AO-2012-036: CS-TQM, Hard Landing

Date and time:	28 February 2012, 2327 CST	
Location:	Darwin Airport, Northern Territory	
Occurrence category:	Incident	
Occurrence type:	Hard landing	
Aircraft registration:	CS-TQM	
Aircraft manufacturer and model:	Airbus A340-313X	
Type of operation:	Charter	
Persons on board:	Crew – 8	Passengers – 116
Injuries:	Crew – Nil	Passengers – Nil
Damage to aircraft:	Serious incident	

FACTUAL INFORMATION

On 28 February 2012, an Airbus A340-313X aircraft, Portuguese registered CS-TQM (TQM), was operating on a chartered service from Sydney, New South Wales to Darwin Airport, Northern Territory.

At about 2327 Central Standard Time (CST)[1], the flight crew of TQM were conducting an ILS[2] approach to runway 29 at Darwin Airport. The descent and initial stages of the approach were conducted in night visual meteorological conditions[3] in light rainfall. The flight crew recalled seeing heavy rainfall close to the threshold of runway 29 during the approach. They requested further information about the weather from Air Traffic Control (ATC) and were informed that there was a storm at the threshold of runway 29, extending to the east. The flight crew asked ATC for the reported wind at the aerodrome and were told it was indicating 360° at 5 kts at the western side of the field and downwind at 5 kts[4] at the threshold. The crew briefed the possibility of a missed approach[5] if the conditions deteriorated.

Approaching the runway, the rain increased and the First Officer requested the wipers be selected to high. The flight crew noted an increased sink rate and at 55 ft above ground level (AGL), the thrust levers were set to maximum continuous thrust to arrest the descent rate. At 34 ft, engine thrust was set to idle. As the aircraft entered the flare[6] the rain intensified, significantly reducing visibility.

The aircraft landed heavily, recording 2.71 G on touchdown. The tower enquired about the landing conditions and the flight crew reported heavy rain and marginal conditions. This required a hard landing inspection to be conducted prior to further flight. An engineering inspection was conducted in Darwin and a crack in the No. 1 engine rear attachment bolt retainer was found. However, the link between this crack and the hard landing could not be established.

The Portuguese National Authorities (INAC) and the European Aviation Safety Agency (EASA) approved the aircraft to fly up to three non-revenue flights to access a maintenance facility for repair work to be

1 Central Standard Time (CST) was Coordinated Universal Time (UTC) + 9.5 hours

2 Instrument Landing System (ILS) is a standard ground aid to landing, comprising two directional radio transmitters: the localizer, which provides direction in the horizontal plane; and the glideslope, for vertical plane direction, usually at an inclination of 3°. Distance measuring equipment or marker beacons along the approach provide distance information.

3 Visual Meteorological Conditions is an aviation flight category in which visual flight rules (VFR) flight is permitted – that is, conditions in which pilots have sufficient visibility to fly the aircraft maintaining visual separation from terrain and other aircraft.

4 Downwind 5kts indicated a tailwind of 5kts.

5 An aborted approach for any reason, followed by a go-around.

6 Final nose-up pitch of landing aeroplane to reduce rate of descent close to zero at touchdown.

conducted. It was subsequently decided that a number of components from both main landing gears were to be replaced as they may have exceeded their design limit.

Aircraft performance

The Flight Data Recorder (FDR) data was provided to the ATSB by the operator for analysis. Airbus also completed an analysis of the flight data which showed that just prior to touchdown, the wind changed from a 9 kt headwind to a 6 kt tailwind, with a downdraft component of 7 kts in a 2.5 second period (Figure 1).

From 560 ft AGL to 49 ft, vertical speed fluctuated between 240 ft/min and 943 ft/min rate of descent. From 350 ft, the aircraft began to deviate above the glideslope, reaching a maximum deviation of about 0.5 dots at 280 ft. From 250 ft, the glideslope deviation decreased, with a value of -0.6 dots at approximately 150 ft, when the parameter value became unreliable.

At 49 ft AGL, the crew set maximum continuous thrust and engine power increased to 75% N1[7] and the rate of descent reduced to about 300 ft/min.

At 25 ft AGL, thrust was set to the idle position. Between 34 ft and touchdown, two consecutive nose-down commands were followed by two full back stick commands.

At touchdown, the tailwind was recorded at 18 kts and the rate of descent was 783 ft/min.

Weather

Automated Terminal Information Service (ATIS)

During the initial stages of the approach, ATIS ‘Mike’ was in effect. This ATIS reported the wind to be from 320° at 5 kts.

The ATIS was updated to ‘November’ 46 seconds prior to TQM being cleared to land. ATC informed the flight crew of TQM that ‘November’ was now in effect and reported the wind to be from 360° at 5 kts.

The wind speed information for the ATIS was supplied by the anemometer located in the centre of the field, about 2.3 km from the runway 29 threshold.

7 Low compressor speed.

Weather reports

Routine aerodrome weather reports (METAR) for Darwin Airport were issued every 30 minutes with SPECIs[8] issued at 1352, 1356 and 1400 UTC. These weather reports were available to the tower controller.

The SPECI issued at 1356, one minute prior to TQM landing, showed the wind from 320° at 5 kts, visibility of 3000 m, cloud scattered[9] at 2,000 ft.

The flight crew were aware of the 1330 METAR which showed the wind to be from 310° at 6 kts, visibility greater than 10 km and scattered cloud at 2,000 ft. They were not aware of subsequent SPECI reports, however during the latter stages of flight, weather information was sought from the ATIS, the on-board weather radar, visual cues and the tower controller.

Weather radar

The tower had access to radar images which were updated every 10 minutes and showed rainfall intensity. The radar image at 1356 UTC showed light to medium rainfall overhead the airport.

Bureau of Meteorology

The Bureau of Meteorology (BOM) issued a report detailing weather conditions at Darwin Airport at the time of the incident. The report noted that there were no obvious dry slots in the atmosphere that would be typically present in a microburst. The report could not rule out the presence of a microburst forming under rain showers (Figure 1).

Microburst

The US Federal Aviation Administration published the Aeronautical Information Manual (AIM) to provide the aviation community with general flight information. Chapter 7, Safety of Flight, of that manual was titled Meteorology. It included the following information regarding microbursts:

8 An aerodrome weather report issued whenever weather conditions fluctuate about or are below specified criteria.

9 Scattered indicates that cloud was covering between a quarter and half of the sky.

7-1-26. Microbursts

a. Relatively recent meteorological studies have confirmed the existence of microburst phenomenon. Microbursts are small scale intense downdrafts which, on reaching the surface, spread outward in all directions from the downdraft center. This causes the presence of both vertical and horizontal wind shears that can be extremely hazardous to all types and categories of aircraft, especially at low altitudes. Due to their small size, short life span, and the fact that they can occur over areas without surface precipitation, microbursts are not easily detectable using conventional weather radar or wind shear alert systems.

b. Parent clouds producing microburst activity can be any of the low or middle layer convective cloud types. Note, however, that microbursts commonly occur within the heavy rain portion of thunderstorms, and in much weaker, benign appearing convective cells that have little or no precipitation reaching the ground.

Air traffic control

The following summary outlines radio transmission between TQM and Darwin Tower:

** Time in UTC*

- **13:52:16** Request from TQM for weather information at the field. Informs Darwin Tower that they have a large weather cell overhead the airfield visible on their on-board radar.
- **13:52:26** Tower informs TQM that the storm is over the runway 29 threshold, extending the east of the aircraft's position and that it has just begun to rain at the airfield.
- **13:52:44** TQM informs tower they are concerned about windshear and asks if the windsocks are indicating different wind direction and strength at different points on the airfield.
- **13:53:00** Tower confirms that on the western side of the field the windsock shows the wind is from 360° at 5 kts and the windsock at the threshold of runway 29 indicates downwind at 5 kts.
- **13:54:44** ATIS changes to 'November' with wind reported from 360° at 5 kts with a wet runway.
- **13:55:28** TQM is cleared to land.
- **13:58:41** (after landing) Tower clears TQM to taxi to their bay and requests conditions on finals.
- **13:58:48** TQM reports conditions were not very good on finals. There was very heavy rain at the threshold and conditions were very marginal.
- **13:58:56** Tower asks for reports of windshear.
- **13:59:01** TQM reports no windshear, but rain made visibility very poor on approach.

Company procedures

Wet runway procedures

The operator's procedures state that the pilot in command of the aircraft shall be the pilot flying in the case of rain or a wet runway. The Captain reported that he did not realise that the runway was wet and therefore did not take over the role of pilot flying.

Stabilised approach criteria

The company used stabilised approach criteria as well as an approach and landing risk awareness tool to determine the procedure for a stabilised approach. The company procedure states that the aeroplane must be on the correct lateral and vertical flight path by 1,000 ft. If the pilot flying (PF) deviates by more than 1 dot on the glideslope, the pilot not flying must call "glide" to alert the PF of the deviation. If the approach is not stable by 1,000 ft on an ILS approach, a missed approach must be conducted.

Flight crew

The Captain held an Australian-issued Airline Transport Pilot Licence (ATPL) and had over 11,800 hours flying experience, with 769 hours on the A330/A340. The First Officer held a United Kingdom-issued ATPL with 17,500 hours total flying experience and 6,000 hours on the A330/A340. Both pilots had satisfactorily passed a proficiency test within the last six months.

TQM

The aircraft, an Airbus A340-313, was registered in Portugal and had a total of 40,447 flight hours and 9,213 flight cycles. The aircraft was serviceable at the time of the incident.

SAFETY ACTION

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Aircraft operator

As a result of this occurrence, the aircraft operator has advised the ATSB that they have taken the following safety actions:

Go-around procedures and training

- Introduced go-arounds from 50 ft and go-arounds from immediately after touchdown before application of thrust reversers into simulator training sessions.
- Developed an awareness program to increase the go-around mind set among Flight Crew, including allowing First Officers to initiate a go-around without the need for consent from the Commander.

SAFETY MESSAGE

Microbursts can create a severe hazard for aircraft operating within 1,000 ft of the ground. After flying into a microburst, it is common for the aircraft to encounter a headwind followed by a downdraft and tailwind. Some important characteristics of microbursts are:

- They are typically less than 1 mile in diameter, however the downdraft and subsequent horizontal outflow can extend to about 2 ½ miles in diameter.
- The downdrafts can be as strong as 6,000 ft per minute and horizontal winds can be up to 45 kts.
- They may be embedded in heavy rain associated with a thunderstorm or in light rain in benign appearing virga.
- Individual microbursts seldom last longer than 15 minutes.

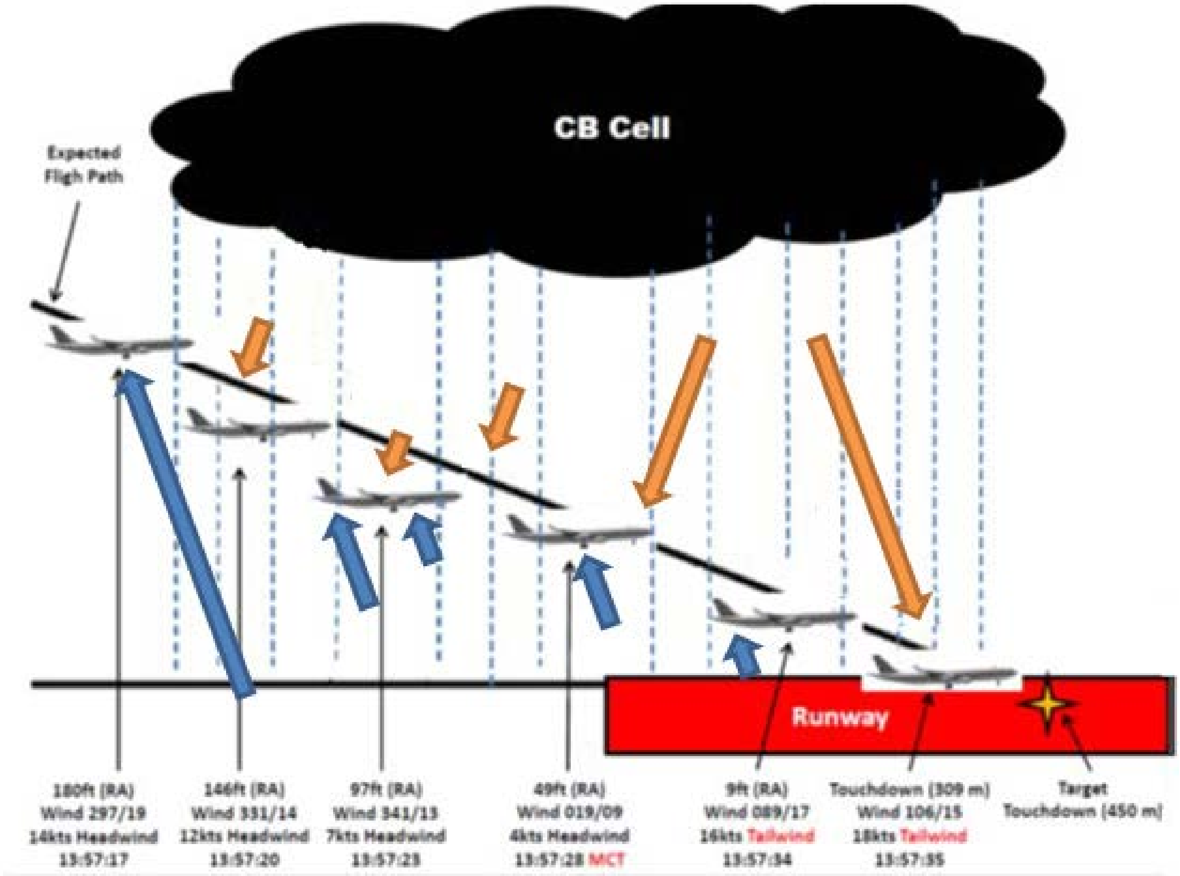
The Flight Safety Digest issued a publication, *Stabilized Approach and Flare are Keys to Avoiding Hard Landings,* which examined techniques for avoiding hard landings. This paper highlighted the importance of a stabilised approach, noting that "Hard landings usually result from nonstabilized approaches conducted in difficult conditions." The paper also advocates the importance of conducting a go-around, even if the approach becomes unstable in the flare.

The full report can be found at: www.flightsafety.org/fsd/fsd_aug04.pdf

Airbus has published two Flight Operations Briefing Notes; *Flying Stabilized Approaches* and *Aircraft Energy Management during Approach*, which provide additional guidance information on flying approaches. They are available at:

www.airbus.com/company/aircraft-manufacture/quality-and-safety-first/safety-library/

Figure 1: Flight path diagram with wind component



Source: the operator and Airbus.