Airline Strategies and Choice of Aircraft
– Does Recovery or Size Matter –

9th Hamburg Aviation Conference

Hamburg, February 22 - 24, 2006

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Summary

- Market economics require smaller long haul aircraft rather than larger ones
- Incremental capacity per flight earns incremental revenue
- Middle East A380 carriers will impose enormous yield pressure on long haul markets to / from Asia and Pacific
- Larger aircraft might increase airport congestion rather than reduce it

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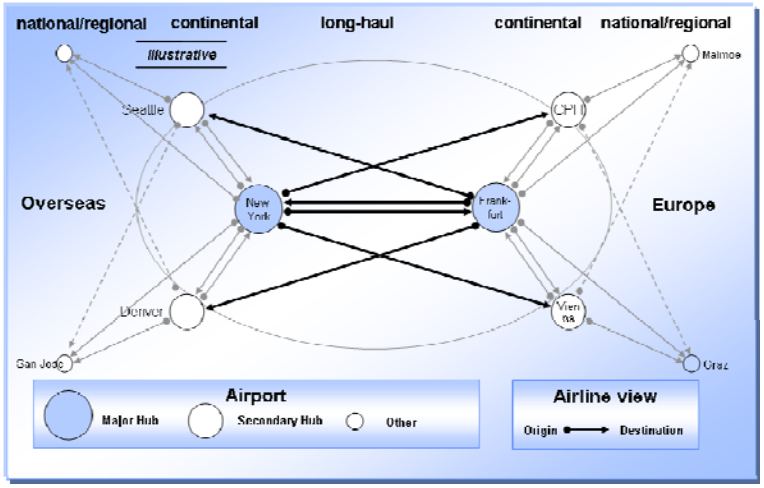
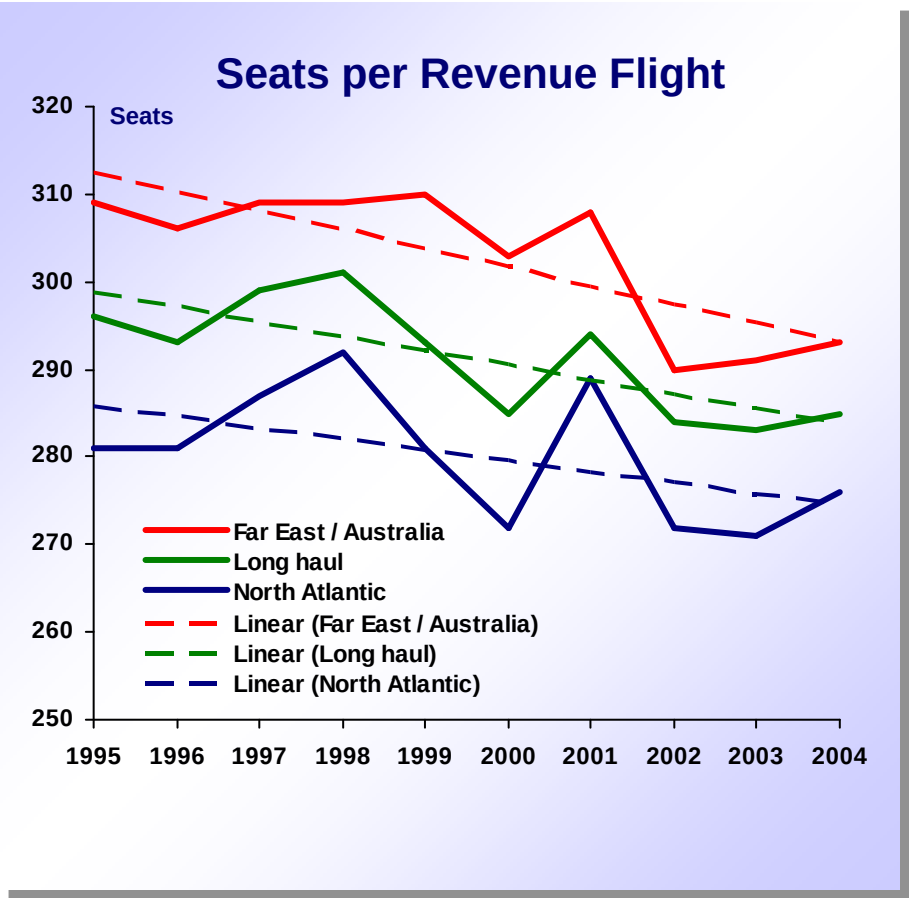


- ETOPS reduced economies of size in long haul operation
- B 787 and A 350 will further do so
- Customers prefer non stop
- Cost per O&D passenger of non stop operation lower than that of hub & spoke operation
- Growing demand allows for increasing non stop services between major hubs and secondary hubs



Incremental capacity per flight earns incremental revenue

- F-/C-Class compartments of existing aircraft can well be expanded to serve additional high yield demand.
- Additional A 380 seat capacity potential is economy class potential.
- Economy class market is highly price sensitive
- Long range economy class capacity of network carriers is oversized anyway and offered at extremely discounted rates to fill seats.

Additional seat capacity of A 380 will put further pressure on low yield market segments.

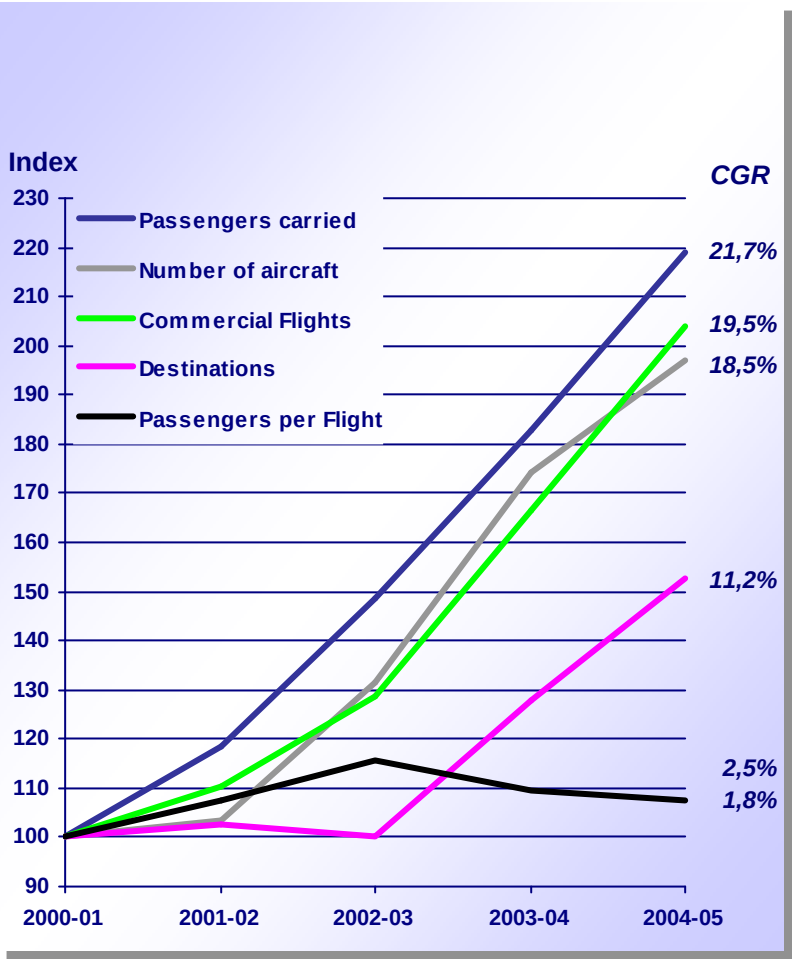
Middle East A380 carriers will impose enormous yield pressure on long haul markets to / from Asia and Pacific.

- Growth targets extremely aggressive
- Required increase of passengers per flight against market dynamics
- A 380 to be operated from / to major hubs, mostly in direct competition to non stops
- Feeder cost at network origin and destination hubs
- Investment seems to be driven by the vision to create local value added potential once oil reserves have been exploited

Additional capacities of Middle East carriers will trigger next economic down cycle of long haul markets concerned!

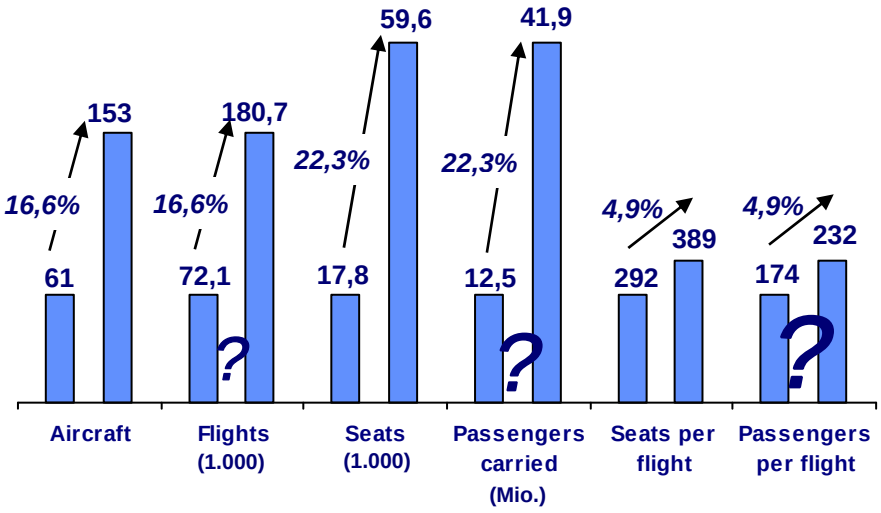
EMIRATES Key Performance Indicators

History



Future

Aircraft	2004	2010	Seats / AC	Seats 2004	Seats 2010
B777-200	9	9	303	2.727	2.727
B777-300	12	12	434	5.208	5.208
B777-300ER	1	30	386	386	11.580
A330-200	29	29	237	6.873	6.873
A340-300	6	8	267	1.602	2.136
A340-500	4	10	258	1.032	2.580
A340-600	0	10	370	0	3.700
A380-800	0	45	550	0	24.750
Total	**61**	**153**		**17.828**	**59.554**



CGR: Compounded growth rate

Larger aircraft might increase airport congestion rather than reduce it.

Wake vortex aspects of Airbus A380 aircraft

1. Departure spacing:

a) one additional minute to be added to all separations listed in Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM, Doc 4444), paragraph 5.8, when an A380 is the leading aircraft;

b) one additional minute to be added to the separation in PANS-ATM, paragraph 5.8.5

2. Horizontal spacing:

a) where both aircraft are established on final approach, 10 NM between an A380 and any other following aircraft;

b) 15 NM minimum radar spacing for all other phases of flight, including en route, between an A380 and all other aircraft operating directly behind at the same altitude or less than 300 m (1 000 ft) below.

Source: ICAO Regional Director Europe and North Atlantic; Ref. T 13/3 – 05-0661.SLG 10; Guidance for Amendment to PANS-ATM, Doc 4444; November 2005

Procedures for Air Navigation Services

5.8 NON-RADAR WAKE TURBULENCE LONGITUDINAL SEPARATION MINIMA

Spacing minima to be applied

- between landing aircraft: 2 – 3 minutes
- beween departing aircraft: 2 – 3 minutes

depending on operational layout and size of leading / following aircraft

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- between landing aircraft: 2 – 3 minutes
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Note: Horizontal minimum spacing to avoid wake turbulence risk behind a landing B 747 is 4 – 6 NM depending on the size of aircraft

position until either the unidentified controlled flight has been identified or non-radar separation has been established.

8.7.3.8 Radar separation may be applied between an aircraft taking off and a preceding departing aircraft or other radar-controlled traffic provided there is reasonable assurance that the departing aircraft will be identified within 2 km (1 NM) from the end of the runway, and that, at the time, the required separation will exist.

8.7.3.9 Radar separation shall not be applied between aircraft holding over the same holding point. Application of radar separation between holding aircraft and other flights shall be subject to requirements and procedures prescribed by the appropriate ATS authority.

8.7.4 Radar separation minima

8.7.4.1 Unless otherwise prescribed in accordance with 8.7.4.2, 8.7.4.3 or 8.7.4.4, or Chapter 6 with respect to independent and dependent parallel approaches, the horizontal radar separation minimum shall be 9.3 km (5.0 NM).

8.7.4.2 The radar separation minimum in 8.7.4.1 may, if so prescribed by the appropriate ATS authority, be reduced, but not below:

a) 5.6 km (3.0 NM) when radar capabilities at a given location so permit; and

b) 4.6 km (2.5 NM) between succeeding aircraft which are established on the same final approach track within 18.5 km (10 NM) of the runway end. A reduced separation minimum of 4.6 km (2.5 NM) may be applied, provided:

i) the average runway occupancy time of landing aircraft is proven, by means such as data collection and statistical analysis and methods based on a theoretical model, not to exceed 50 seconds;

ii) braking action is reported as good and runway occupancy times are not adversely affected by runway contaminants such as slush, snow or ice;

iii) a radar system with appropriate azimuth and range resolution and an update rate of 5 seconds or less is used in combination with suitable radar displays; and

iv) the aerodrome controller is able to observe, visually or by means of surface movement radar (SMR) or a surface movement guidance and control system (SMCGS), the runway-in-use and associated exit and entry taxiways;

v) wake turbulence radar separation minima in 8.7.4.4, or as may be prescribed by the appropriate ATS authority (e.g. for specific aircraft types), do not apply;

vi) aircraft approach speeds are closely monitored by the controller and when necessary adjusted so as to ensure that separation is not reduced below the minimum;

vii) aircraft operators and pilots have been made fully aware of the need to exit the runway in an expeditious manner whenever the reduced separation minimum on final approach is applied; and

viii) procedures concerning the application of the reduced minimum are published in AIPs.

8.7.4.3 The radar separation minimum or minima to be applied shall be prescribed by the appropriate ATS authority according to the capability of the particular radar system or sensor to accurately identify the aircraft position in relation to the centre of an RPS, PSR blip or SSR response and taking into account factors which may affect the accuracy of the radar-derived information, such as aircraft range from the radar site.

8.7.4.4 The following wake turbulence radar separation minima shall be applied to aircraft in the approach and departure phases of flight in the circumstances given in 8.7.4.4.1.

Aircraft category		
Preceding aircraft	*Succeeding aircraft*	*Wake turbulence radar separation minima*
HEAVY	HEAVY	7.4 km (4.0 NM)
	MEDIUM	9.3 km (5.0 NM)
	LIGHT	11.1 km (6.0 NM)
MEDIUM	LIGHT	9.3 km (5.0 NM)

Note.— The provisions governing wake turbulence aircraft categorization are set forth in Chapter 4, Section 4.9.

8.7.4.4.1 The minima set out in 8.7.4.4 shall be applied when:

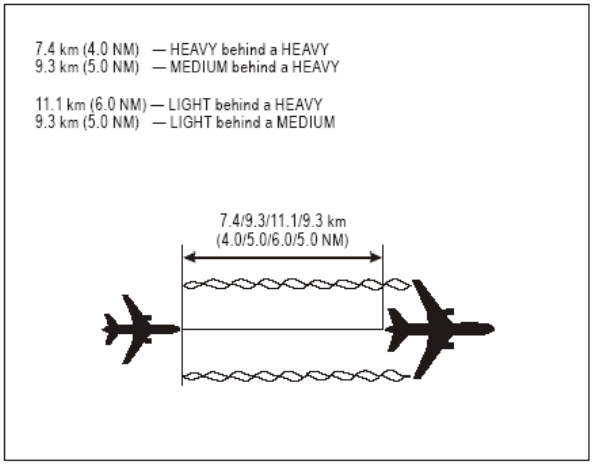
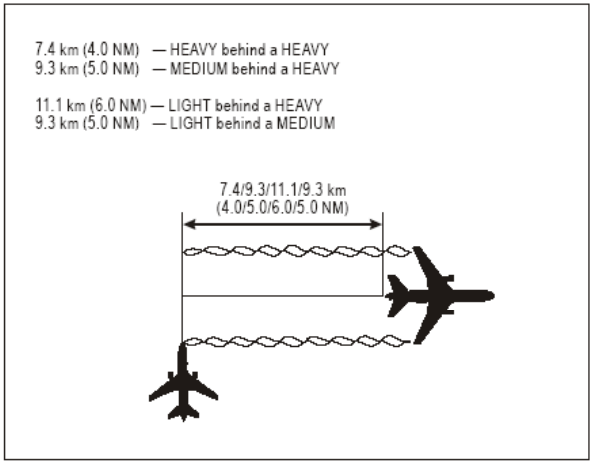


Figure 8-1A. Operating directly behind (see 8.7.4.4 and 8.7.4.4.1)



Figures 8-1B. Crossing behind (see 8.7.4.4 and 8.7.4.4.1).

5.7.1.2 If an arriving aircraft is making a straight-in approach, a departing aircraft may take off:

a) in any direction until 5 minutes before the arriving aircraft is estimated to be over the instrument runway;

b) in a direction which is different by at least 45 degrees from the reciprocal of the direction of approach of the arriving aircraft:

1) until 3 minutes before the arriving aircraft is estimated to be over the beginning of the instrument runway (see Figure 5-38), or

2) before the arriving aircraft crosses a designated fix on the approach track; the location of such fix to be determined by the appropriate ATS authority after consultation with the operators.

5.8 NON-RADAR WAKE TURBULENCE LONGITUDINAL SEPARATION MINIMA

5.8.1 Applicability

5.8.1.1 The ATC unit concerned shall not be required to apply wake turbulence separation:

a) for arriving VFR flights landing on the same runway as a preceding landing HEAVY or MEDIUM aircraft; and

b) 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.

5.8.1.2 The ATC unit shall, in respect of the flights specified in 5.8.1.1 a) and b), as well as when otherwise deemed necessary, issue a caution of possible wake turbulence. The pilot-in-command of the aircraft concerned shall be responsible for ensuring that the spacing from a preceding aircraft of a heavier wake turbulence category is acceptable. If it is determined that additional spacing is required, the flight crew shall inform the ATC unit accordingly, stating their requirements.

5.8.2 Arriving aircraft

5.8.2.1 Except as provided for in 5.8.1.1 a) and b), the following non-radar separation minima shall be applied:

5.8.2.1.1 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.

5.8.3 Departing aircraft

5.8.3.1 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 (2 500 ft);

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 300 m (1 000 ft) below;

d) parallel runways separated by 760 m (2 500 ft) 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 300 m (1 000 ft) below.

Note.— See Figures 5-39 and 5-40.

5.8.3.2 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 (2 500 ft).

Note.— See Figure 5-41.

5.8.4 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:

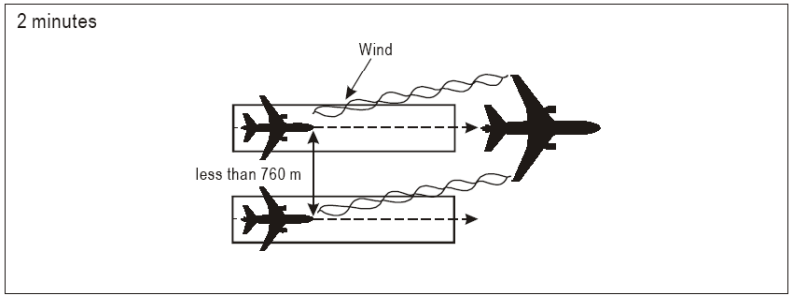


Figure 5-39. Two-minute separation for following aircraft (see 5.8.3.1 a) and b))

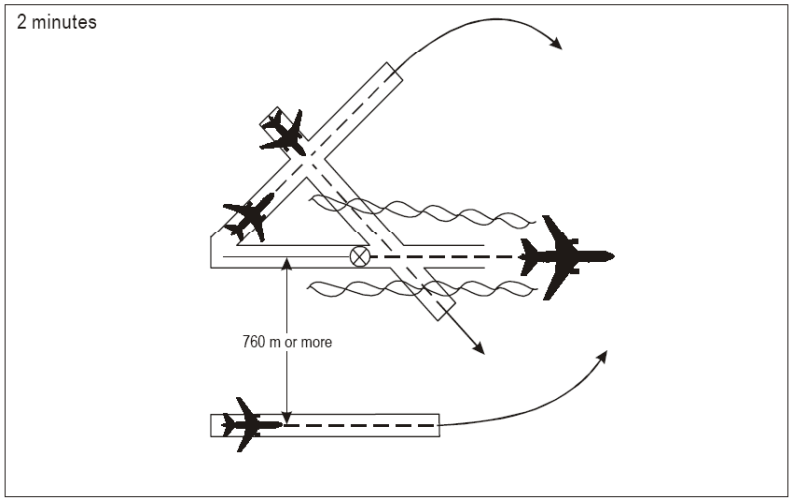


Figure 5-40. Two-minute wake turbulence separation for crossing aircraft (see 5.8.3.1 c) and d))

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.

5.8.5 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

Note.— See Figure 5-42.

b) landing on the same runway in the opposite direction, or on a parallel opposite-direction runway separated by less than 760 m (2 500 ft).

Note.— See Figure 5-43.

5.9 CLEARANCES TO FLY MAINTAINING OWN SEPARATION WHILE IN VISUAL METEOROLOGICAL CONDITIONS

Note 1.— As indicated in this Section, the provision of vertical or horizontal separation by an air traffic control unit is not applicable in respect of any specified portion of a flight cleared subject to maintaining own separation and remaining in visual meteorological conditions. It is for the flight so cleared to ensure, for the duration of the clearance, that it is not operated in such proximity to other flights as to create a collision hazard.

Note 2.— It is axiomatic that a VFR flight must remain in visual meteorological conditions 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.

Note 3. — The objectives of the air traffic control service as prescribed in Annex 11 do not include prevention of collision with terrain. The procedures prescribed in this document do not therefore relieve pilots of their responsibility to ensure that any clearance issued by air traffic control units is safe in this respect, except when an IFR flight is vectored using radar. See Chapter 8, 8.6.5.2.

When so requested by an aircraft and provided it is agreed by the pilot of the other aircraft and so authorized by the appropriate ATS authority, 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. When a controlled flight is so cleared, the following shall apply:

a) the clearance shall be for a specified portion of the flight at or below 3 050 m (10 000 ft), during climb or descent and subject to further restrictions as and when prescribed on the basis of regional air navigation agreements;

b) if there is a possibility that flight under visual meteorological conditions may become impracticable, an IFR flight shall be provided with alternative instructions to be complied with in the event that flight in visual meteorological conditions (VMC) cannot be maintained for the term of the clearance;

c) the pilot of an IFR flight, on observing that conditions are deteriorating and considering that operation in VMC will become impossible, shall inform ATC before entering instrument meteorological conditions (IMC) and shall proceed in accordance with the alternative instructions given.

Note.— See also 5.10.1.2.

5.10 ESSENTIAL TRAFFIC INFORMATION

5.10.1 General

5.10.1.1 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.

Note.— Pursuant to Section 3.1 of Chapter 3, but subject to certain exceptions stated therein, ATC is required to provide separation between IFR flights in airspace Classes A to E, and between IFR and VFR flights in Classes B and C. ATC is not required to provide separation between VFR flights, except within airspace Class B. Therefore, IFR or VFR flights may constitute essential traffic to IFR traffic, and IFR flights may

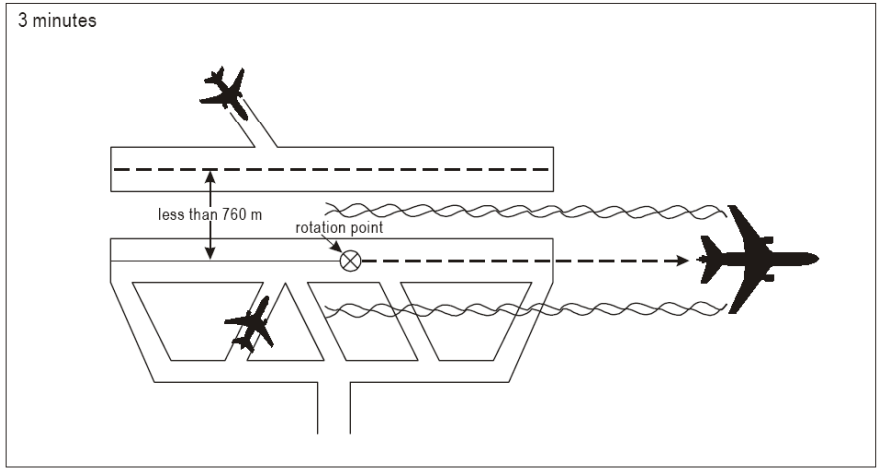


Figure 5-41. Three-minute wake turbulence separation for following aircraft (see 5.8.3.2)

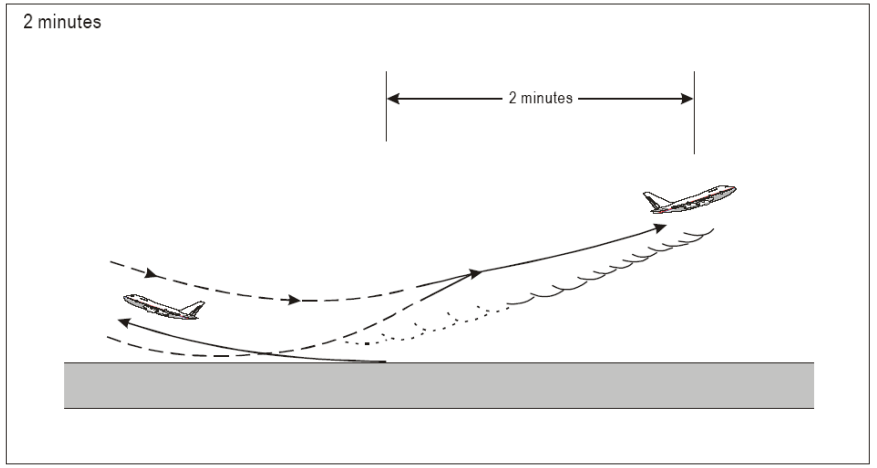


Figure 5-42. Two-minute wake turbulence separation for opposite direction take-off (see 5.8.5 a))