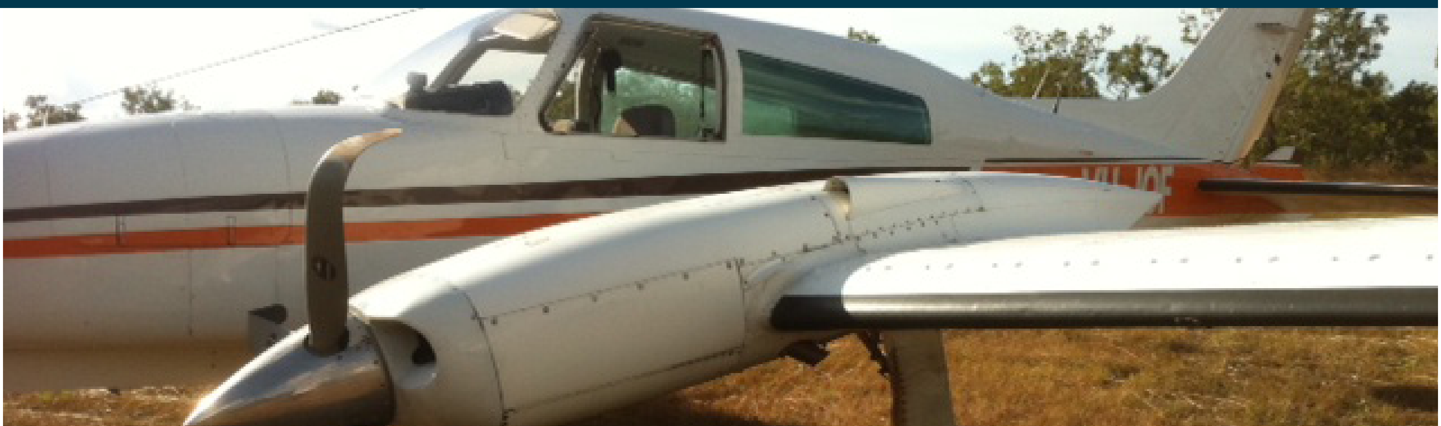
Australian Government

Australian Transport Safety Bureau

Aviation Short Investigation Bulletin

Issue 11



Investigation

ATSB Transport Safety Report

Aviation Short Investigations

AB-2012-088

Final

Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT

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Issue 11

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INTRODUCTION

About the ATSB

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The Bureau 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 fare-paying passenger operations.

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 Bulletin

The ATSB receives around 15,000 notifications of aviation occurrences each year; 8,000 of which are accidents, serious incidents and incidents. It is from the information provided in these notifications that the ATSB makes a decision on whether or not to investigate. While further information is sought in some cases to assist in making those decisions, resource constraints dictate that a significant amount of professional judgement needs to be exercised.

There are times when more detailed information about the circumstances of the occurrence would have allowed the ATSB to make a more informed decision both about whether to investigate at all and, if so, what necessary resources were required (investigation level). In addition, further publicly available information on accidents and serious incidents would increase safety awareness in the industry and enable improved research activities and analysis of safety trends, leading to more targeted safety education.

To enable this, the Chief Commissioner has established a small team to manage and process these factual investigations, the Short Investigation Team. The primary objective of the team is to undertake limited-scope, fact-gathering investigations, which result in a short summary report. The summary report is a compilation of the information the ATSB has gathered, sourced from individuals or organisations involved in the occurrences, on the circumstances surrounding the occurrence and to highlight any safety messages that may be useful to the aviation industry or members of the public in order to prevent similar occurrences. The summary reports detailed herein were compiled from information provided to the ATSB by individuals or organisations involved in an accident or serious incident.

AO-2012-041: Runway excursion, aircraft unknown

Date and time:	Between 19 and 21 March 2012	
Location:	Williamtown, New South Wales	
Occurrence category:	Serious incident	
Occurrence type:	Runway excursion	
Aircraft registration:	Unknown	
Aircraft manufacturer and model:	Unknown	
Type of operation:	Unknown	
Persons on board:	Crew –Unknown	Passengers –Unknown
Injuries:	Crew – Unknown	Passengers – Unknown
Damage to aircraft:	Unknown	

FACTUAL INFORMATION

On Wednesday 21 March 2012 at 0530 Eastern Daylight-saving Time (EDT)[1], an aerodrome reporting officer (ARO) reported a runway edge light outage at Williamtown Airport, New South Wales. A further inspection during daylight revealed a broken runway edge light and wheel marks in the grass adjacent to the runway. The evidence was consistent with an aircraft departing from the sealed operational readiness platform (ORP) adjacent to the runway threshold onto the grass and colliding with the runway edge lighting.

A review of aerodrome lighting inspections showed that a comprehensive lighting inspection was conducted during daylight on Monday 19 March 2012 by a lighting contractor. All flights operating into and out of Williamtown between the light inspection on Monday 19 March and the discovery of the broken light on the morning of Wednesday 21 March were noted and cross-referenced with the tyre marks on the grass. The aircraft had a double wheel main landing gear approximately 5 metres wide and a single nose gear. This was consistent with a Beechcraft Kingair aircraft type. A review of air traffic control (ATC) records show that no other aircraft with this wheel arrangement had operated within the period considered.

The air traffic control records noted that on the evening of 19 March, a Beechcraft Kingair aircraft had rejected a takeoff on runway 12.

The pilot of the Beechcraft Kingair recalled that he rejected the takeoff due to asymmetric power during the initial takeoff roll. The pilot recalled that prior to commencing the takeoff roll, the aircraft was positioned at the threshold of runway 12, aligned with the runway centreline. On releasing the brakes and simultaneously applying full power, the aircraft quickly deviated to the left of the runway centreline. At the time the brakes were released, the pilot was engaged with looking inside the cockpit at the engine instruments.

The pilot felt the aircraft deviate to the left and rejected the takeoff. After stopping the aircraft, he noted that the aircraft was on the runway with the left wing overhanging the runway edge lighting on the left side of the runway. ATC was informed of the rejected takeoff and a new takeoff clearance was issued. The pilot did not recall anything unusual that would indicate he had departed the sealed runway.

After landing at Sydney Airport, the pilot conducted a routine inspection of the aircraft. There were no indications of grass, dirt or mud in the wheel wells or on the tyres. The aircraft did not fly for a number of days following the incident and subsequent inspections by multiple company personnel failed to find any indication of a runway excursion around the landing gear of the aircraft.

[1] Eastern Daylight-savings Time (EDT) was Universal Coordinated Time (UTC) + 11 hours.

The air traffic controller on duty in the tower observed the rejected takeoff but did not note that the aircraft had diverged from the runway centreline.

Williamtown Airport

Williamtown Airport had an operational readiness platform (ORP) at each end of runway 12/30 (Figure 1). The ORP was a wide section of tarmac adjacent to the runway threshold, used during military operation. There was purple coloured lighting around the edge of the ORP and lead in lights from the taxiway which directed aircraft to the runway centreline.

The runway had runway edge lighting, but was not fitted with runway centreline lighting. All lighting systems were reported to be operational during the period between the runway inspections.

The pilot of the Beechcraft Kingair had requested the intensity of the runway lighting be turned down during the approach to Williamtown on the previous sector. This was actioned and the lights were at the reduced setting for subsequent takeoff. This setting was still considered to be a normal level of lighting.

Wheel markings

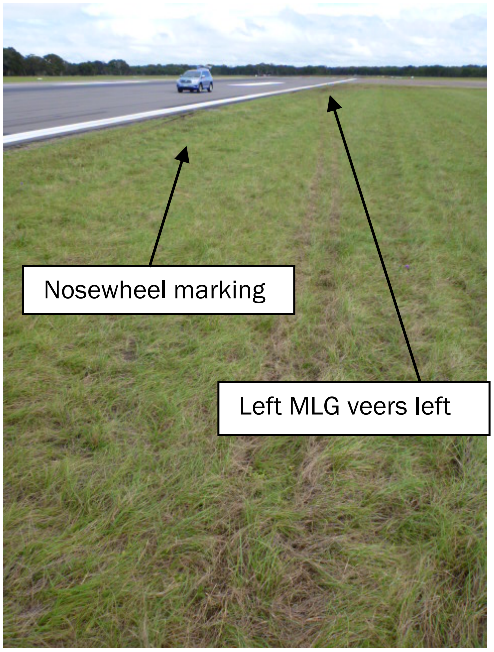
An inspection of the wheel markings showed that the left main landing gear departed the ORP adjacent to runway 12, 145 metres from the threshold, tracking straight (Figure 1).

Figure 1: Wheel markings (looking back in direction of threshold runway 12)

Source: Department of Defence

The aircraft then veered left and the nosewheel entered the grass at about 180 metres (Figure 2).

Figure 2: Wheel markings, left MLG and nosewheel



Source: Department of Defence

The right main landing gear contacted the grass at about 240 metres after impacting a runway edge light. The right main landing gear re-entered the runway at about 300 metres, with the nose wheel and left main landing returning to the sealed runway surface at about 330 metres (Figure 3).

Aircraft movement

A review of all aircraft operating at Williamtown Airport during the period between runway inspections showed a number of other Beechcraft Kingair aircraft operated at the airport. During the tower's hours of operation, they did not observe any runway excursions. Outside of tower hours, only one Kingair departed and that aircraft operated on the opposite direction runway.

Previous occurrence

A previous incident was reported to the ATSB in May 2007. During this event, a Boeing 737 began the take off roll on runway 12 at Williamtown before noticing that they were left of the runway centreline. Right rudder and right nose wheel steering was applied to re-align the aircraft to the centre of the runway and the takeoff was continued. The tower later confirmed that there was no evidence that the aircraft had departed the runway surface.

The flight crew reported that a lack of lead-in lights from the holding point to the runway 12 threshold and runway centreline markings that were hard to see at the threshold, impaired situational awareness. They also reported that ground lighting on the ORP was very dark.

ATSB COMMENT

It was not possible to determine which aircraft had departed the runway. There were indications that an aircraft, similar to a Kingair, departed the sealed runway surface between 19 and 21 March 2012. While a rejected take off was reported, it may not have been linked to this event. The wheel markings on the grass suggested that an aircraft may have been aligned with the runway edge lighting and then veered left during its takeoff run.

SAFETY MESSAGE

The ATSB published a research paper titled, *Factors influencing misaligned take-off occurrence at night* in 2010. The paper found that the following factors may increase the risk of a misaligned take-off occurrence:

- night time operations
- the runway and taxiway environment, including confusing runway entry markings or lighting, areas of additional pavement on the runway, the absence of runway centreline lighting, and recessed runway edge lighting
- flight crew distraction (from within the cockpit) or inattention
- bad weather or poor/reduced visibility
- conducting a displaced threshold or intersection departure
- provision of air traffic control clearance when aircraft are entering the runway or still taxiing
- flight crew fatigue

The full research report can be found at atsb.gov.au/publications/2009/ar2009033.aspx

Figure 3: ORP and approximate location of runway excursion wheel markings

Source: GoogleEarth©

JET AIRCRAFT

AO-2011-134: VH-OJS, Number 3 engine in-flight shut down

Date and time:	16 October 2011, 1041 UTC	
Location:	Near Suvarnabhumi Airport, Bangkok, Thailand	
Occurrence category:	Incident	
Occurrence type:	Abnormal engine indications	
Aircraft registration:	VH-OJS	
Aircraft manufacturer and model:	Boeing Company 747-438	
Type of operation:	Air transport –high capacity	
Persons on board:	Crew – 18	Passengers – 358
Injuries:	Crew –Nil	Passengers –Nil
Damage to aircraft:	Minor	

FACTUAL INFORMATION

On 16 October 2011 at 1033 Coordinated Universal Time (UTC)[1], a Boeing Company 747-438 aircraft registered VH-OJS, operated by Qantas Airways, departed Suvarnabhumi Airport, Bangkok, Thailand on a scheduled passenger flight to Sydney, Australia.

About 8 minutes into the flight, as the aircraft was climbing through 13,000 feet, the crew reported hearing a loud bang and experiencing vibrations and abnormal indications from the No. 3 engine. Fumes were also reported in the cabin for several minutes after the event.

The flight crew shut down the engine and broadcast a PAN[2] before jettisoning approximately 55 tonnes of fuel and returning to Bangkok where the aircraft landed safely at 1147 UTC. The engine failure was fully contained and there were no reported injuries to passengers or crew.

Engine examination

Initial borescope inspection of the Rolls-Royce RB211-524G2-T engine, serial number 13748, was conducted by the aircraft operator before the engine was removed for disassembly and examination at an overhaul facility in Hong Kong.

The initial inspection showed that a single, stage 7 intermediate pressure compressor (IPC) blade had separated from its slot in the compressor disc (Figure 1). Disassembly of the engine confirmed the blade release and revealed significant damage to the remaining IPC blades as well as to the surrounding components.

There was evidence of a small, localised titanium fire that appeared to be the result of the released blade being jammed between the stage 7 IPC rotors and stators.

The released blade was destroyed as a result of its passage through the engine. The condition of the recovered blade fragments was such that identification and physical analysis of the blade release mechanism was not possible.

Analysis of the factors contributing to the blade release, including examination of the stage 7 IPC disc slot, is the subject of an ongoing investigation by the engine manufacturer.

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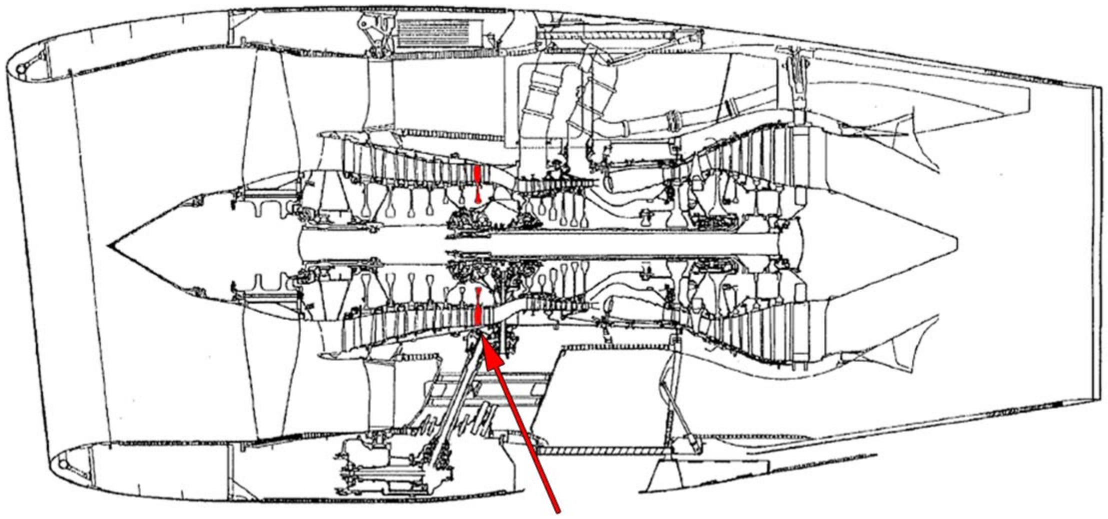
1 Coordinated Universal Time (UTC) is the time zone used for civil aviation. Local time zones around the world can be expressed as positive or negative offsets from UTC. Bangkok was UTC +7 hours.

2 An internationally recognised radio call announcing an urgency condition which concerns the safety of an aircraft or its occupants but where the flight crew does not require immediate assistance.

Figure 1: RB211-524 engine with stage 7 IPC rotor highlighted



Source: Boeing Aircraft Company

Engine history

The engine had undergone a full overhaul prior to being fitted to VH-OJS in August 2007 and had accrued 19,615 hours and 1,988 cycles since that time. There were no known issues with the engine.

Previous occurrences

The engine manufacturer advised that this was the first recorded stage 7 IPC blade release event in over 40 million hours of engine-type service and that there had only been two previous findings relating to stage 7 IPC blades.

In 2005, a stage 7, IPC blade was found to contain cracking in the blade root during a routine inspection after a planned engine removal, however the cause of the crack was not conclusively identified. In 2007, an engine was rejected due to a stage 7 IPC blade that was found displaced rearwards within the disc slot during a routine engine inspection.

ATSB COMMENT

At the time of this report's release, the engine manufacturer was continuing their internal investigation into the occurrence, including analysis of any similarities between the above previous findings and the subject blade release event. Depending on the outcomes of the investigation, further safety actions may be taken to reduce the likelihood of recurrence. If further information becomes available relating to the engine failure, the ATSB will update this report.

AO-2011-143: VH-VUF, Landing gear event

Date and time:	8 November 2011	
Location:	Sydney Airport	
Occurrence category:	Incident	
Occurrence type:	Mechanical Failure – Landing gear	
Aircraft registration:	VH - VUF	
Aircraft manufacturer and model:	The Boeing Company 737-8FE	
Type of operation:	Air transport –high capacity	
Persons on Board	Crew – 6	Passengers - 108
Injuries:	Crew – Nil	Passengers - Nil
Damage to aircraft:	Minor	

FACTUAL INFORMATION

On 8 November 2011, a Virgin Australia Boeing 737-8FE aircraft, registered VH-VUF (VUF), was being operated on a scheduled flight from Melbourne, Victoria to Sydney, New South Wales. At approximately 0820 Eastern Daylight-saving Time (EDT)[1], after landing at Sydney Airport, the crew experienced difficulty in taxiing to the gate, reporting that excessive engine thrust was required during the taxi and that the aircraft was difficult to steer. A subsequent inspection found the No. 4[2] main wheel had failed at the radius of its hub (Figure 1). Relevant identification details on its rim were the part number (2615480-1) and serial number (B8645).

Figure 1: No. 4 axle with remnants of wheel hub (circled).

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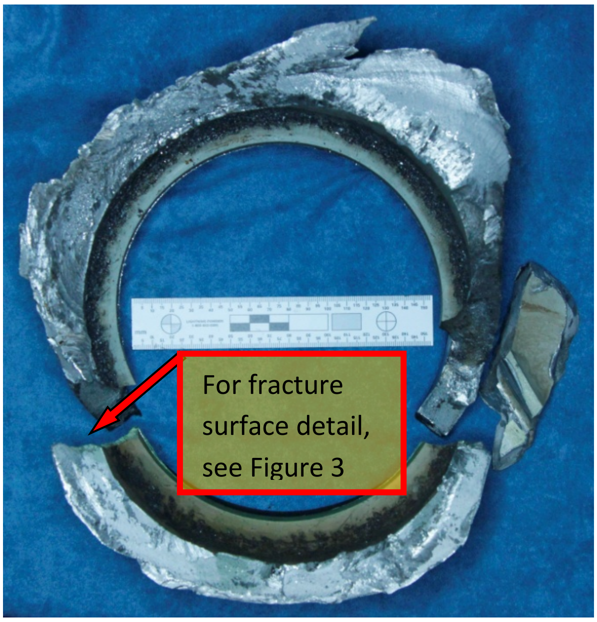
Source: Virgin Australia

Wheel examination

The wheel's hub had separated from its rim and had broken into three principal (Figure 2) and three sub-60mm pieces.

Figure 2: Principal pieces of the wheel hub



Source: ATSB

Examination of the fracture surfaces showed two zones: a discoloured zone concentrated around the bearing shoulder and the remaining, bright, metallic-grey zone (Figure 3).

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1 Eastern Daylight-saving Time (EDT) was Co-ordinated Universal Time (UTC) + 11 hours.

2 Main landing gear, outboard wheel (right side)

Figure 3: Discoloured and grey fracture zones

Source: ATSB

Oblique lighting showed chevrons emanating from the bearing shoulder radius (Figure 4). Microscopic examinations of the radius showed fatigue cracks adjacent to the shot-peened area (Figure 5). Their presence was confirmed with fluorescent dye penetrant.

Figure 4: Fracture surface of the small piece; note the chevron origin at the bearing shoulder radius (arrowed).

Source: ATSB

Figure 5: Axial cracks adjacent to the peened radius

Source: ATSB

Similar occurrences

On 20 October 2009, a similar No. 4 wheel failure occurred on another Boeing 737-8FE with the same operator. The failure mechanism was also as a result of fatigue cracking that initiated in the unpeened area of the bearing shoulder radius. Details of that incident can be found in ATSB investigation AO-2009-062 available at www.atsb.gov.au/publications/investigation_reports /2009/aair/ao-2009-062.aspx

Maintenance procedures

On 8 April 2010, the aircraft manufacturer issued a Service Bulletin (SB 737-32-1444 L*anding Gear - _Tires and Wheels – Main Landing Gear Wheel Half Inspection*). It required ultrasonic inspection in accordance with the wheel manufacturer's service bulletin 2612311-32-003. For part number 2615480-1 and serial numbers 15418 and prior, which included the No. 4 main wheel on VUF, an ultrasonic inspection was mandatory on a 12-monthly basis with an operator's option to perform the inspection on every fifth tyre change. The service bulletin also specified that the Component Maintenance Manual (CMM), 32-40-14, must be used to complete this task.

The CMM re-specified the 12-month/5th tyre change frequency for the above wheel half part number/serial number combination but also allowed a wheel assembly to remain in service for an additional four months to accommodate tyre wear. The inspection was to be done during overhaul maintenance or, optionally, during a tyre change. Wheel assemblies had to be overhauled every 24 months or 1,800 landings. An operator option allowed timing to be based on accumulated tyre changes equivalent to the 1,800 landings criterion.

On 6 May 2010, the operator revised its inspection requirements, as per the above documents, with an inspection frequency of every 365 days/900 flight cycles, whichever came first. The operator's analysis of its historical records for tyre changing versus flight cycles showed an average of 180 flight cycles per tyre change i.e. 180 x 5 = 900. The optional, number-of-tyre-changes versus ultrasonic inspection criterion was not used due to the potential for tyre damage or faster wear than the analysed average.

Wheel maintenance

The operator's wheel maintenance records indicated that the last ultrasonic inspection of the wheel from VUF had occurred in July 2010, when a tyre change also occurred. After that date, there were five further tyre changes prior to the incident. This equated to an average of 165 flight cycles per tyre change.

The maintenance records showed that the wheel failed before the 12 + 4 months and 24 month time limits for ultrasonic inspection. In addition, the wheel failed before the operator's 900 flight cycles limit and the CMM's 1,800 cycle limit.

SAFETY ACTION

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

Wheel manufacturer

The wheel manufacturer made a change to the design of new production wheel components, incorporating shot peening of the entire bearing bore area to help prevent the fatigue cracks from developing. This change was introduced at wheel assembly serial number B15419. The improved wheels were intended for delivery on new aircraft at line number 3099; scheduled for November 2009 (extract from AO-2009-062).

Virgin Australia

As a result of this incident, the operator advised the ATSB that they took the following safety action:

Revised ultrasonic inspection schedule

Virgin Australia's Engineering Individual Detail document[3], 737-32-1444-MAND, was revised on 24 November 2011; the ultrasonic inspection test schedule frequency was changed from 900 to 200 flight cycles so as to occur at every tyre change[4]. The time schedule remained at 365 days.

Revised post-eddy current inspection disposition

Virgin Australia issued Technical Advisory B737-TA-32-005 on 28 November 2011. It specified that, if abnormal ultrasonic indications were detected in the hub-bearing bore of the wheel inner-half, then an eddy current inspection is required. If that inspection detects cracks, the wheel half shall be quarantined, awaiting disposition.

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[3] This document controls Engineering's requirements for parts, including schedules

[4] CMM 32-40-14 Check Instruction 5 notes that "As a wheel half accumulates more landings, it may become necessary to shorten the timeframe between overhaul inspections or increase the frequency of NDT inspections."

AO-2011-161: A6-EGG, Procedures related event

Date and time:	30 November 2011, 0342 EDT
Location:	Melbourne Airport, Victoria
Occurrence category:	Incident
Occurrence type:	Procedures related event
Aircraft registration:	A6-EGG
Aircraft manufacturer and model:	Boeing 777-31H/ER
Type of operation:	Air transport –high capacity,
Injuries:	Crew - Nil Passengers –Nil
Damage to aircraft:	Nil

FACTUAL INFORMATION

At about 0331 Eastern Daylight-saving Time (EDT)[1] on 30 November 2011, an Emirates Airlines, Boeing Company 777-31H/ER aircraft, registered A6-EGG (EGG), was being prepared for a scheduled passenger service from Melbourne, Victoria, to Kuala Lumpur, Malaysia. The duty runway for departure at the time was runway 27. Because of aircraft performance restrictions from runway 27, the flight crew required a departure from runway 16 which was granted by the aerodrome controller.

The flight crew taxied the aircraft to the threshold of runway 16, and were given a takeoff clearance as they approached the holding point. As the aircraft was ready for takeoff, the captain (who was the flying pilot) advised the first officer that they would perform a rolling takeoff[2].

At about 0349 EDT, the aircraft was aligned with the runway centreline and the takeoff initiated. As the aircraft accelerated down the runway, the captain noticed that the runway lights appeared to be on a low intensity setting[3]. The first officer agreed and the takeoff continued.

After takeoff, the crew advised the approach controller twice that they believed the runway lights may not have been on during the takeoff. The approach controller advised the aerodrome controller, who checked the operation of the runway light system.

Aerodrome controller

The aerodrome controller stated that the night's activities were uneventful. Prior to EGG's departure, the flight crew had requested a change of runway from runway 27 to 16, which meant that runway 16 lights would need to be selected on. The aerodrome controller did not recall specifically selecting the lights on, but felt sure that they had been. On being informed by the approach controller that there may be a problem with the runway lights, the aerodrome controller checked the runway lighting systems which appeared to be operating normally.

A subsequent check of the runway lighting system by Melbourne Airport Corporation, found that the runway 16 lights had not been selected on during EGG's take off.

Controller information

The aerodrome controller had more than 5 years experience in air traffic control and had worked in Melbourne Tower since 2010. The controller was well rested and had recently returned to duties after holidays.

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1 Eastern Daylight-saving Time (EDT) was Coordinated Universal Time (UTC) + 11 hours

2 A rolling takeoff occurs when the aircraft does not stop on the runway prior to the application of take off power.

3 The runway lighting had six different levels of intensity which could be changed as required.

Control Tower manning levels

Because of the relatively small number of aircraft operating to and from Melbourne airport at the time, the control tower had two controllers rostered on duty, with Surface Movement and aerodrome controller responsibilities combined. At the time of the incident, one of the controllers was on a meal break and not in the tower.

Airport information

Melbourne Airport had two runways designated 34/16 and 27/09. The lighting available on Runway 16 was variable intensity runway lighting and centreline lighting at 15 m spacing.

Aircraft lighting

The Boeing Flight crew operations manual described the aircraft lighting system as:

> The landing lights consist of the left, right, and nose gear Landing light. The left and right lights are located in the left and right wing root. These lights are optimised for flare and ground roll. The two nose gear-located landing lights are optimised for approach.
>
> The Runway turnoff lights are installed in the left and right wing roots. The lights illuminate the area in front of the main gear
>
> Taxi lights are installed on the non-steerable portion of the nose strut.

The illumination provided by the aircraft lights was sufficient to be mistaken as low intensity runway lighting and provided adequate brightness to facilitate a safe take off.

SAFETY ACTION

Airservices Australia

Airservices Australia advised the ATSB that they were in the process of standardising the operation of runway lighting controls at Towers consistent with ICAO document 4444: *Procedures for Air Navigation Services – Air traffic Management,* and would promulgate a national ATC instruction pending the related change effective 28 June 2012.

SAFETY MESSAGE

This incident highlights the potential hazards associated with skill based human errors, where an individual's intention is correct but their execution is incorrect. As such errors (known as slips and lapses) are common, it is important that all individuals involved in safety critical roles understand the nature of these errors and take the necessary steps to minimise the likelihood of them occurring.

Additionally, individuals should understand the need for high levels of vigilance when working in isolation in a safety critical environment.

The following publication provides additional information on human error types:

www.skybrary.aero/index.php/Human_Error_Types

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.

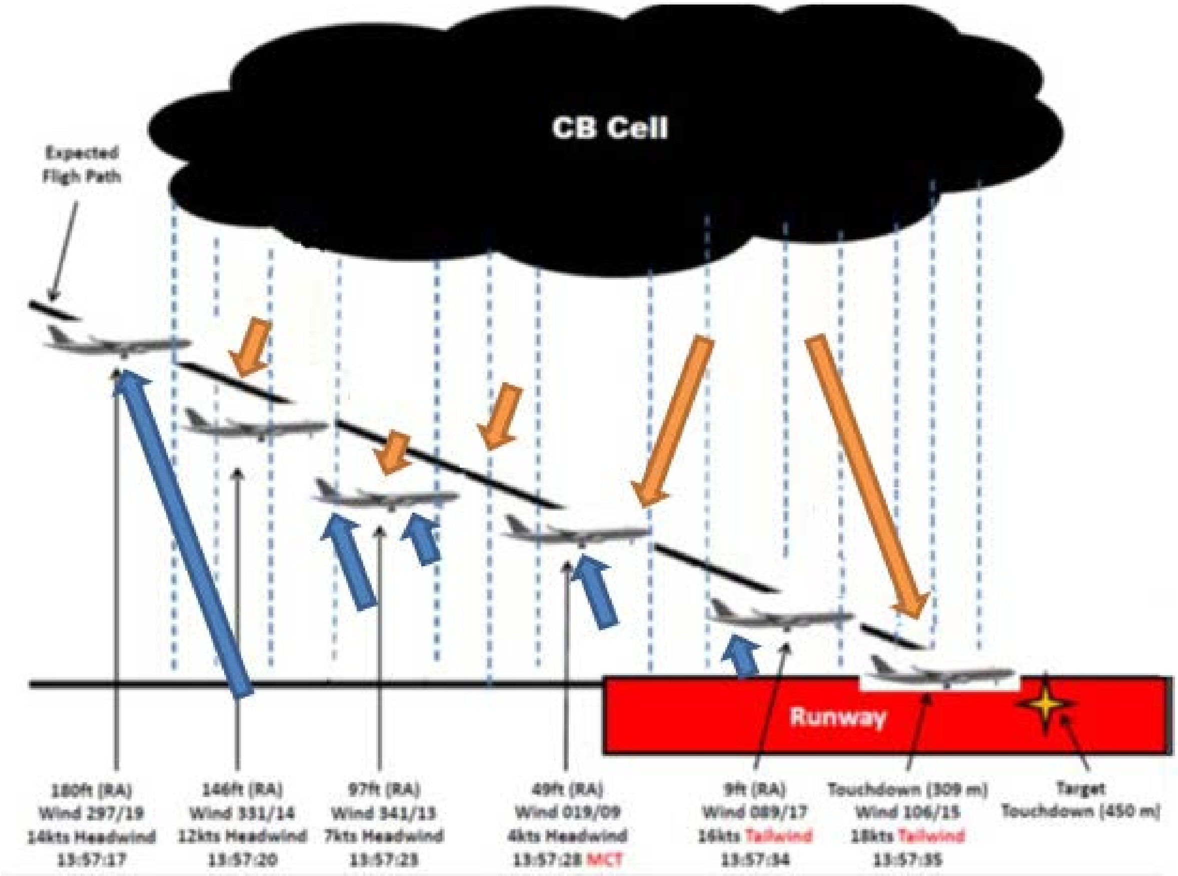
The Flight Safety Digest issued a publication, *Stabilized Approach and Flare are Keys to Avoiding Hard Landings,* which examined techniques for avoiding hard landings. This paper highlighted the importance of a stabilised approach, noting that "Hard landings usually result from nonstabilized approaches 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.

AO-2012-048: VH-VXI and B-6073, Breakdown of separation

Date and time:	6 April 2012, 1342 CST
Location:	near Tindal, Northern Territory
Occurrence category:	Serious incident
Occurrence type:	Breakdown of separation
Aircraft registration:	VH-VXI and B-6073
Aircraft manufacturer and model:	VH-VXI: Boeing Company 737-838
	B-6073: Airbus Industries A330-243
Type of operation:	VH-VXI: Air transport – high capacity
	B-6073: Air transport – high capacity
Injuries:	Nil
Damage to aircraft:	Nil

FACTUAL INFORMATION

On 6 April 2012, a Boeing Company 737-838 aircraft (B737), registered VH-VXI, was being operated on a scheduled passenger flight from Sydney, New South Wales to Darwin, Northern Territory. The aircraft was scheduled to track via Tindal, Northern Territory at Flight Level (FL)[1] 360. The B737 was estimating arrival overhead Tindal at 1344 Central Standard Time (CST)[2].

On a different but converging track, an Airbus Industries A330-243 aircraft (A330), registered B-6073, was operating a scheduled passenger flight from Melbourne, Victoria to Shanghai, China. The A330 was also at FL360 and also had an estimate for Tindal of 1344.

Both aircraft were operating under Instrument Flight Rules (IFR)[3] and were in airspace controlled by Brisbane Centre utilising radar.

[1] A Flight Level (FL) is a standard nominal altitude of an aircraft, used over 10,000 ft in Australia and denominated in up to three digits that represent hundreds of feet (FL 170 equates to 17,000 feet).

[2] Central Standard Time (CST) was coordinated Universal Time (UTC) + 9.5 hours.

[3] Instrument flight rules permit an aircraft to operate in instrument meteorological conditions (IMC), which have much lower weather minimums than visual flight rules.

At 1323, the crew of the A330 first called the air traffic controller (controller) and reported their altitude, prior to entering the controller's airspace. The controller acknowledged the call.

At 1324, the controller conducted a handover to a second controller. During the handover, the crew of the B737 made an initial call prior to entering the airspace. The first controller acknowledged this call and the second controller was monitoring the frequency as part of the handover. The handover was completed at 1326.

At about 1342, the Short Term Conflict Alert (STCA) activated, prompting the second controller to look at the lower portion of the air situation display (display) and see two aircraft on converging tracks, at the same level with only about 5 NM lateral separation between them. The required separation standard was 5 NM or 1,000 ft.

The controller immediately instructed the flight crew of the A330 to descend to FL350. The crew acknowledged and advised that they could see the traffic on their traffic collision avoidance system (TCAS)[4]. Subsequently, the controller instructed the B737 to climb to FL370 and provided a traffic alert.

[4] Traffic collision avoidance system (TCAS) is an aircraft collision avoidance system. It monitors the airspace around an aircraft for other aircraft equipped with a corresponding active transponder and gives warning of possible collision risks.

The lateral separation between the aircraft reduced to about 3.5 NM before the vertical separation requirement of 1,000 ft was established at 1343, resulting in a breakdown of separation.

The flight crew of the A330 monitored the traffic and later reported that there were no TCAS Traffic Advisory (TA)[5] or Resolution Advisory (RA)[6] alerts issued during the incident.

Handover

The incident occurred about 16 minutes after the handover between the controllers. Both controllers used a published handover checklist and the handover was recorded. One of the items on the checklist was 'traffic'; the handover contained a description of the traffic, but the first controller did not highlight that the two aircraft were on converging tracks.

Scanning

The primary display screen used by both controllers covered airspace about 600 by 200 NM in size, from south of Tindal to well north of Darwin. The controllers had access to a secondary display screen, but this was being used to monitor traffic in the Darwin area.

At the time of the incident, the second controller reported he was focussing on traffic in the Darwin area at the top of the primary display screen. The controller only became aware of the breakdown of separation when the STCA activated, drawing his attention to the Tindal area situated on the bottom half of the screen.

Separation Assurance

Loss of separation assurance describes a situation where a separation standard existed but planned separation was not provided or separation was inappropriately or inadequately planned. Controllers are required to be proactive in applying separation by executing and monitoring plans that guarantee separation[7].

Subsequent to the incident, the first controller noted that, at the time of the handover, though they were radar separated, the B737 and the A330 were on converging tracks at the same flight level and the controller had not established a plan to ensure separation would be maintained.

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.

Airservices Australia

As a result of a number of incidents involving handovers, Airservices Australia (Airservices) advised the ATSB that they had taken the following safety action:

Monitoring the handover process

Airservices has amended the handover procedure to require supervision and for the relinquishing controller to remain at the console to provide assistance until the accepting controller indicated that assistance was not required.

SAFETY MESSAGE

This occurrence highlights the continuing importance of separation assurance and thorough handovers by controllers.

The following ATSB investigation reports provide further reading on occurrences related to handovers conducted by air traffic controllers:

- 200400856 – Breakdown of Separation, 9 March 2004 www.atsb.gov.au/publications/investigation_reports/2004/aair/aair200400856.aspx

5 TCAS Traffic Advisory – when a TA is issued, pilots are instructed to initiate a visual search for the traffic causing the TA.

6 TCAS Resolution Advisory – when an RA is issued pilots are expected to respond immediately to the RA unless doing so would jeopardize the safe operation of the flight.

7 From Section 10-10-320 of the Manual of Air Traffic Services, version 19.

- 200701982 – Breakdown of separation, 4 April 2007
  www.atsb.gov.au/publications/investigation_reports/2007/aair/aair200701982.aspx
- AO-2010-012 – ATC information error, 25 February 2010
  www.atsb.gov.au/publications/investigation_reports/2010/aair/ao-2010-012.aspx

In addition, a US Federal Aviation Administration (FAA) report titled: *FAA Strategies for Reducing Operational Error Causal Factors*, is available at: www.faa.gov/library/reports/medical/oamtechreports/2000s/2003/

PISTON AIRCRAFT

AO-2011-153: VH-SKQ, Runway excursion

Date and time:	30 November, 1458 WST	
Location:	Kalumburu, Western Australia	
Occurrence category:	Accident	
Occurrence type:	Runway excursion	
Aircraft registration:	VH-SKQ	
Aircraft manufacturer and model:	Cessna 210L	
Type of operation:	Charter – passenger	
Persons on board:	Crew – 1	Passengers – 6 (3 adults, 2 children, 1 infant)
Injuries:	Crew –Nil	Passengers –Nil
Damage to aircraft:	Serious	

FACTUAL INFORMATION

On 30 November 2011, a Cessna 210L aircraft, registered VH-SKQ (SKQ), departed Derby for Kalumburu, Western Australia, on a passenger charter flight. On board were one pilot and six passengers (including an infant).

The flight had originated in Broome, Western Australia and had been flown to Derby without any passengers. The pilot conducted a pre-flight inspection of SKQ prior to departure from Broome and reported that the aircraft was serviceable. The pilot recalled that the aircraft operated normally on the Broome to Derby sector.

The aircraft was refuelled in Derby and the fuel quantity checked. The pilot reported that during taxi the aircraft brakes were operating normally. After takeoff, the pilot depressed the brake pedals prior to raising the undercarriage and stated that the brake pressure appeared normal. The flight from Derby to Kalumburu was approximately two hours and there were no abnormalities noted.

On descent into Kalumburu (Figure 1), the pilot recalled that the brake pressure was not checked prior to lowering the landing gear, as was the normal procedure. The aircraft was slightly high on approach and the pilot reduced the power to correct the approach path. By short finals, the aircraft was on the correct approach path at approximately 75 kts. The aircraft ballooned slightly during the landing sequence and the pilot added power to reduce the rate of descent. The aircraft touched down about 400 metres from the landing threshold with about 700 metres of runway remaining.

After landing, the pilot attempted to slow the aircraft using the brakes, but there was no brake pressure and no obvious slowing of the aircraft. The pilot asked the front seat passenger to use the brakes on their side of the aircraft, however they also had no brake pressure. At that point, the pilot estimated that there was 200 m of runway remaining and determined that the aircraft was too far down the runway to conduct a go around[1]. The aircraft was unable to come to a stop on the runway and ran off the end at about 40 kts, colliding with large rocks. The aircraft sustained serious damage, however there were no injuries to the passengers or the pilot.

Pre-flight inspection

The pilot reported that a pre-flight inspection had been conducted in Broome prior to departure. The hydraulic fluid level in the brake reservoirs was not checked then, as this was not part of the pre-flight inspection.

Standard operating procedures

The pilot was not aware of any published procedure that provided guidance on how to respond to a brake failure. No training had been received by the pilot for this scenario during either commercial pilot's licence training or training provided by the company.

1 An aborted landing of an aircraft on final approach.

Runway conditions

Runway 10 was 1,130 metres long and had a natural unrated surface. The pilot reported that the conditions were dry and the runway surface was good.

The landing distance required was estimated to be about 500 m.

Engineering inspection

Inspection of the aircraft at the accident site determined that the left wheel brake system was operating while the right system had failed, resulting in the loss of pressure to the right wheel brake. The right brake reservoir appeared to be empty, with a quantity of oil or hydraulic fluid noted in the forward fuselage and on the cabin floor. A subsequent inspection confirmed that the fluid level in the right brake reservoir was very low. A pressure test of both brake systems did not indicate any leaks and an inspection of the master brake cylinders found the seals intact. It was not determined why the right hydraulic fluid reservoir level was low, nor why the pilot could not obtain any brake pressure from the left wheel brake system.

Figure 1: Kalumburu ALA

Source: Google Earth

SAFETY MESSAGE

The pilot stated that the normal approach procedure was to check the brake pressure prior to lowering the undercarriage. If the brake system fault had been identified prior to touchdown, the pilot would have had more time to consider the options available. That would have also enabled the pilot to plan the touchdown as close to the threshold as possible, maximising the available stopping distance on the runway.

The Civil Aviation Safety Authority Day VFR aeroplane syllabus states that students should be able to detail the actions to take in the event of a brake failure during their flight training.

The full syllabus can be found here:

www.casa.gov.au/wcmswr/_assets/main/fcl/download/vfrasfull.pdf

The Federal Aviation Administration's (FAA) Airplane Handbook advices that the key to successfully managing an emergency situation, and/or preventing a non-normal situation from progressing into a true emergency, is by understanding and following the aircraft manufacturer's procedures found in an aircraft's Flight Manual and/or Pilot's Operating Handbook (AFM/POH).

www.faa.gov/library/manuals/aircraft/airplane_handbook/media/faa-h-8083-3a-7of7.pdf

AO-2012-033: VH-ICS and VH-YCR, Airspace related event

Date and time:	21 February 2012, 0900 EDT	
Location:	8 NM East of Gunnedah, New South Wales	
Occurrence category:	Incident	
Occurrence type:	Airspace separation event	
Aircraft registration:	VH-ICS and VH-YCR	
Aircraft manufacturer and model:	Piper Aircraft Company PA-39 and Pacific Aerospace CT/4B (CT/4)	
Type of operation:	VH-ICS Flying training VH-YCR Flying training	
Persons on board:	VH-ICS Crew –3	Passengers – 0
	VH-YCR Crew –2	Passengers – 0
Injuries:	Crew – Nil	Passengers – Nil
Damage to aircraft:	Nil	

FACTUAL INFORMATION

On 21 February 2012, at about 0900 Eastern Daylight-saving Time (EDT)[1], a Piper aircraft company PA-39 Twin Comanche aircraft, registered VH-ICS (ICS) and a Pacific Aerospace CT/4B aircraft registered VH-YCR (YCR), were conducting instrument flight rules (IFR) flying training operations in visual metrological conditions (VMC). Both aircraft were on a reciprocal track between Tamworth and Gunnedah. On board ICS were a flying instructor and two students; on board YCR were a flying instructor and one student. Both aircraft were flying in class G (uncontrolled) airspace, clear of any significant airports. The radio frequencies used for VFR operations in the area were Brisbane Centre air traffic services (ATS) on 127.1 MHz and the Gunnedah common traffic advisory frequency (CTAF)[2] 127.4 MHz.

Following completion of a missed approach into Gunnedah, the crew of ICS descended to 1,900 ft above mean sea level (AMSL), intending to return to Tamworth, tracking on the Tamworth very high frequency (VHF) omnidirectional radio range (VOR), 271 radial at 7,000 ft. At the same time, YCR was tracking inbound to Gunnedah at 6,000 ft AMSL, on the Gunnedah non-directional (radio) beacon (NDB) bearing 091° (the reciprocal of the 271 radial).

The pilot in command (PIC) of YCR received a traffic advisory from Brisbane ATS that two other aircraft in the area were operating below 5,000 ft. The PIC then broadcast an intention to overfly Gunnedah at 6,000 ft, on the Gunnedah CTAF. The crew of ICS later reported that transmission was not received.

Shortly after, YCR reported hearing ICS on the Brisbane ATS frequency requesting traffic information for a departure to Tamworth at 7,000 ft. Brisbane ATS then advised ICS of YCR's intentions. The PIC of YCR then attempted to contact ICS several times on the Gunnedah CTAF to request their position and altitude, but reported that there was no response. The PIC of ICS reported that he also tried to contact YCR on the Gunnedah CTAF and that there was high density of radio transmissions on that frequency. Both PICs intended to contact each other on the Brisbane ATS frequency, but found that frequency also congested.

Unable to establish communications with ICS, the crew of YCR conducted small clearing turns at 6,000 ft with both crew attempting to gain visual contact with ICS. The crew then heard the pilot of ICS broadcast a departure call on the Brisbane frequency, stating they were established on bearing

1 Eastern Daylight-saving Time (EDT) was Coordinated Universal Time (UTC) + 11 hours.

2 Transmissions broadcast on the Gunnedah CTAF were not recorded.

091°, at 5 NM outbound from Gunnedah and climbing through 6,000 ft (Figure 1).

At the time of that transmission, the PIC of YCR estimated that they were within 1 NM of ICS. He immediately turned YCR left 90° onto a southerly heading to achieve lateral separation and both crew tried to visually acquire ICS.

The PIC of ICS, also mindful of the conflicting traffic, turned north while climbing through 6,000 ft to achieve separation. During the climb, the crew of ICS tried to visually acquire YCR. Neither crew sighted the other aircraft.

When communications were finally established between both aircraft on the Gunnedah CTAF, the PIC of YCR estimated they were 5 NM from Gunnedah, with ICS within 1 NM laterally and 200 ft above YCR. At the same time, the PIC of ICS noted they were approaching 7,000 ft with their GPS showing 8.3 NM from Gunnedah, giving 3.3 NM and 1,000 ft separation. When satisfied they had separation assurance, both crews continued their training flights.

Communications

Both aircraft were equipped with dual VHF radios and both crew reported that they were simultaneously monitoring the Brisbane ATS and the Gunnedah CTAF frequencies.

Collision avoidance equipment

Both aircraft were equipped with a transponder which enabled ATS to be aware of the location and altitude of each aircraft, however they were in uncontrolled airspace.

YCR had a traffic and collision alert device (TCAD) fitted. There was no indication on that device of any conflicting aircraft at any time during the period when the position of ICS was unknown.

The limitations of the system included a failure to detect a threat aircraft unless that aircraft was equipped with a transponder and under interrogation by radar. Radar coverage was not always assured in the Tamworth area. The TCAD was a passive receptive unit[3], with a typical 6 NM range.

SAFETY MESSAGE

When operating in uncontrolled airspace where separation is based on visual separation, it is important that pilots apply the principles of 'see-and-avoid'. The concept of unalerted 'see-and-avoid', however, is far from reliable with research showing the effectiveness of a search for other traffic is eight times greater under alerted circumstances than when un-alerted. As such, the principles of 'see-and-avoid' should be applied in conjunction with an active listening watch.

As this incident demonstrates, when operating in the vicinity of a CTAF, it is imperative that pilots make a broadcast with position and intentions, particularly when changing frequencies or if there is any doubt as to the position of other aircraft. Pilots should also be mindful that transmission of information by radio does not guarantee receipt and complete understanding of that information. Without understanding and confirmation of the transmitted information, the potential for alerted see-and-avoid is reduced to the less safe situation of un-alerted see-and-avoid.

A 2004 ATSB review of all 37 mid-air collisions in Australia between 1961 and 2003 (ATSB, 2004) identified that radio problems, use of the wrong frequency, or failure to make the standard positional broadcasts were factors in many of these collisions.

www.atsb.gov.au/publications/2004/review_of_midair_collisions.aspx

- In at least six of the aeroplane/aeroplane collisions, one or both pilots did not hear a required radio broadcast made by the other pilot.
- In one of the aeroplane/aeroplane collisions at a non-towered aerodrome, the pilot did not make a required broadcast due to radio frequency congestion.

The following publications provide some useful information on see-and-avoid principles:

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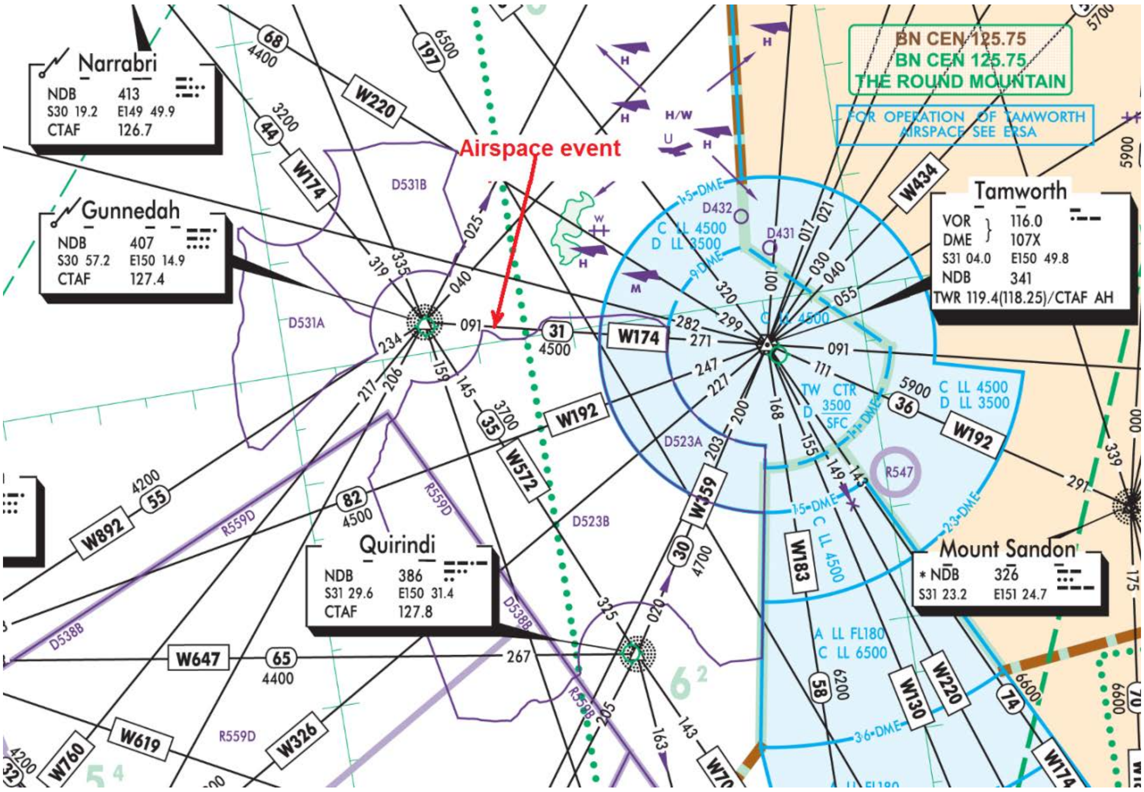
[3] Passive receptive units listen for transponder signals from other aircraft in the immediate area, but can suffer 'blind spots' because they use a single antenna.

- Limitations of the See-and-Avoid Principle (1991), available from the ATSB's website at www.atsb.gov.au/publications/1991/limit_see_avoid.aspx

- Pilot's responsibility for collision avoidance in the vicinity of non-towered (non-controlled) aerodromes using 'see-and-avoid' (Civil Aviation Advisory Publication CAAP 166-2(0)), available from the Civil Aviation Safety Authority's website at www.casa.gov.au

- *Safety in the vicinity of non-towered aerodromes* (2010) AR-2008-044(2), available from the ATSB website at www.atsb.gov.au/publications/2008/ar-2008-044(2).aspx

Figure 1: Position of the airspace related event on bearing 091



Source: Air Services Australia

AO-2012-051: VH-JOF, Windshear event

Date and time:	12 April 2012, 1400 CST	
Location:	Marlgawo, Northern Territory	
Occurrence category:	Accident	
Occurrence type:	Windshear event	
Aircraft registration:	VH-JOF	
Aircraft manufacturer and model:	Cessna 310	
Type of operation:	Charter	
Persons on board:	Crew – 1	Passengers – 2
Injuries:	Crew – 0	Passengers – 1 (minor)
Damage to aircraft:	Serious	

FACTUAL INFORMATION

On 12 April 2012 at about 1345 Central Standard Time (CST)[1], a Cessna Aircraft Company 310R, registered VH-JOF (JOF), was conducting a charter flight from Jabiru to several remote Northern Territory communities. On board the aircraft were the pilot and two passengers.

On approach to Marlgawo Aircraft Landing Area (ALA), the pilot joined a left base for runway 09 at 1,500 ft above ground level (AGL). At 135 kts indicated airspeed (IAS), the pilot selected 15° of flap[2] and landing gear down to slow the aircraft to 100 kts IAS.

At 300 ft, while on final approach to runway 09, the pilot selected full flap and completed his final approach checks. The pilot noticed that the aircraft had slowed to 90 kts IAS and reported this to be 5 kts slower than his usual final approach speed.

After passing over tall trees located near the threshold of runway 09 (Figure 1), the pilot lowered the nose to increase the airspeed and bring the aiming point closer to the runway threshold. Shortly after lowering the nose and passing below the tree line, the pilot described feeling a shudder through the airframe which he stated differed to pre-stall buffet[3] and was unlike anything he had experienced before. This shudder was immediately followed by activation of the stall[4] warning[5] and a rapid descent to the runway. The pilot reported that he believed the aircraft had encounter severe windshear.

The aircraft contacted the ground heavily in a level attitude on the main landing gear, coming to a stop in approximately 200 m. The pilot reported the loss of lift to be sudden and that he was not able to apply power or take any corrective action before the aircraft contacted the ground.

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

2 Movable surface forming part of the trailing edge of an aerofoil. Able to hinge downwards to alter the wing camber, in order to exert a powerful force on low speed lift and drag.

3 Aerodynamic buffet induced by turbulence over wing and /or control surfaces or fixed tail giving warning of imminent stall.

4 Term used when a wing is no longer producing enough lift to support an aircraft's weight

5 Aural warning giving the pilot warning of an impending stall.

Figure 1: Marlgawo ALA

Source: Aircraft operator

One passenger reported some minor whiplash injuries. The remaining passenger and pilot were uninjured. The aircraft was seriously damaged (Figure 3) including:

- wings and engine nacelles bent downwards approximately 30°
- propeller tips bent from striking the ground
- fuselage extensively distorted.

Pilot information

At the time of the accident, the pilot held a Commercial Licence (Aeroplane) with about 1,100 hrs total time and 55 hrs on type. The pilot estimated that he had landed at Marlgawo ALA on twelve previous occasions.

Weather

The closest Bureau of Meteorology (BOM) observational sites to Marlgawo ALA were Jabiru and Tindal. The Jabiru observational site was located at 85 ft and Tindal at 135 ft above mean sea level (AMSL), whereas, Marlgawo ALA was located on an escarpment at 800 ft AMSL.

A report provided by the BOM estimated that observations recorded at Jabiru and Tindal would be a reasonable guide to general winds however they would not be representative of the winds on the higher ground of the escarpment. The BOM estimated the winds at Marlgawo to be from 070 degrees at 20 kts with higher gusts. Moderate turbulence was also forecast for the area below 6,000 ft.

Approach speed and aircraft stall characteristics

The pilot's operating handbook (POH) recommends a minimum multi-engine approach speed of 93 kts.

The POH states that the stall characteristics are conventional with an aural warning provided between 5 to 10 kts above the stall in all configurations. The stall speed in the landing configuration at the aircraft's weight at the time of the incident was approximately 70 kts.

Effect of obstructions on wind flow and aviation operations

The BOM *Manual of Aviation Meteorology (2nd Edition)* provides meteorological information that meets the needs of pilots, air traffic controllers, flight planners, and those interested in meteorology from an aviation perspective. The manual states that any obstruction to the wind flow at the time, including by buildings and trees would produce disturbed air, manifested as windshear[6] and mechanical turbulence[7].

The combination of surface winds and obstacles to the wind flow that are situated upwind of an approach or departure path, such as large buildings, low hills or close planted stands of tall trees can create localised areas of low-level windshear[8]. The effect of those upwind obstacles on the wind flow depends on a number of factors, the most important being the speed of the wind and its orientation relative to the obstacle, and the size of the obstacle in relation to the runway dimensions.

The BOM estimates that for smaller impermeable barriers, such as trees and buildings, turbulence occurs up to about twice the height of the barrier vertically, and an equivalent distance downwind of up to 15 times the height of the barrier (Figure 2)

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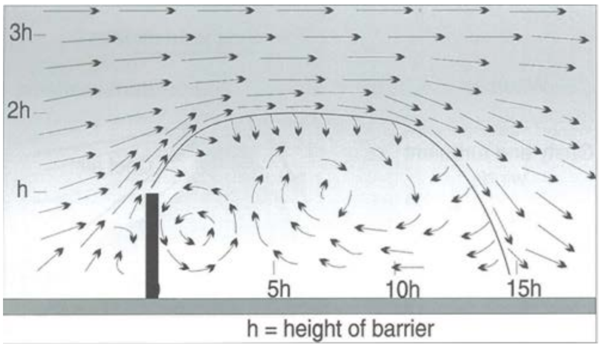
6 A sudden change of wind velocity in either the horizontal or vertical planes of the atmosphere, or a mixture of both.

7 Disrupted air flow caused by frictional interference.

8 ICAO (2005). Manual on Low-level Wind Shear (1st ed.) (Doc 9817-AN/449). Montreal, Canada. International Civil Aviation Organization.

Figure 2: Airflow near a solid (impermeable) cross wind barrier



Source: Bureau of Meteorology

ATSB COMMENT

A loss of lift like that reported by the pilot on crossing the tree line may be due to localised low level windshear generated by barriers, such as the close proximity of tall trees to the runway and the prevailing winds. The effect of any low level windshear can be exacerbated by maintaining slower than recommended approach speeds in the area affected by low level windshear.

SAFETY MESSAGE

It is important to consider the possibility of windshear when planning the descent and landing phase of flight. Strong gusting winds and obstacles close to the runway surface may increase the likelihood of windshear conditions.

The Flight Safety Foundation (FSF) Approach and Landing Accident Reduction (ALAR) tool kit provides guidance on avoiding, recognising and recovering from windshear. The tool kit reinforces the importance of following the wind shear recovery technique recommended in the aircraft operating manual and flying a stabilised approach.

The *Flight Safety Foundation* recommends that an immediate go around be commenced in the event that an approach becomes unstable below 1,000 ft above ground level (AGL) in instrument meteorological conditions[9] and below 500 ft AGL for visual meteorological conditions[10].

Although the FSF tool kit is aimed at pilots of aircraft over 5700kgs, the guidance on recognising, avoiding and recovering from windshear is just as applicable to pilots of smaller aircraft.

The following provide further information on windshear avoidance and recovery;

- *AO-2010-008 Turbulence event - Canberra Aerodrome ACT, 31 January 2010, VH-ERP, Grumman Traveller AA-5:* www.atsb.gov.au/publications/investigation_reports/2010/aair/ao-2010-008.aspx
- *Flight Safety Foundation briefing note – Windshear*

  www.flightsafety.org/files/alar_bn5-4-windshear.pdf

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9 Instrument meteorological conditions (IMC) describes weather conditions that require pilots to fly primarily by reference to instruments, and therefore under Instrument Flight Rules (IFR), rather than by outside visual references. Typically, this means flying in cloud or limited visibility.

10 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.

Figure 3: VH-JOF

Photo courtesy of the operator

AO-2012-056: VH-TWP, Collision with terrain

Date and time:	18 April 2012, 1200 CST
Location:	Nyirripi (ALA) Northern Territory
Occurrence category:	Accident
Occurrence type:	Operational - Collision with terrain
Aircraft registration:	VH-TWP
Aircraft manufacturer and model:	Cessna Aircraft Company 210
Type of operation:	Charter – freight
Persons on board:	Crew – 2 Passengers – Nil
Injuries:	Crew – 1 Serious 1 Minor
Damage to aircraft:	Serious

FACTUAL INFORMATION

At about 1200 Central Standard Time (CST)[1] on 18 April 2012 at the Nyirripi aircraft landing area (ALA), Northern Territory, a Cessna Aircraft Company 210 (Centurion), registered VH-TWP (TWP), sustained serious damage while attempting to land on runway 09. The supervisory pilot was seriously injured and the pilot in command under supervision (ICUS) sustained minor injuries.

The supervisory pilot was conducting line training for the ICUS pilot. The aircraft had departed Kintore ALA Northern Territory about 30 minutes previously with the ICUS pilot flying.

The supervisory pilot reported that the aircraft had not been slowed sufficiently during the landing flare. As a result the aircraft ballooned[2] slightly at about 90 kts. The aircraft then ballooned again, this time more severely.

The supervisory pilot took control of the aircraft with the intent of recovering from the balloon to a normal landing as sufficient runway remained. Both flight crew reported that a strong wind gust caught the aircraft and caused the aircraft to yaw left significantly. The supervisory pilot applied full power to go-around and set a climb attitude. The aircraft did not climb and, to reduce drag, the supervisory pilot retracted the landing gear.

As the aircraft was descending and heading towards shrubs and low trees, the supervisory pilot rolled the aircraft into a 30° right bank to remain over clear ground closer to the runway. The flaps were fully extended and the landing gear partially retracted.

Realising that the aircraft was going to impact the ground, the supervisory pilot rolled the wings level. The aircraft impacted fairly hard and skidded about 100 m before coming to rest north of the runway and about 600 m from the threshold facing south-east (Figure 1).

Weather

The weather was reported as fine and the wind had been predominantly easterly during the day at less than 10 kts. The flight crew could see the windsock while on final approach and both reported that the wind was mostly headwind.

Though there were dust devils[3] forecast, the supervisory pilot reported that there were none observed at Nyirripi.

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

2 Ballooning is a sudden, unwanted gain in aircraft height during the landing.

3 Miniature whirlwind with the potential to be of considerable intensity, and to pick up dust and perhaps other items and carry them some distance in the air. A dust devil can cause localised intense turbulence.

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 action:

Guidance notes on wind shear

Guidance notes have been issued to all flight crew regarding windshear recognition and recovery, as well as a reminder of information in the procedures manual.

SAFETY MESSAGE

This accident demonstrates that should an approach become unstable, conducting a go-around early may be the safest course of action. A Bureau of Meteorology Research Centre report on Australian dust devils noted that not all dust devils were visible and that they pose a major hazard to light aircraft during landing and takeoff.

Chapter 12 of the Civil Aviation Safety Authority (CASA) *Flight Instructor Manual (Aeroplane)* and chapter 8 of the Federal Aviation Administration (FAA) *Airplane Flying Handbook* are useful aids for a go-around refresher.

The Flight Safety Foundation provides a number of briefing notes as part of their approach and landing accident reduction initiative, including *Being Prepared to Go Around* and *Bounce Recovery – Rejected Landing*.

The following ATSB investigations relate to go-around accidents:

- AO-2010-109
  www.atsb.gov.au/publications/investigation_reports/2010/aair/ao-2010-109.aspx
- 199904898
  www.atsb.gov.au/publications/investigation_reports/1999/aair/aair199904898.aspx

The following ATSB investigations relate to the impact of dust devils on aircraft operations:

- 200605133
  www.atsb.gov.au/publications/investigation_reports/2006/aair/aair200605133.aspx
- AO-2007-060
  www.atsb.gov.au/publications/investigation_reports/2007/aair/ao-2007-060.aspx

The Bureau of Meteorology Research Centre Report No. 20, *A Survey of Australian Dust Devils*, is available at: www.cawcr.gov.au/bmrc/pubs/researchreports/researchreports.htm

The CASA *Flight Instructor Manual (Aeroplane)* is available at: www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_90300

Chapter 8 of the FAA *Airplane Flying Handbook* is available at: www.faa.gov/library/manuals/aircraft/airplane_handbook/media/faa-h-8083-3a-4of7.pdf

The Flight Safety Foundation briefing notes in relation to their approach and landing accident reduction initiative are available at: www.flightsafety.org/current-safety-initiatives/approach-and-landing-accident-reduction-alar/alar-briefing-notes-english

Figure 1: TWP at Nyirripi

Source: Aircraft operator

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