



Australian Government

Australian Transport Safety Bureau

Severe turbulence involving Airbus A330, B-5921

near Sydney, New South Wales, 29 November 2016

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Addendum

Page	Change	Date

Severe turbulence involving Airbus A330, B-5921

What happened

On 28 November 2016, at about 1656 Coordinated Universal Time (UTC),¹ a China Eastern Airlines Airbus A330-243, registered B-5821, operating flight MU-777, departed Kunming, China, for Sydney, New South Wales. On board were 14 crew and 213 passengers.

As the aircraft approached Sydney, the flight crew commenced descent from flight level (FL) 370.² The flight crew advised the cabin crew of the descent and illuminated the seatbelt signs. The cabin crew manager announced to the passengers that the aircraft was on descent to Sydney and that as the seatbelt sign had been illuminated they needed to fasten their seatbelts. The cabin crew proceeded to check that passengers had their seatbelts fastened, starting from the front rows and moving towards the back of the cabin.

During descent, the flight crew diverted 5 NM from the flight route due to thunderstorms. Once clear of weather, they received instructions to descend via waypoint³ BOREE.

At 0248 UTC at FL 230, about ten minutes after the seatbelt sign had been illuminated, the aircraft experienced a severe turbulence event which lasted about 30 seconds. The flight crew commenced the turbulence checklist as per the quick reference handbook (QRH), starting with 'ignition on', but as the turbulence had stopped, the rest of checklist was not completed. They checked the flight instruments and engine indications, which were normal, so the flight was continued to Sydney.

Prior to the event, the cabin crew manager was at the back of the cabin checking seatbelts and observed four passengers without a seatbelt, one of whom was standing and reaching for their baggage. During the turbulence event, the cabin crew manager struck their back on a seat armrest. A cabin crewmember in front of the cabin crew manager fell to the ground. Two of the passengers without seatbelts struck their head on the ceiling. After the event, all cabin crewmembers returned to their seats.

After landing, at around 0314 UTC, a cabin crewmember informed the flight crew that there were eleven people who were injured, including three cabin crew. The aircraft sustained minor damage to the interior cabin above row 42, 64, 65, and 68 (Figure 1).

¹ Coordinated Universal Time (abbreviated UTC) is the time zone used for civil aviation. Local time zones around the world can be expressed as positive or negative offsets from UTC.

² At altitudes above 10,000 ft, an aircraft's height above mean sea level is referred to as a flight level (FL). FL370 equates to 37,000 ft.

³ A pre-determined geographic position in airspace.

Figure 1: Damage to cabin (row 42, and 68 passenger service unit)



Source: Operator (annotated by the ATSB)

Captain's comments

The captain provided the following comments:

- On approach to Sydney, the crew did not receive any reports regarding turbulence. They did observe other aircraft divert to avoid the thunderstorms.
- Once they completed the diversion around the thunderstorms, there was no further weather on the radar.
- During the descent, there was some cloud scattered, but no dangerous weather, because they had diverted from the thunderstorms 5–8 minutes earlier.
- The turbulence they experienced was different to any turbulence they experienced before, as it was very short, but very strong.
- As the turbulence event was very short, they did not report it to ATC.
- During the turbulence, there was little change in airspeed or rate of descent.
- The flight crew did not realise that there were any issues within the cabin until after landing. Normally, they would be notified by the cabin crew if there were injuries.
- The flight crew did not make any announcement to passengers, nor cabin crew about the turbulence, as they did not have any warning.

Cabin crew manager comments

The cabin crew manager provided the following comments:

- The seatbelt sign had been switched on about 10 minutes before the turbulence.
- The cabin crew were preparing the aircraft for landing, and ensuring that passengers had their seatbelts on, when the turbulence event occurred.
- The cabin crew did not notify the captain until after landing as the cabin crew manager was injured and they were aware the flight crew were preparing for landing.
- The cabin crew had to keep encouraging passengers to fasten their seatbelts during the flight.

Flight data

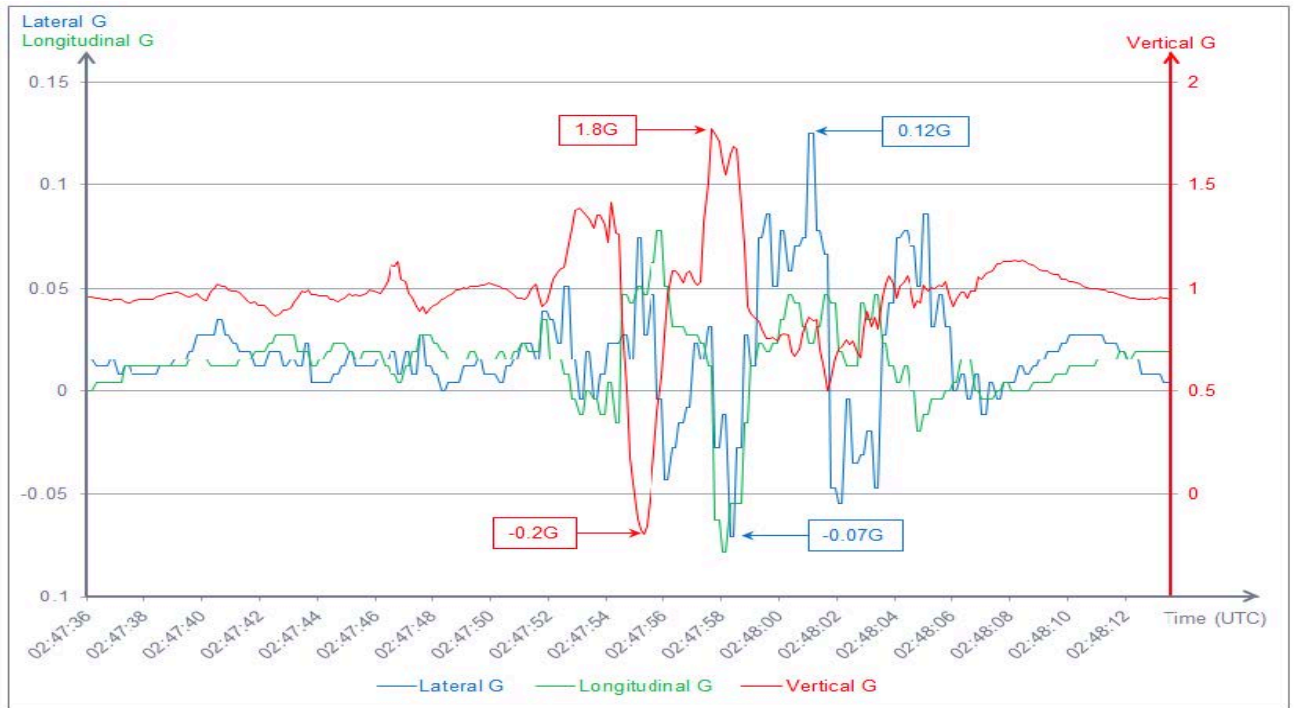
The aircraft manufacturer provided the ATSB with a report of the data extracted from the digital flight data recorder (DFDR). The data shows that when the aircraft encountered the turbulence, the vertical G⁴ loadings varied between -0.20 G and 1.8 G and the lateral G loadings varied

⁴ G load: the nominal value for acceleration. In flight, g load represent the combined effects of flight manoeuvring loads and turbulence and can have a positive or negative value.

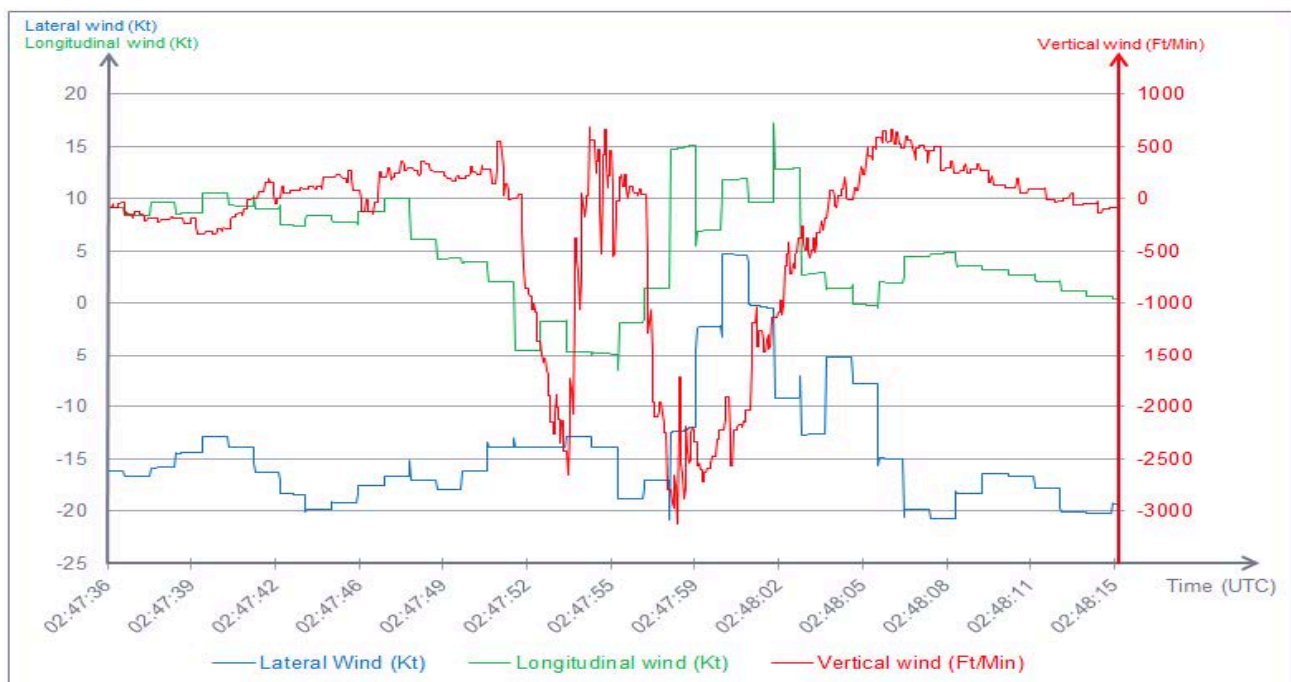
between -0.07 G and 0.12 G (Figure 2). The calculated longitudinal wind varied between around 15 kt tailwind and 5 kt headwind and the lateral wind varied between 20 kt right and 5 kt left. The vertical wind reached a maximum of about 3,100 feet per minute updraft (Figure 3). During the turbulence, the autopilot stayed engaged and the load factors experienced during the turbulence did not exceed the limits of the aircraft.

The rapid changes to wind speed and direction confirm the aircraft encountered turbulence conditions.

Figure 2: G Loadings during turbulence



Source: Airbus

Figure 3: Wind variation during turbulence

Source: Airbus

Bureau of Meteorology report

The Bureau of Meteorology (BoM) provided the ATSB with a report detailing the weather at the time of the incident, including conditions, the weather forecast, warnings, and satellite and radar imagery.

The report showed that there were light winds between 20 to 30 kt from FL180 to FL450. There was no significant weather at the time of the turbulence.

It is likely that the turbulence encountered was the result of developing thunderstorms in the area.

Clear air turbulence

Clear air turbulence (CAT) is defined as sudden severe turbulence occurring in cloudless regions that causes violent buffeting of aircraft.

CAT can be serious, because it is not shown on weather radar, meaning it is difficult for pilots, air traffic controllers, and weather forecasters to detect. It can also occur when no clouds are visible. It is common at high altitudes, especially in the vicinity of jetstreams.

Previous occurrences

A search of the ATSB database found the following occurrences where aircraft encountered clear air turbulence resulting in injuries on board:

- On 27 October 2000, a Boeing 747 encountered clear air turbulence en route from Sydney to Osaka, Japan ([ATSB investigation 200005031](#)). Although the weather forecast indicated thunderstorms within 110 NM of the flight route there was no turbulence forecast. When the CAT struck, the seatbelt sign was not illuminated, and people were moving about the cabin. Two passengers sustained broken ankles.
- On 10 May 2013, a Bombardier DHC-8 encountered clear air turbulence about 49 NM north of Townsville, Queensland ([ATSB investigation AO-2013-084](#)). The turbulence lasted about 10 seconds. The crew did not observe any cloud and the weather radar did not show any significant weather for the entire flight. Two cabin crew members who were standing at the

time sustained head injuries, one of whom was knocked unconscious. Two flight crew sustained minor injuries when objects were thrown around the flight deck.

Safety analysis

The aircraft encountered unforecast CAT about ten minutes after the seatbelt sign had been illuminated for the descent into Sydney. The cabin crew were preparing the cabin for landing. A number of passengers and members of the cabin crew, towards the back of the aircraft, who were not wearing seatbelts, were injured during the CAT event. They sustained head, neck, hand, back, and abdominal injuries.

Finding

This finding should not be read as apportioning blame or liability to any particular organisation or individual.

- The aircraft encountered CAT. The cabin crew and passengers who were injured during the turbulence did not have seatbelts fastened, despite the seatbelt sign being switched on.

Safety message

A clear air turbulence encounter can be a surprising experience for both crew and passengers. A safety bulletin published by the ATSB [Staying safe against in-flight turbulence](#), noted that almost all turbulence injuries involved people who are not properly seated and do not have their seatbelt fastened. This incident is a timely reminder of the importance of having the seatbelt fastened when the seatbelt sign is switched on and to pay attention to instructions given by the cabin crew, so that injuries during a turbulence encounter can be minimised.

General details

Occurrence details

Date and time:	29 November 2016 – 1345 ESuT	
Occurrence category:	Incident	
Primary occurrence type:	Turbulence	
Location:	Near Sydney Airport	
	Latitude: 33° 56.77' S	Longitude: 151° 10.63' E

Aircraft details

Manufacturer and model:	Airbus A330	
Registration:	B-5921	
Operator:	China Eastern Yunnan Airlines	
Serial number:	1402	
Type of operation:	Air Transport – High capacity	
Persons on board:	Crew – 14	Passengers – 213
Injuries:	Crew – 3 (minor)	Passengers – 8 (minor)
Aircraft damage:	Minor	

About the ATSB

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in:

independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; and fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.