Boeing 747-436, G-CIVP

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Aircraft Type and Registration:	Boeing 747-436, G-CIVP
No & Type of Engines:	4 Rolls-Royce RB211-524H2-19 turbofan engines
Year of Manufacture:	1998
Date & Time (UTC):	13 April 1999 at 1200 hrs
Location:	Java Sea, Indonesia
Type of Flight:	Public Transport
Persons on Board:	Crew - 17 - Passengers - 235
Injuries:	Crew - 2 minor - Passengers - 3 (serious) - 22 (minor)
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	N/A
Commander's Flying Experience:	N/A
Information Source:	AAIB Field Investigation

The incident occurred on a scheduled flight from Brisbane, Australia to Singapore. The aircraft was in level flight at FL390, in the vicinity of airway intersection SABIL, when severe turbulence was experienced. In the passenger cabin a meal service was being carried out. Turbulence was not anticipated and the seat belt signs were off. The turbulence was of short duration, lasting for 15 seconds, but there were a number of injuries. The aircraft commander decided to continue the flight to Singapore and made a request for medical services to meet the aircraft on arrival. The aircraft landed at Singapore 44 minutes later. An engineering inspection was carried out after landing and revealed no damage to the aircraft.

Meteorological conditions

Weather balloon observations were available for the region having been recorded at 1200 hrs. These indicated that the winds at FL390 were around 30 kt. There were no significant windshears or large changes in direction evident from the data. It is thus considered that clear air turbulence of the type associated with strong vertical and horizontal windshear can be discounted.

The significant weather charts available for the region gave no indication of expected cumulonimbus (CB) activity in the area. It should be noted that these charts only use the term CB when referring to areas of widespread or embedded CB cloud and not for isolated clouds.

The incident occurred after sunset when it was dark outside the aircraft. An infrared satellite photograph of the weather activity in the area for 1200 hrs was obtained and showed a single very bright cell located almost exactly at the point of the turbulence encounter. Indications from cloud top temperatures in the location show that there was strong vertical development.

Other information

The incident occurred at an airway intersection and so the possibility of a wake turbulence encounter should be considered. There was no evidence of another aircraft operating in the vicinity at the time of the incident. Low level wake turbulence is well understood but there is only a limited amount of information on the severity of wake turbulence at high levels.

Flight recorders

The operator's Optical Quick Access Recorder (OQAR) showed the aircraft was at FL390, 264 kt (CAS) and on a heading of 313°M. The wind speed and direction were recorded on the OQAR from the inertial reference system. Initially the wind speed was 18 kt from a direction of 090°. At 1200 hrs UTC the wind backed to a direction of about 020° and reduced to below 10 kt. There was also a change in the recorded outside air temperature of ± 2°. The airspeed increased to 274 kt CAS, and then reduced to 256 kt before stabilising back at 264 kt. The maximum altitude recorded was 39,285 feet and the aircraft rolled to maximum roll attitude of -11° left wing down.

The upset was recorded by excursions in normal acceleration, with a maximum 'g' recorded of 1.77 and a minimum of -0.26. The upset lasted for a period of about 15 seconds. The stick shake operated for a period of less than one second. The autopilot remained engaged throughout.

Discussion

The aircraft encountered turbulence probably associated with an area of rapidly developing CB cloud. Under the prevailing conditions of darkness weather detection and avoidance would have been achieved by reference to weather radar. Airborne weather radar is unable to detect rapidly rising cloud tops composed of small particles. The development of the cloud may have been at an early stage so that it was not detectable by radar although it was already visible on an infrared satellite image. It is known that severe turbulence can occur well above the tops of CB clouds.