (i) The same runway;
 - (ii) Parallel runways separated by less than 760 m;
 - (iii) Crossing runways if projected flight path of the second A/C will cross projected path of the first A/C at the same altitude or less than 1 000 ft below;
 - (iv) 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 1 000 ft below.
- b) **3 min separation minimum shall be applied between:**
 - 1) LIGHT or MEDIUM aircraft when taking off behind a HEAVY aircraft; or
 - 2) LIGHT aircraft when taking off behind a MEDIUM aircraft **from:**
 - (i) An intermediate part of the same runway; or
 - (ii) An intermediate part of a parallel runway separated by less than 760 m.

5.3.4 DISPLACED LANDING THRESHOLD

- a) **2 min separation minimum shall be applied between:**
 - 1) LIGHT or MEDIUM aircraft and a HEAVY aircraft; and
 - 2) LIGHT aircraft and a MEDIUM aircraft **when operating on a runway with a displaced landing threshold when:**
 - (i) Departing LIGHT or MEDIUM aircraft follows a HEAVY aircraft arrival and a departing LIGHT aircraft follows a MEDIUM aircraft arrival; or
 - (ii) 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.

5.3.5 AIRCRAFT OPPOSITE DIRECTION

a) 2 min separation minimum shall be applied between:

I) LIGHT or MEDIUM aircraft and a HEAVY aircraft; and

2) LIGHT aircraft and a MEDIUM aircraft **when the heavier aircraft is making a low or missed approach and the lighter aircraft is:**

(i) Utilizing an opposite-direction runway for take-off;

(ii) Landing on the same runway in the opposite direction, or on a parallel opposite-direction runway separated by less than 760 m.
