Aviation Safety Investigation Report 199502093

Boeing Co B737

05 July 1995

Readers are advised that the Australian Transport Safety Bureau investigates for the sole purpose of enhancing transport safety. Consequently, Bureau reports are confined to matters of safety significance and may be misleading if used for any other purposes.

Investigations commenced on or before 30 June 2003, including the publication of reports as a result of those investigations, are authorised by the Executive Director of the Bureau in accordance with Part 2A of the Air Navigation Act 1920.

Investigations commenced after 1 July 2003, including the publication of reports as a result of those investigations, are authorised by the Executive Director of the Bureau in accordance with the Transport Safety Investigation Act 2003 (TSI Act). Reports released under the TSI Act are not admissible as evidence in any civil or criminal proceedings.

NOTE: All air safety occurrences reported to the ATSB are categorised and recorded. For a detailed explanation on Category definitions please refer to the ATSB website at www.atsb.gov.au.

Occurrence Number:	199502093	Occurrence Type:	Incident		
Location:	21km NW Sydney, Aerodrome				
State:	NSW	Inv Category:	3		
Date:	Wednesday 05 July 1995				
Time:	0925 hours	Time Zone	EST		
Highest Injury Level:	None				
Aircraft	Boeing Co				
Manufacturer:	-				
Aircraft Model:	737-376				
Aircraft Registration:	VH-TAX			Serial Number:	23489
Type of Operation:	Air Transport Domestic Hig Scheduled	h Capacity Passeng	er		
Damage to Aircraft:	Nil				
Departure Point:	Canberra ACT				
Departure Time:					
Destination:	Sydney NSW				

Approved for Release: Tuesday, December 10, 1996

FACTUAL INFORMATION

The Boeing 737 was being radar vectored to intercept the final approach path for a landing on runway 16R from a right base leg, to follow a Boeing 747 which was already established on the instrument landing system (ILS) final approach. The B737 turned onto the ILS localiser track below the glideslope whilst descending to 2,500 ft some 10.5 NM from the runway threshold. Shortly after the localiser track was intercepted, the aircraft experienced several abrupt changes in bank angle, both left and right, the most severe being a roll to the right through 51 degrees to a maximum right bank of 34.8 degrees. A missed approach was carried out, followed by a normal approach and landing. A post-flight inspection found no defects which may have contributed to the occurrence. The aircraft was subsequently cleared to continue scheduled operations.

A review of recorded radar data and of information derived from the flight data recorders of the B737 and the preceding B747. It showed that the B737 was about 450 ft lower than the B747 had been at the same point in space, reaching that point some 127 seconds after the B747 had passed. The longitudinal separation between the B737 and the B747 at that time was 5.5 NM.

Recorded wind data, as derived from the inertial reference system of the B737, indicated the wind direction varied between 165 and 185 degrees, at a speed of 8-14 kts.

ANALYSIS

The circumstances described in this occurrence are very similar to those of an earlier occurrence (9500460). The following features were common to both:

Both lead aircraft were B747s which were established on the localiser as well as the glideslope. Both following aircraft were B737s which were given a radar vector to intercept the localiser, below the glideslope, at 2,500 ft. This resulted in both B737s passing the same point in space some two minutes later, but 500 ft lower than the preceding B747s.

Atmospheric conditions in the vicinity of the approach path at the time of both occurrences were conducive to the slow decay of wake vortices. As the localiser track is 155 degrees, there would have been little or no lateral displacement of any wake vortices produced by the B747s.

Both following aircraft encountered uncommanded rolls consistent with encountering wake turbulence generated by the preceding B747.

United Kingdom Civil Aviation Authority wake turbulence studies (August 1994) have shown that B747 aircraft produce high rates of wake turbulence affecting following aircraft.

For sequencing purposes during VMC operations in the Sydney terminal area, most domestic aircraft arriving from the south are radar vectored to join a downwind leg when runway 16 is the duty runway. These aircraft are routinely cleared to descend to 2,500 ft whilst being radar vectored to intercept final approach about 6 NM from touchdown. International flights however, must be established on final approach at least 10 NM from the threshold. Many of these aircraft, such as the B747, are in the "heavy" category. This sequencing often results in the following domestic aircraft passing through the same lateral airspace as the preceding aircraft but some 500 ft lower.

The relative positions of respective aircraft, the provision of minimum wake turbulence radar separation, and meteorological conditions conducive to the formation and slow decay of wake vortices can make it possible for aircraft to experience wake turbulence encounters whilst such procedures are being implemented.

Consideration, therefore, of the vertical positioning of the following aircraft relative to the leader may provide the greatest potential for preventing accidents and incidents as a result of wake turbulence encounters.

SIGNIFICANT FACTORS

1. Atmospheric conditions were conducive to the slow decay of wingtip vortices generated by the preceding B747.

2. The B737 was sequenced by ATC to intercept the localiser for runway 16 approximately 500 ft below the preceding B747.

SAFETY ACTION

As a result of the investigation into this occurrence and a number of other occurrences, the Bureau of Air Safety Investigation issued interim IR 960101 recommendations to the Civil Aviation Safety Authority and Airservices Australia on 7 November 1996.

"1. The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority and Airservices Australia:

"(i) Evaluate the current wake turbulence separation standards. Consideration should be given to the evaluation of technology being developed to aid in the detection, tracking and forecasting of wake vortices as a further means of reducing the risk of wake turbulence encounters.

"(ii) Critically evaluate all current airport arrival and departure paths and procedures to identify and eliminate potential wake turbulence problems.

"2. The Bureau of Air Safety Investigation recommends that the Civil Aviation Safety Authority re-institute a wake turbulence education program. This education program should highlight areas of possible wake turbulence encounters and advise ways to minimise the effects of the encounters".